

Sign L - The Development of Sign Language System for Primary School Student

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Abstract: Sign language is body language that communicates with people through hand gestures. Sign language is frequently used to communicate with deaf or hard-of-hearing people, whereas deafness is a condition in which the ability to hear sounds is lost. However, there are several problems that deaf people face in daily life where they must understand people speak. Over time, deaf people try to read my lips and gestures to understand words when people speak naturally. Therefore, this project aims to develop and be suitable a system development that ordinary people will use by learning a simple virtual sign language. In addition, the ADDIE model is the best methodology for applying sign language development in primary school. This system allows people to learn basic sign language using digital platform learning approaches. In summary, to secure education, society should have a new learning alternative to support awareness of communication with deaf people.

Keywords: Sign Language, System, ADDIE Model, Deaf People, Primary School.

1. Introduction

This project aimed to develop a Sign Language system to enhance primary school students' learning experience toward education 4.0. As we engage with instructors or speakers, many languages are taking time to learn. It's same goes for sign language as well as excellent. Our fluency will improve as we attend the physical classes. However, to cater to this problem, we can learn it online anywhere and anytime using web sign language because it is challenging to search physical courses and rural areas. In addition, learning sign language at a young age is far more exciting and less challenging to understand as young people quickly learn new things. For good purposes, this system helps beginners starting with primary school.

Thus, each country has its sign language and complex sign language used in certain countries. Many people can't differentiate between American Sign Language (ASL) and *Bahasa Isyarat* Malaysia (BIM) sign language and access the wrong information for their language perspective to understand. There are

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various videos and random pictures on the internet on many platforms. This problem will make learners less interested in learning sign language because they need to find a particular sign they want to learn. The objective of this project is to design a web system for learning basic sign language using any digital learning platform. This system provides basic sign language teaching through online and is easily accessible by users.

This paper contains six main sections. The first section describes the project's background, while section two provides the literature review. Next, the research methodology is provided in Section 3, and Section 4 explains the findings from the analysis and design of the system. Included also is a discussion about the result of testing done on the product. The final section will be the conclusion to summarize the development process.

2. Related Work

2.1 Sign Language System for primary school

Sign Language for primary school is to begin the exposure from a younger era, the development Malaysian Sign Language system is now compatible for primary school. As we know people nowadays lack basic sign language to communicate with deaf people. This is because school education does not introduce a sign language learning system that can gain basic knowledge and help to communicate with deaf people. Thus, awareness to learn sign language starts from a young age to understand new things better. This language is usually learned by attending physical classes or online courses provided by the outside program that students need to register by themselves.

The sign language system proposes learning education for a primary school that can access by teachers for fun learning. In addition, this system will be widely used in Malaysia and society. They can contribute to promoting awareness of the importance of learning sign language. The mode of this learning method is online or at school. Teachers can use this system as a tool to teach sign language in class while students can access the learning and download it for offline learning. For example, a teacher can remote the ICT classes with sign language learning when students can access the computer provided.

2.2 Computer technology- Web Technology

Web-based has evolved in recent years, thanks to significant advancements in security and technology [2]. Traditional software-based programmers and systems may be readily enhanced by transitioning to a web-based. E-learning is the transmission of educational content and learning using digital means compared to an application that only allows application download by google play. The system can be browsed at physical classes in the school ICT lab which are more convenient rather than the school providing another gadget. Remote access to selected classes is one of the most significant benefits of online education too.

Furthermore, the use of the system proposed allows the video elements to be played as many times as necessary to comprehend the subject fully and can be downloaded. This type of learning encourages active and independent learning because it doesn't have to rely on anyone. Students can train by themselves whenever they choose, and you'll always be able to get help from teachers at school and peers via online learning.

2.3 Comparison of existing application

For comparison of the existing study, there is 3 different application of sign language to be compared such as ASL Kids, The ASL App, and aslTest. ASL Kids apps have completed modules that consist of learning basic sign language and quizzes to be compared. The ASL App completes basic sign language to the middle hardest sign but no quizzes at all.

Table 1: Comparison of existing application study

Features	ASL Kids	The ASL App	aslTest
User log in	X	X	X
Basic Alphabetical numbering	√	√	√
Universal gestures hand shape exercise	X	√	X
Basic sign environment	√	√	X
Display video	√	√	X
Quiz/Test	√	√	X
Controlling speed	X	√	X
Favorite draft	X	√	X
Purchase future sign bundles	√	√	X
Guidelines to use an app	√	√	X
Colorful interface	√	X	X

However, both application is good to be reference for this project. Finally, the aslTest application was different this app only has one module alphabetical sign language, and test for alphabetical only.

3. Methodology/Framework

ADDIE model is the methodology used for this project suitable for developing a system of sign language for primary school [1]. This model has 5 phases to complete the project development as ADDIE using analysis, design, development, implementation, and evaluation. ADDIE model will help to guide the project implemented as well as the problems studied such as instrument, data collection, and analysis methods. **Figure 1** shows the ADDIE model.

3.1 Analysis

The first phase is the phase that requires the need to collect data and analyze the problem from some research. It requires the developer to refer the sign language specialist or person that teaches sign language from any association or deaf school. The developer needs to collect the information from their knowledge sharing and provide workflow with idea checking on applications proposed. This system will help awareness and knowledge about sign language, especially when they want to communicate with deaf people to gain primary sign language. The target user is children where the understanding starts from a young because the problem of our generation didn't well know the basic language. Apart from this project, as the project's objective, the developer must reach the goals and ensure this project successfully develops.

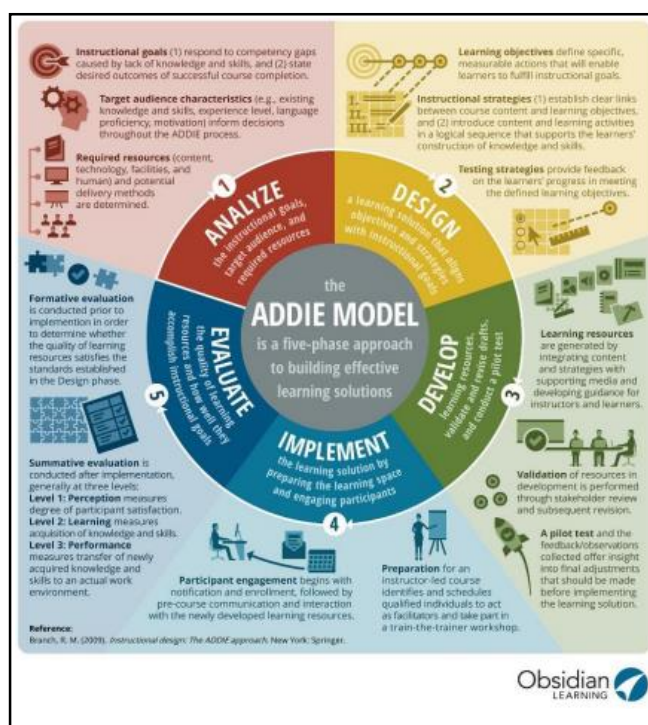


Figure 1: ADDIE model [1]

3.1.1 Requirement Analysis

Table 1 shows the functional requirements for each module with functionalities products such as admin login & register, user login & register, performance module, and learning module. In addition, table 3 shows the non-functional requirements such as performance, operational, and security.

Table 2: Functional Requirements

No	Modules	Functionalities
1.	Admin Login & register	<ul style="list-style-type: none"> The system allows the admin to login into the system using a username and password The system allows admin to add new admin into the system with detailed registration The system should provide an invalid username or password The system should provide an existing account for the twice same registration The system allows admin to edit, delete and add new modules or learning to the main menu
2.	User Login & register	<ul style="list-style-type: none"> The system allows the student to register a new account The system should provide an existing account for twice the same registration The system should provide an invalid username or password
3.	Performance module	<ul style="list-style-type: none"> The system should display the interfaces of modules including learning, quiz, admin list, and user list The system should display the video of sign language The system should save the input and edit from the admin The system should delete input from the admin
4.	Learning Module	<ul style="list-style-type: none"> The system shows a learning module for the user

		<ul style="list-style-type: none"> • The system allows the user to choose a module • The system allows the user to play the video
5.	Quiz Module	<ul style="list-style-type: none"> • The system should display the quiz • The system allows the user to answer the quiz question • The system should show the score

Table 3: Non-Functional requirements

No	Requirements	Non-Functionalities
1.	Performance	<ul style="list-style-type: none"> • The system should be able for used anytime • The interaction between the user and the system is unlimited time
2.	Operational	<ul style="list-style-type: none"> • The system should be user-friendly for kids • The system should be easily maintained and updated by the admin • The system should be able to work on the web browser version
3.	Security	<ul style="list-style-type: none"> • Only administrators can edit and add modules to the system • User can access their learning without login

Analysis for this project emphasizes an investigation of the problem and its requirements; hence this project will be a computerized information system that can be used to design objects. It is the process of gathering and interpreting facts, identifying problems to solve, and breaking them down into their constituent parts. Thus, analysis is to investigate the development of a system to determine its objectives. This will help improve the project to ensure work efficiently to achieve their goals. The design emphasizes a conceptual solution that meets the requirements for this development, such as object design and database design to be put into action. It is the process of designing a new product to replace an existing application by defining the components or modules to meet specific needs.

3.1.2 User Requirement Analysis

Table 4 explains the user requirement analysis and how the system works between user and admin.

Table 4: User Requirement Analysis

No	User Requirements
1.	Admin should be able to input the username and password for login editing purposes
2.	Admin should be able to add a new user as admin with detailed registration
3.	Admin should be able to input/add the modules and edit modules on the system
4.	Admin should be able to update and maintain the
5.	Users should be able to register an account
6.	Users should be able to input the username and password for learning purposes
7.	Users should be able to select the main menu
8.	Users should be able to view the learning materials
9.	Users should be able to choose the learning materials
10.	Users should be able to play the learning video
11.	Users should be able to download learning materials

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12. Users should be able to answer the quiz
-
13. Users should be able to view the score for the quiz
-

4.2 Context Diagram

Figure 2 shows a context diagram for the Sign L system where the user and admin can access the system. The user, also need to register and can access easily to learning the sign language. The user can learn the sign language by choosing the list of modules on main the menu selection. Users also can answer the quiz and the answer will give right after they answer. On the other hand, administrators have to log in to the system to make some changes to the module whether want to edit, add or delete.

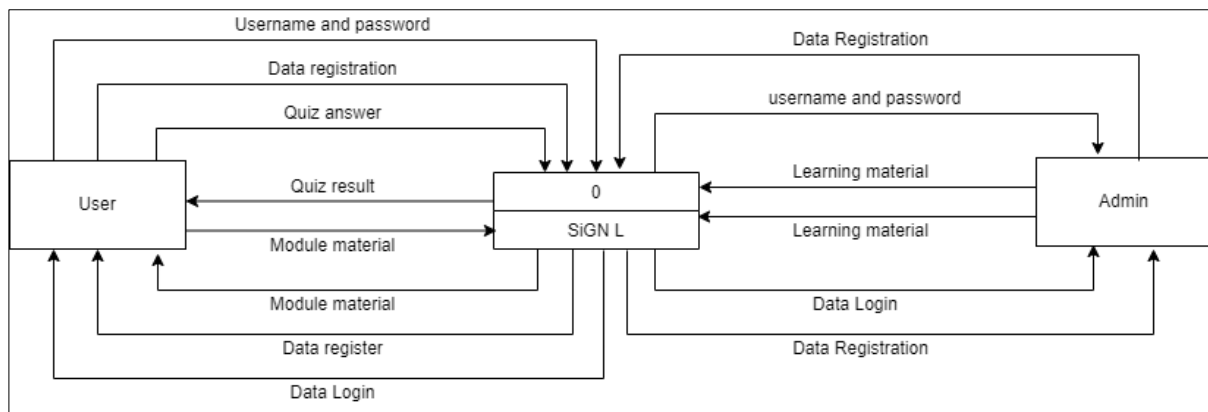


Figure 2: Data Flow Diagram Context Diagram (DFD CD)

3.2 Design

The designing interface is the beginning of the development product on software that the developer chooses suitable for the necessary system development. The second phase will be a design that starts to make the project. The developer will design the interface of the system. The user will interact with this interface using their fingertips by clicking on-screen graphics or icons. It is self-explanatory and easy to use as simple instructions icon will use and not require the user to remember the input complex commands.

3.2.1 System Architecture

Data Flow Diagram Level 0 shows the system work inside and Data Flow Diagram Level 1 shows the details process from the context diagram which focuses on entity flow. The purpose of this diagram is to provide the details of each process in that the system works for better understanding. The DFD Level 0 has six processes which are registration, login, learning, update module, update quiz, and quiz. **Figure 3** shows Data Flow Diagram Level 0 for the Sign L system.

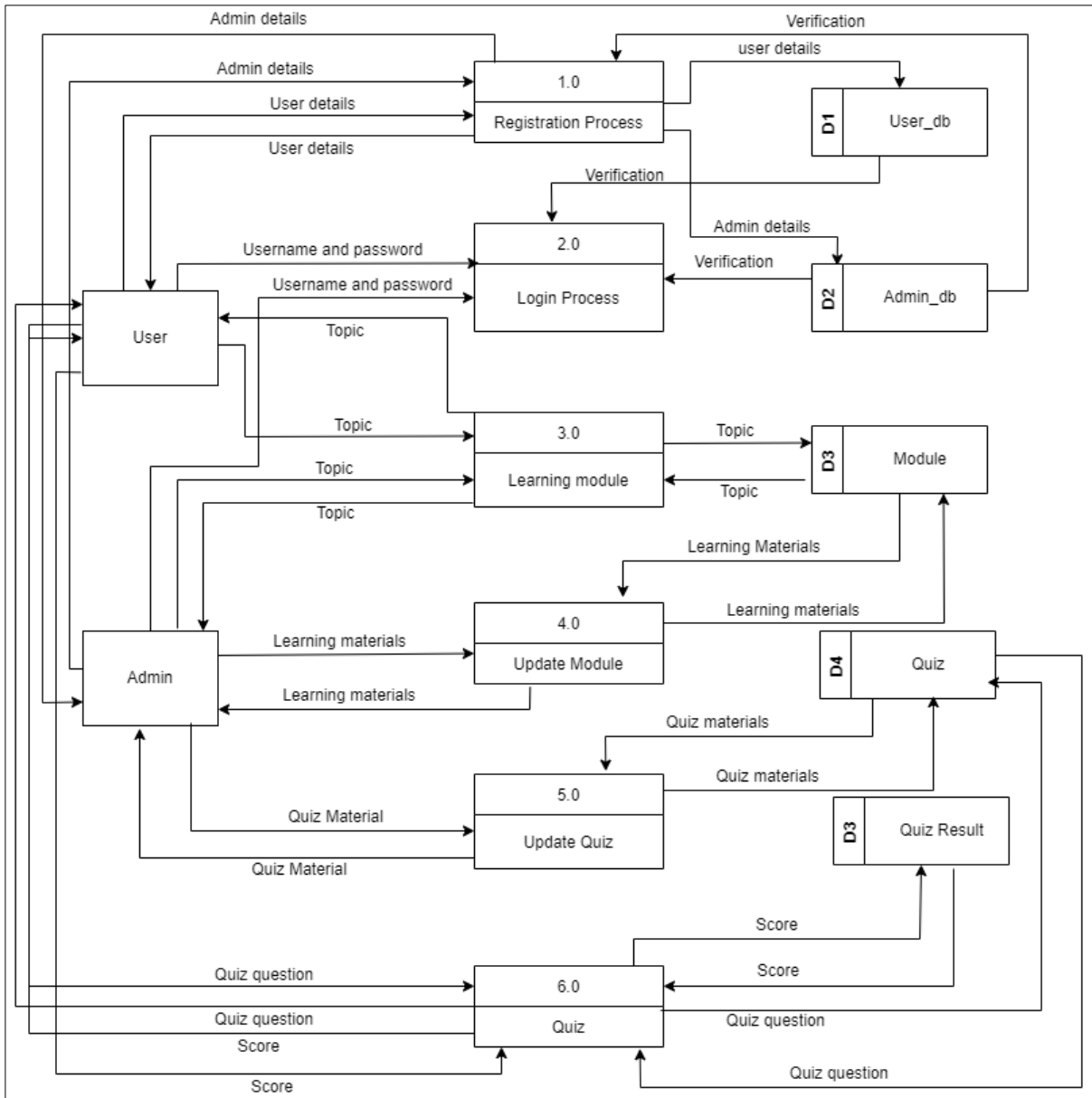


Figure 3: Data Flow Diagram Level 0 for Sign L System

3.2.1 Database Design

This Entity-relationship diagram (ERD) represents the structure diagram in the database. **Figure 4** shows 6 entities such as users_db, student_db, module_db, score_db, studentquestion_db, and quiz_db with a simple attribute on it. This system was conducted by the administrator for education and the user only log in to the system to access the system.

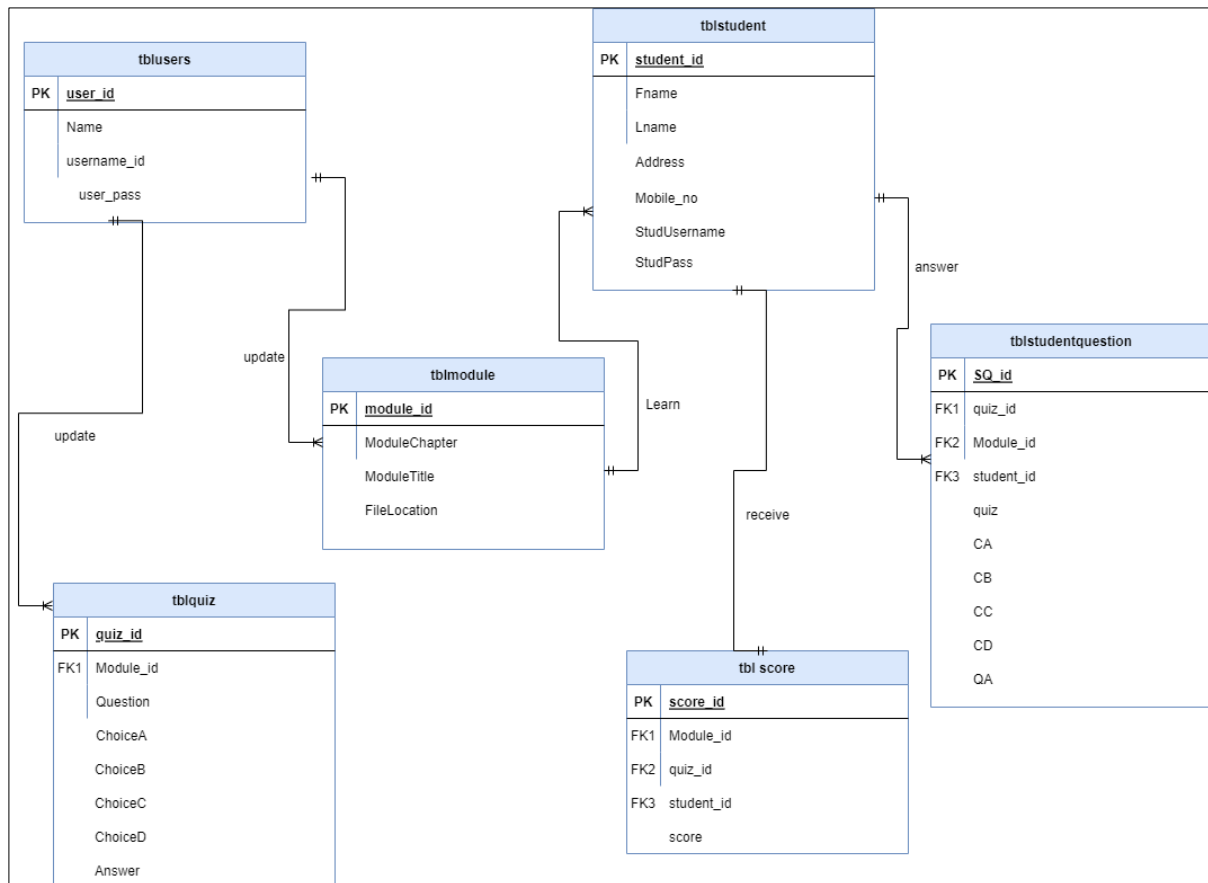


Figure 4: Entity Relationship Diagram (ERD)

3.2.2 Interfaces Design

The user can learn from learning modules and answer the quiz. These features help them explore the learning material in one language include. Other than that, this system allows teachers to edit, delete and add learning material and quizzes. In this system, teachers can insert video learning and be able to view quiz results from students. All the student and teachers' data are linked to the database, where all the account registration details are stored.

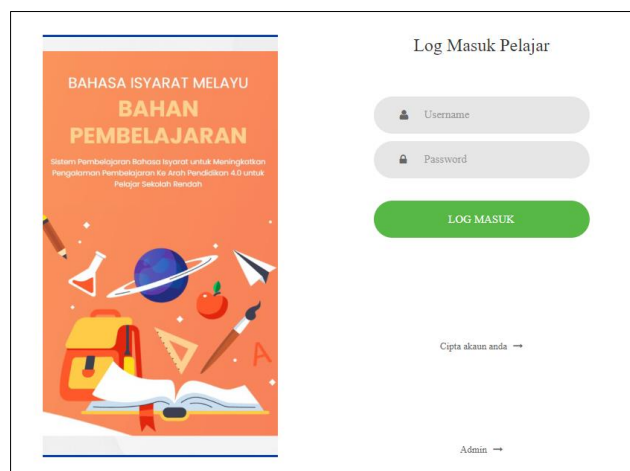


Figure 5: Main Page & Student login

Figure 5 shows the main page of the sign language system and student login. This main page displays the student login page. There is an admin login under creating an account for students for admin login.

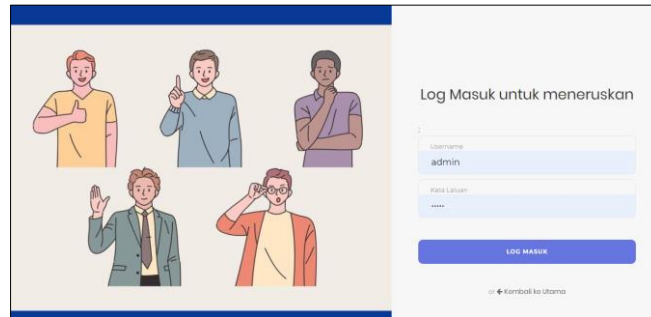


Figure 6: Administrator’s Login

Figure 6 shows the administration for teacher login after redirect from the main page. This selection allows users to choose which categories to log in to and access the learning purpose. Admin registration is not available on this page however previous admin will add a new admin for registration after they login into their account.

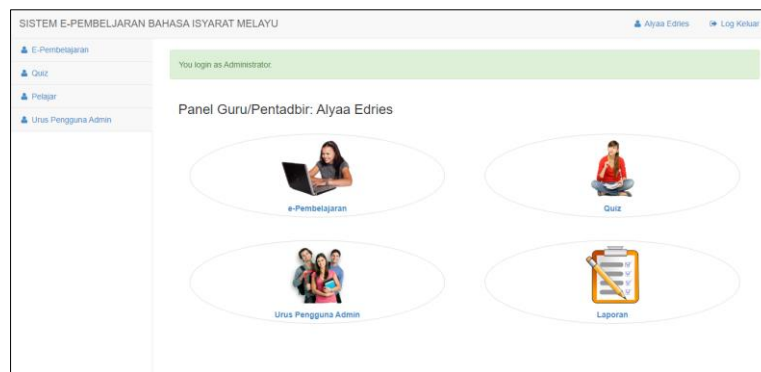


Figure 7: Administrator’s Navigation

Figure 7 shows administrator navigation where the admin can choose the module. There is consist of learning, quiz, student, managing admin, and reports.

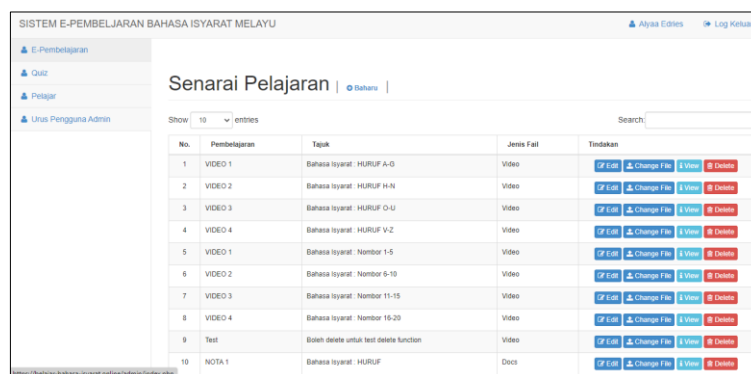


Figure 8: Administrator’s Learning Module

Figure 8 shows the administrator’s learning module. This page shows the list of learning that contain sign language materials for online learning.

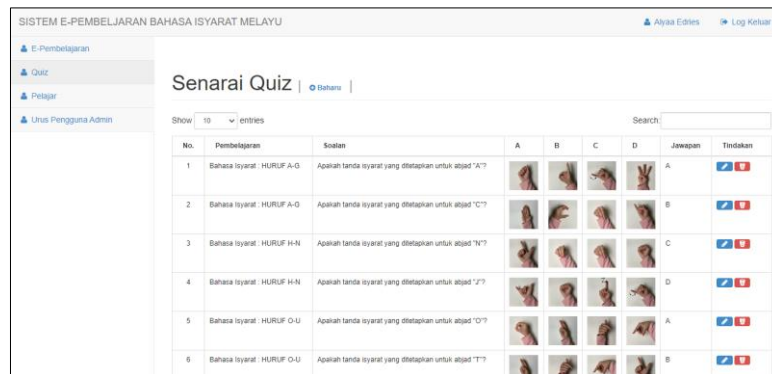


Figure 9: Administrator’s Quiz

Figure 9 shows the administrator’s quiz which a teacher can add, edit and delete quiz. The teacher also needs to insert a sign language photo for each answer option.



Figure 10: Administrator’s list of student account

Figure 10 shows the list of student accounts that have already registered. There are added new features for project requirements.

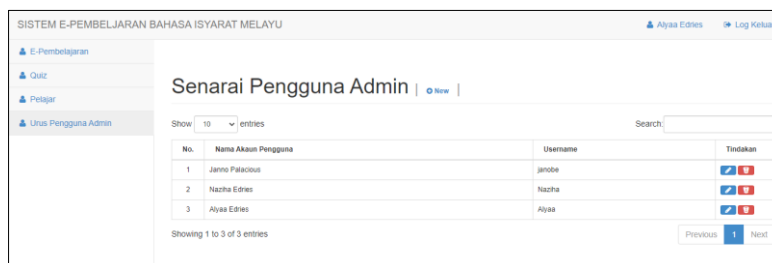


Figure 11: Administrator’s list of the admin account

Figure 11 shows a list of the admin account. These are newly added features for the sign language system where the administrator can edit and delete another administrator. They also can register new administrators.

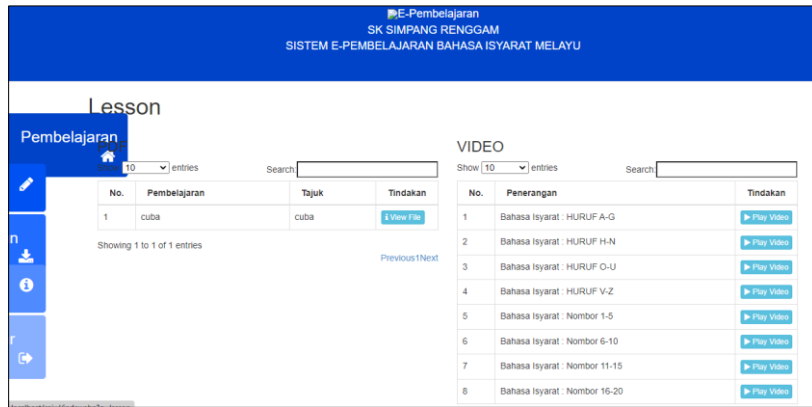


Figure 12: Student Learning Module

Figure 12 shows the student learning module for the student side. This module consists of learning material for sign language. The newly added features for this feature are PDF upload where the type file of the learning is a document. The teacher can insert notes for students for this new feature.

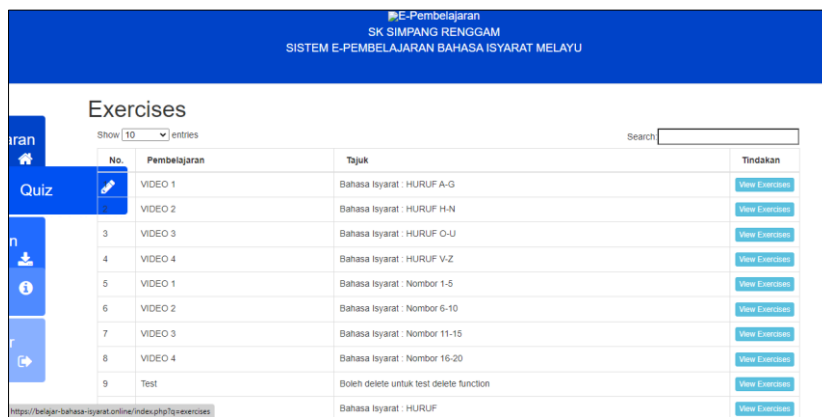


Figure 13: Student Exercise and Quiz

Figure 13 shows the student quiz where the revision question is after students learn sign language. Students can view the exercise as they can answer the question as well.

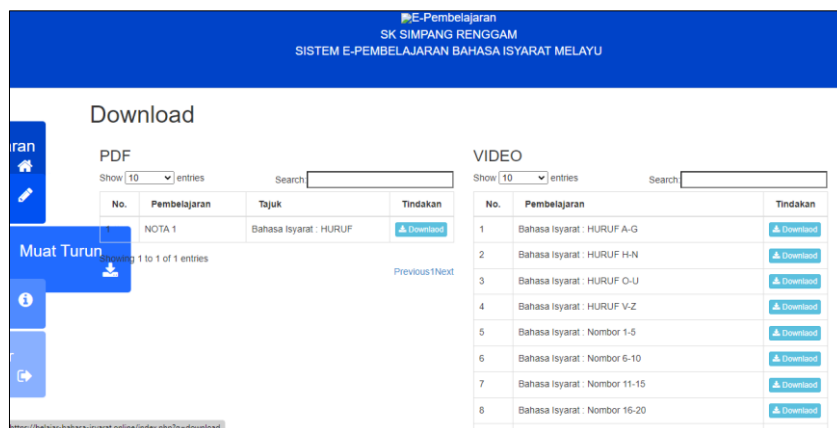


Figure 14: Student Learning Material Download

Figure 14 shows student learning material download. These are newly added features for this project requirement. Student allows downloading the materials in doc and video for offline learning by themselves.

3.3 Development Phase

The development in this phase is to coordinate and meet the objectives of the project plan. As the project developed, the targeted audience for 7+ years old and suitable for primary school students as their education. During development, software that will be used is Xampp and notepad++ as this software includes Hypertext Preprocessor (PHP) programming, and sign language content will be edited with suitable software such as Adobe Photoshop CS6 and CAP CUT application available on IOS for editing the video.

Table 5: Hardware and software

Hardware	Software
<ul style="list-style-type: none"> • ACER Laptop Aspire E14 Core i5 • iPhone X 	<ul style="list-style-type: none"> • Xampp • Notepad++ • Adobe Photoshop CS6 • CAP CUT

Programming will be the crucial development where the font, text, color, and function will be through the development phase. The development process of a sign language system needs this hardware and software to build it successfully.

3.4 Implementation Phase

At this phase, testing will be on after the development phase to ensure the features implemented during development are done and ready to take on part testing. The user will take their part in the testing phase which they experience first and then gather feedback from them for improvement to be done as they personal experience and opinions to make necessary changes to the system. User testing will be any primary school near Simpang Renggam primary school. The testing event considers targeting users up to 20 students maximum to get the experience and feedback.

3.5 Evaluation

After gathering all the data and documentation are made the apps will be ready to use however this phase also allows for making minor changes if there is other feedback for improvement. These apps also will get an evaluation from the deaf association regarding the information sign language is applicable to use on these apps or not. It is to prevent limited feedback. The apps will start to launch at this phase. Finally, in the last phase, the system is ready to use and can be downloaded at the play store using a smartphone or tablet.

4. Results and Discussion

Figure 5 until **figure 14** shows the interface design for the sign language system. **Figure 5** is the main page to choose whether the user is a teacher or student to log in and access the learning materials. **Figure 5** and **figure 6** is the login page for admin and student as well. **Figure 6** until **figure 11** are teachers' interfaces including learning update, quiz update, account student list, and account admin list while **figure 12** and **14** are student interfaces that have the learning, quiz, and download section.

Once the product is completely developed and ready to use, testing the website will be recorded to make sure the functionalities of the product have reached the requirement. The test table is created to examine the system's tests.

4.1 Test Cases

Test Cases to test the functionality of system behavior before entering modules. This testing is carried out to ensure that the developed system performs to the requirements needed. Besides, any bug will be recorded if found during the test. **Table 6** shows one of the test plan results obtained for the login module system

Table 6: Test Plan for Login Module

No.	Test cases	Description	Status
Test Case Login (TEST_01)			
1.	TEST_01_01	Teacher and student enter correct username and password	PASS
2.	TEST_01_02	Teacher and student enter invalid username and password	PASS
Test Case Registration (TEST_02)			
1.	TEST_02_01	New teachers and students register new usernames and password	PASS
2.	TEST_02_02	New teachers and students register existing usernames and password	PASS
Test Case Learning Module (TEST_03)			
1.	TEST_03_01	Teachers access the list of learning	PASS
2.	TEST_03_02	Teachers can edit, view, change files, delete learning	PASS
3.	TEST_03_03	Teacher insert learning material	PASS
Test Case Quiz for Teacher (TEST_04)			
1.	TEST_04_01	Teacher view list of Quiz	PASS
2.	TEST_04_02	Teacher insert new, delete the question	PASS
3.	TEST_04_03	Teacher insert Sign Language photo question	PASS
4.	TEST_04_04	The teacher updates and makes changes to the question	PASS
5.	TEST_04_05	Teacher view score student quiz	NOT PASS
Test Case List of student Account (TEST_05)			
1.	TEST_05_01	Teacher view list of student account	PASS
3.	TEST_05_02	Teachers search for students and sort student	PASS
Test Case Learning for Student (TEST_06)			
1.	TEST_06_01	Students view the learning material	PASS
2.	TEST_06_02	Student Play the video learning	PASS
Test Case Quiz for Student (TEST_07)			
1.	TEST_07_01	Students view a list of Question	PASS
2.	TEST_07_02	Students answer the question	PASS
3.	TEST_07_03	Student view score	PASS
Test Case Download learning (TEST_08)			
1.	TEST_08_01	Students view learning material	PASS
2.	TEST_08_02	Students download learning material	PASS
Test Case Log Out (TEST_09)			
1.	TEST_09_01	Teacher and student log out of the account	PASS

To conclude this testing phase, 2 features failed to develop which are the teacher unable to view the score student quiz and the student unable to answer the question. However, there is some added feature for this project which is the user can download the learning material and PDF learning material uploaded. Lastly, there are some newly added features at administrator where the admin can view the list of administration and student accounts list.

4.2 User Acceptance Testing

User acceptance testing is required performance from user experience as admin and user of the system. This testing is to check whether the system met the requirement. In addition, this testing was done by students and teachers from primary school as virtual meetings were conducted to present the flow and function of the system. A questionnaire was created and distributed to the users so that they can rate and give suggestions for improvement. **Table 7** shows the acceptance testing form obtained from the user experience.

Table 7: User Acceptance Testing Form

No	Acceptance Requirement	Test Result	
		Accept	Reject
1.	Registration admin & student working well	24	
2.	Login admin & student working well	24	
3.	Admin update-modules	24	
4.	Admin list student account	24	
5.	Admin list admin account	24	
6.	User modules	24	
7.	Admin update quiz	24	
8.	User quiz	13	11
9.	Navigation functional	24	
10.	Good Interface & acceptance design	24	
11.	Systems are User friendly	24	

The survey was collected by google form with various ages answering the question from 7 to 25 and above. Overall, the survey was all collected and received a complete answer with suggestions for improving the system.

5. Conclusion

By highlighting key points in the analysis or findings this project is to produce a system of sign language for schools to enhance smart learning that can gain basic knowledge and help to communicate with deaf people. The conclusion for this paper is an opportunity to succinctly the uniqueness and the characteristics of this application. The importance of the development of this project is to be able to teach the basic sign language and recap the learning for free using the web-based system without having physical classes.

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References

- [1] e-Learning Infographics. 2022. *The ADDIE Model Infographic - e-Learning Infographics*. [online] Available at: <<https://elearninginfographics.com/the-addie-model-infographic/>> [Accessed 14 June 2022].
- [2] Tekdal, Mehmet & SAYGINER, Şenol & Baz, Fatih. (2018). *DEVELOPMENTS OF WEB TECHNOLOGIES AND THEIR REFLECTIONS TO EDUCATION: A COMPARATIVE STUDY*.
- [2] Josep, Q. and Markus, S. "Handling Sign Language Data: The Impact of Modality." 2019; 10: 483, DOI 10.3389/fpsyg.2019.00483
- [3] R. Samual, "Benefits of using Mobile Apps in education", (2017). [E-book] Available: Safari e-book.
- [4] A. Liew Shu, L., and L.Khai, Y. "Gesture recognition-Malaysian Sign Language Recognition using Convolutional Neural Network", 9(10) pp1-6, 2020.
- [5] S. Meeze, M., A. Norlidah, J. Nazean, M. Yakub, Z., and H. Zahiah. "Kepentingan Bahasa Isyarat Malaysia (BIM) Dalam Pengajaran Perkara asas Fardhu Ain (PAFA) Terhadap Komuniti Pekak" 2(4) pp 1-7, oct. 2014.
- [6] Rashid, S. M. M., Yasin, M. H. M., and Sahari, N. "Penggunaan Bahasa Isyarat Malaysia (BIM) di dalam Terjemahan Maksud Surah Al'Fatihah" (The use of Malayian Sign Language in Al-Fatihah Translation) 17(4) , 2017. GEMA Online Journal of language Studies.
- [7] Harris, A. Q. M, Rini, A., Sara, B. "Malaysian Sign language Database For Research" International Conference. (ICCCE 2012), DOI 10.1109/ICCCE.2012.6271327
- [8] Nursyahirah. M, "Guna app belajar Bahasa isyarat" My Metro, p. 20, September 27, 2017. [Online]. Available: My Metro <http://hmetro.com.my> [Accessed Dis 29, 2021]
- [9] Fadila, A, "Belajar Bahasa Isyarat agar OKU Pekak dan Bisu Tidak Terpinggir" Malaysia Now, p. 10, Disember 25, 2021. [Online]. Available: Malaysia Now <http://malaysianow.com> [Accessed Dis 29, 2021]
- [10] Ramlia, H., said, T. S., Bin, M. N., Hazmanc, S. N. A. M. and Hussain, R. (2019). The development and evaluation of an Interactive Multimedia Module for the Topic of art elements of the Visual Art Education Subject. *Development* 10(6)
- [11] Dr. Verena, K. (2008). "The protection and promotion of sign languages and the rights of their users in Council of Europe member state: needs analysis." Pp. 9-25. (Example review sign language towards deaf citizen)