Introducing ESMADI, Android-Based Learning Application with Prototyping Model

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Abstract. The difficulties in communication experienced by people with speech and hearing impairment requires special attention. Their language and communication skills can be developed through various special facilities and programs that suit their needs. The success of overcoming the obstacle of speech and hearing impairment depends on the kind of program they undertake. Most of them prefer to learn while playing. Sign language can also be used by children that have no problem with hearing and speaking. Electronic Smart Application for People with Disabilities (ESMADI) is an application that can help users to learn SIBI in an easy, interesting, and exciting way, anytime and anywhere. This application integrates various learning features, such as images, sounds, and videos to ensure an enjoyable learning experience. The method used in designing this application was the prototyping method to facilitate easier development of ESMADI in accommodating users' needs.

Keywords: sign language, disabilities, prototyping.

1 Introduction

Nowadays, technology plays a big role in our life. This includes our work, communication, life, learning, and many more. Almost everyone is familiar with the current technology, one of which is the smartphone. Smartphones are one of the latest technology media and are easy to carry everywhere. This Android-based application design is called Smart Electronic Application for People with Disabilities, which is an application that can help users learn sign language to facilitate communication among people with hearing loss or speech impairment (disabled).

Generally, sign language is used as a communication medium for people with hearing loss or speech impairment. For children, sign language also has other functions that are beneficial for their development. Sign language can help communication between two parties that cannot be done through speech. This is not only limited to hearing loss or speech impairment but can also be used by other children who do not from suffer hearing loss and speech impairment.

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Nareza revealed that anyone can learn sign language. However, children with hearing impairment or hearing loss must learn sign language as early as possible. The goal is for the children to communicate better. Sign language can be introduced to 6-8 months old children. At this age, children start to indicate what they want through movements. Sign language is a way of conveying words and sentences through hand gestures and expressions. Like any other language, sign language varies from country to country [1].

In the United States, for example, the most common sign language is American Sign Language (ASL). In Indonesia, there are two sign languages, which are Indonesian Sign Language (BISINDO) and Indonesian Sign Language System (SIBI). SIBI and BISINDO have their own distinctive features. SIBI is generally more formal and only requires the movement of one hand, while BISINDO tends to be more vernacular and requires both hands [8]. Furthermore, BISINDO has different variations or “dialects” in some areas.

Children can suffer hearing loss due to damaged organs, resulting in their inability to hear, ranging from mild to severe, from hard of hearing to deaf. A deaf person cannot hear sounds, thus experiencing difficulties in processing language information conveyed through speech, with or without the use of hearing aids. On the other hand, people suffering from hard of hearing can use hearing aids. They can still process language information to some extent. It means they can still engage in a conversation with the help of hearing aids [1] [2].

Hearing loss and hard of hearing can occur during the pre-language or post-language periods. Prelingual deafness is a hearing loss that occurs before the development of speech and language skills while Post-language deafness is a hearing loss that occurs spontaneously after speech and language skills have been developed [3]. The direct consequence of hearing loss is the inability to engage in verbal communication, both expressively (speaking) and receptively (understanding others' conversation), making it difficult to communicate with most people who use verbal mode as their primary means of communication. These barriers to communication also result in obstacles in the education and learning process of deaf children. However, deaf children have the potential to learn to connect and communicate. Therefore, deaf children need special attention to develop their language and communication skills to minimize the impact of their deafness. The development of their receptive and expressive language skills depends on what they learn and how they learn it. Most of them prefer to learn while playing [4].

Therefore, this application is also very useful when in emergency conditions. In the journal [9] explains the design made in an android-based application that there are 4 menu options, namely the menu of letter, number cues, gestures of words and sentences that use animation. Meanwhile, the research made using different features consists of learning features of days, months, numbers, colors, letters and vocabulary that display sounds, videos and quizzes. This android-based application is expected to be useful for the purpose of being a teaching material in the Software Design and Implementation Course (INF11025) in designing and building applications according to its method. It is hoped that the general public can increase their knowledge of language and learn sign language in an exciting way, not boring, and can be learned anytime and anywhere.

In addition, this application contains essential features such as images, sounds, and videos to ensure an enjoyable learning experience. Designing ESMADI using the prototype method. The prototyping approach is suitable for systems or software that needs to meet the user's

needs [5]. Based on the description above, the researchers will conduct research to implement prototype Method in designing the game Learn SIBI Sign Language.

2 Research Methods

In designing ESMADI, Prototyping model was employed as the method. Prototyping approach, as shown in Figure 1, is suitable for systems or software that needs to meet the user's needs. This model begins with the collection of information about the needs. The developer and client met to define common goals, identifying the needs, and looking for areas that require further definition [6].

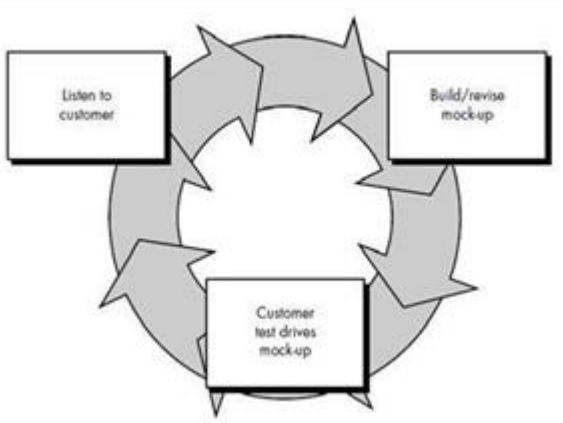


Fig. 1. Stages in Prototyping Method. [4]

1.1 Listening to Customers

At this stage, the system requirement was formulated by taking into account the client's needs. Data collection was carried out by conducting interviews with students who are active in the community for people with disabilities and studying in the field of education for children with special needs as well as looking for references from journals related to the application is the same as doing comparisons to produce something new. Table 1 breaks down the comparison.

Table 1. Comparison table.

Title	Available features	Model
Application Designing a Sign Language Learning Application for the Deaf Android-based.	the menu of letter, number cues, gestures of words and sentences that use animation.	-
Introducing ESMADI, Android-Based Learning Application with Prototyping Model.	learning features of days, months, numbers, colors, letters and vocabulary that display sounds, videos and quizzes	Prototyping Model

1.2 Designing and Creating Prototype

At this stage, the system prototype was designed and manufactured. Adjustments were made to the resulting prototype according to the predefined needs of the system based on the client's and user's needs. Figure 2 shows the flowchart of the planned prototype.

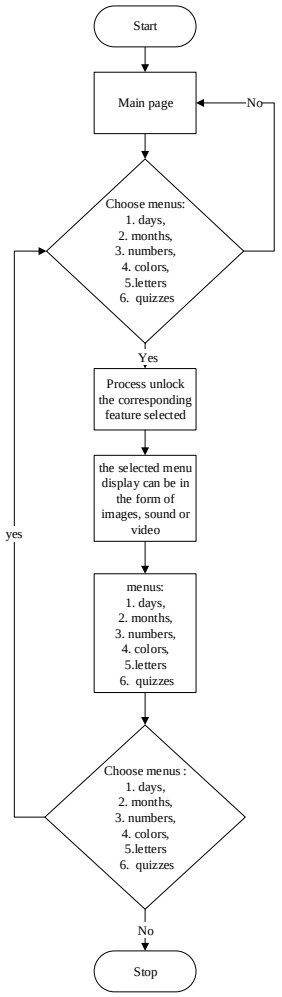


Fig. 2. Designing Prototyping.

1.3 Trials

At this stage, the client or user was testing the system prototype. Then, the problems found were evaluated based on the user's needs. Researchers conducted the trials using black box method and portability testing to check which operating system can be used at least the appropriate version.

3 Results and Discussion

3.1 Building Prototype

3.1.1 Data Collection

The data were obtained from literature related to the Semester Learning Plan of Software Engineering course, reference books that supplement the textbooks, and journals, and were scrutinized for their form, format, and content.

3.1.2 System Requirements Analysis

At this stage, the system requirements were identified. These consist of the data on the functional needs of the introduction of Electronic Smart Application for People with Disabilities (ESMADI) Android-Based Learning System. System users consist of admins and general users.

The following list contains the System Access Rights.

- Admins and Users can perform installation through a specific link to access ESMADI.
- Admins and Users can open the app.
- Admins and Users are free to access all features available on the application as a medium to learn.
- Users cannot change the features in the app.
- Admins can change the features in the app.
- Admins and Users can open and close the application without logging in or out.

The next list catalogues all the Application Functions:

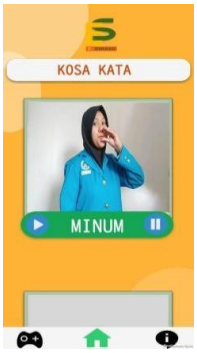
- Potential users can learn sign language through the features available in ESMADI.
- Potential users can hear and see first-hand how the sign language is shown through short-duration videos available on the ESMADI feature.
- Potential users will be presented with interesting games to learn sign language so learning becomes fun and interesting.
- ESMADI can be used in various communities due to its user-friendly features.

3.1.3 Design Analysis

In this process, system modeling activities were carried out on ESMADI page interface and the necessary assets. The details can be found in Table 2.

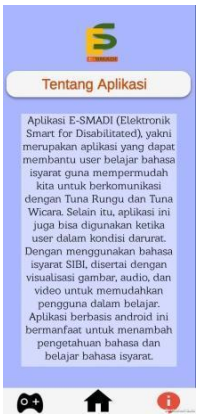
Table 2. Page and assets of ESMADI.

Asset	Description	Asset	Description
	The "ESMADI" logo. ESMADI stands for Electronic Smart Application for People with Disabilities.		Exit button
	Home button		Voice button
	Info button to show the application info		Button to play the quiz
	Button to display materials on letters		Button to display materials on numbers
	Button to display materials on letters		Button to display materials on months
	Button to display materials on vocabulary		Button to display materials about colors
	Button to play video		Button to pause video

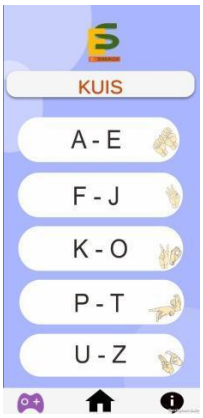
	ESMADI splash screen display is the first display to appear after opening the application that shows ESMADI		Display of ESMADI features in the learning category, which consists of • Letter • Number • Day • Month • Color • Vocabulary
	Display the option to learn letters. This page comes with a quiz, hand symbols, and a short explanation of their meaning.		This is the page to start learning numbers in sign language. This page contains hand symbols and a short explanation of their meaning.
	This is the page to start learning on days in sign language. This page contains a video demonstrating the proper hand movements and a short explanation of their meaning. A dedicated play and pause feature is available for easier access in learning sign language.		This is the page to start learning vocabulary in sign language. This page contains a video demonstrating the proper hand movements and a short explanation of their meaning. A dedicated play and pause feature is available for easier access in learning sign language.

This is the page to start learning about months in sign language. This page contains a video demonstrating the proper hand movements and a short explanation of their meaning. A dedicated play and pause feature is available for easier access in learning sign language.

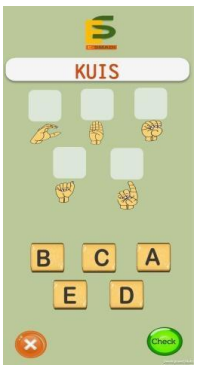
This is the page to start learning about color in sign language. This page contains a video demonstrating the proper hand movements and a short explanation of their meaning. A dedicated play and pause feature is available for easier access in learning sign language.



About the Application: This page contains information about the application, the sign language used by the application, and the picture of the application designer team.



Quiz: This page contains a brain teaser to train the user's memory. The drag quiz system was embedded as a variation to refresh users' memory in remembering what they have learned through this application.



Quiz: This page invites user interaction through dragging and dropping the options to answer the quiz.

3.1.4 Analysis of System Design

UML was used to model the system (not just the software) using object-oriented concepts. UML is used to model systems (not just software) using object-oriented concepts. At UML it is used to teach practical object-oriented software engineering with UML's main real-world tools, and design patterns. This step-by-step approach allows the reader to cope with complex and changing problems with practical and sophisticated solutions [7]. The design of ESMADI involved two diagrams in UML, which were Use Case Diagram and Class Diagram. Figure 2 explains the flow diagram in ESMADI, which actors include Admin and General Users. The use case diagram shows the initial processes. The admin and general users can access all the features available in the application as a learning medium but general users cannot change the features in the application. Admins and general users can enter the application if they have already installed it through the application format apk available on the CD and can close the application if they want to exit the application.

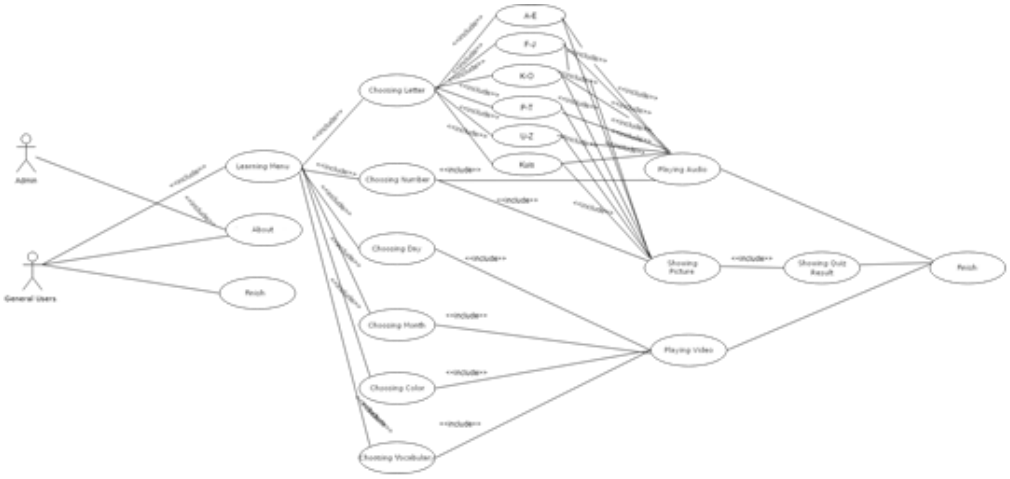


Fig. 3. Use case Diagram

Figure 3 describes the class diagram used in the application, which consisted of 12 classes related to each other in its creation, each class having different functions. The class diagram in Figure 4 explains the relationship between the classes.

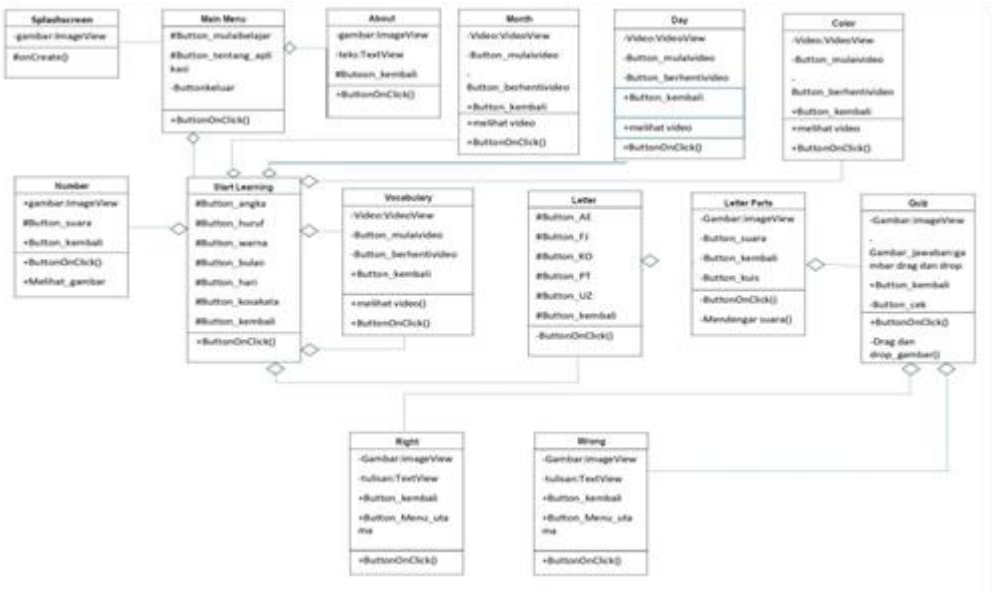


Fig. 4. Class Diagram

3.2 Coding

At the coding stage, the resulting model was implemented into the user interface using the programming language. In the coding stage, the application was developed using C# language, while the software was developed using Unity. As an example, the program listing written for the Splash Screen (1) can be seen below.

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using UnityEngine.SceneManagement;

publicclasssplashl : MonoBehaviour
{
public Transform masukkanbar;
  [SerializeField]
privatefloat nilaisekarang;
  [SerializeField]
privateint nilaikecepatan;
```

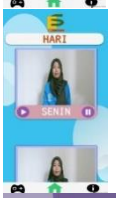
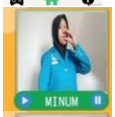
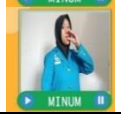
```
// Update is called once per frame
voidUpdate()
    {
if (nilaisekarang < 100)  {
           nilaisekarang += nilaikecepatan * Time.deltaTime;
           Debug.Log((int)nilaisekarang);
         } else
         { SceneManager.LoadScene("mulai belajar");
         }
         masukkanbar.GetComponent<Image>().fillAmount =
         nilaisekarang / 100;    }}
```

3.3 Testing

After the coding stage had been completed, the testing was carried out to check whether it met the needs. The testing was done using black box method and portability testing. Black box method tested the devices or systems for functional specifications without testing the design and program code. This is shown in Table 3. Portability testing was done by verifying whether the application can meet the portability requirements. The results can be found on Table 4. Reported failure in the portability testing could be helpful in identifying any defects not detected during unit testing.

Table 3. Results of black box testing.

No	Menu Functionality	Scenario	Expected results	Test Results:
1	Splash Screen View	Opening ESMADI	The App's logo appears on the Splash Screen	
2	Game Button	Clicking the Game button.	The quiz game display appears	

3	Letter menu button	Clicking the Letter menu button	The display to learn letters appears	
4	Numbers menu button	Clicking the Number menu Button	The display to learn numbers appears	
5	Days menu button	Clicking the Day menu button	The display to learn about days appears	
6	Month menu button	Clicking the Month menu Button	The display to learn about months appears	
7	Color menu button	Clicking the Color menu button	The display to learn colors appears	
8	Vocabulary menu button	Clicking the Vocabulary menu button	The display to learn vocabulary appears	
9	Play video button	Clicking the Play Video button	The video is played	
10	Pause Video button	Clicking the Pause Video button	Video was paused	

11	Application Info Button	Clicking the Application Info button	Information about the application appears	
12	Exit button	Clicking the Exit button	Close the current display; return to the previous display	Success
13	Check button	Clicking the Check button to see whether the correct message is displayed.	If the answer is incorrect, the wrong answer message will be displayed. If the answer is correct, the correct answer message will be displayed.	

Table 4. Results of portability testing

Device	Android OS Version	Installation Result
Oppo A92	OS 11(Red Velvet Cake)	Successfully performed
Oppo A92	OS 10 (Quince Tart)	Successfully performed
Oppo A7	8.1.0 (Oreo)	Successfully performed
Oppo F5	7.1.1 (Nougat)	Successfully performed
Redmi Note 5	9 (Pie)	Successfully performed

4 Conclusion

Based on the results and discussion on the introduction of Electronic Smart Application for People with Disabilities (ESMADI) Android-Based Learning System, it can be concluded that ESMADI had been designed as The android-based ESMADI application that has been taped can run according to what was created, a learning platform to learn sign language for the general audience from various groups, not just for people with speech or hearing impairment. ESMADI contains materials about days, months, numbers, colors, letters, and vocabulary, featuring demo videos and a quiz game about letters. This application can be a medium to facilitate learning anytime and anywhere. ESMADI was based on Android, with a minimum specification of Android 6.0 Marshmallow (API level 23), which can be accessed without internet connectivity (offline). Electronic Smart Application for People with Disabilities (ESMADI) Android-Based Learning System was developed using the prototyping method, starting from listening to users, designing and creating prototypes, to testing.

An application to learn sign language to fulfil the need of the general public must be designed. In the future, more words will be added to expand vocabulary. Therefore, constructive feedback, criticism, and suggestions are needed for the future development of this application.

References

[1] Hallahan, D. P. & Kauffman, J. M.: Exceptional childern: introduction to special education (fifth edition). Prentice Hall International, Inc., US (1991)
[2] Hardman, M. L.: Human exceptionality: society, school, and family (third edition). Allyn and Bacon, US (1990)
[3] Kirk, S. A. & Gallagher, J. J.: Educating exceptional children (sixth edition). Houghton Mifflin Company, US (1989)
[4] Pressman, R. S.: Software engineering: a practitioner's approach (seventh edition), Palgrave Macmillan, UK (2005)
[5] Nabila, N. H. & Amajida, F. G.: Obtaining vocabulary for deaf children with illustrated card media based on Indonesian word class at SLB Prima Bhakti Mulia Bandung. Jurnal SENDIKA FKIP UAD. Vol.2, No. 01, pp. 15-22
[6] Kendall, K. E. & Kendall, J. E.,: Systems analysis and design (4th edition). Prentice Hal, US (1998)
[7] Bruegge, B. & Dutoit, A. H.: Object-oriented software engineering using UML, Patterns, and Java (3rd edition). Pearson (2009)
[8] Muzahidin, S. & Rakun, E.: Text-driven talking head using dynamic viseme and DFFD for SIBI. 7th International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE). (2020)
[9] Rianto, P. P. & Sujana, A.P.: Designing an Android-based sign language learning application for the deaf. Komputika: Jurnal Sistem Komputer. (2019)