DEVELOPMENT OF SIGN LANGUAGE TUTORIAL MOBILE APPLICATION FOR FILIPINOS

CHARMAINE T. BANAG
Cavite State University-Tanza Campus, Cavite
Philippines

ABSTRACT

This paper presents the design and development of Filipino Sign Language (FSL) tutorial mobile application that can be used by the hearing community to learn the language of the Filipino Deaf. It aimed to provide the equivalent FSL of English words and sentences through animation and assess the learning of the users through quizzes. The signs contained in the application are provided by FSL signers and were also verified by an FSL expert. The application was developed using 3ds Max, Unity 3D, and MonoDevelop. The application was tested and evaluated by information technology and mobile application developers, teachers, parents, and Deaf students, as well as hearing end-users using the adapted ISO 25010 quality model as the evaluation instrument. The results showed that the application is excellent as perceived by the respondents as manifested by the mean rating of 4.59. This implies that the application can be useful to the end users who want to learn the Filipino Sign Language.

Keywords: mobile application, Filipino Sign Language, sign language, tutorial, animation

1.0 INTRODUCTION

Communication is very important to people. Through hearing, they have the ability to speak and listen to one another. They use different languages like English and Filipino. For the Deaf community or those who are Deaf-mute, they use signs, known as the sign language, to communicate.

As described by Martinez and Cabalfin (2008, p. 440), 'sign languages are fully visual languages.' Facial expressions, hand movements, and positions are being used to communicate. It also has rules of linguistics like grammar. For the Deaf, this is very important just like how voice and words are important to hearing community.

Different countries have different sign languages and the Filipino Sign Language (FSL) is the local form of communication used by the Deaf and mute in the Philippines. Currently, because only a minimum number of Filipinos know the FSL, there is a great need for FSL interpreters to penetrate the communication barrier between the hearing people and the Deaf. However, interpreters are not always available or present. With this, discrimination still exists and Deaf are less confident to socialize with hearing people.

At present, the Filipino Deaf community either uses American Sign Language (ASL), Signing Exact English (SEE), or Filipino Sign Language (FSL). Although, the Deaf community

organizations are promoting the use of FSL as the national sign language in the Philippines. However, one can only learn the FSL by enrolling in a sign language course or attending training conducted by different organizations.

In line with the existing and on-going developments and researches about sign language recognition, the development of a basic FSL tutorial that can be used by Filipino hearing community can be considered as a big help.

The general objective of the study is to develop a sign language tutorial for Filipinos mobile application that can be used by the hearing community to learn the language of the Filipino Deaf.

Specifically, it aims to:

1. Design a Filipino Sign Language tutorial mobile application that:

   a) provides a Filipino Sign Language signs tutorial by module;
   b) shows the equivalent Filipino Sign Language of English words and sentences through animation; and
   c) assesses the learning of the user through quizzes in each module;

2. Develop the application using 3ds Max and Unity 3D for the 3D character, animation, and user interface, and MonoDevelop for the source code.

3. Test the functionality and portability of the developed system.

4. Evaluate the performance of the developed system using the adapted ISO 25010 quality model.

2.0 METHODOLOGY

2.1 Project Design

Figure 1 presents the hierarchical input-process-output diagram of the sign language tutorial. As shown in the figure, the Filipino Sign Language tutorial mobile application consists of a tutorial and user's guide. The users can browse the modules in the tutorial but can only access these in order. They can view the Filipino Sign Language of the words and sentences in the form of animation. Inside these modules are quizzes that the user must answer correctly before they can proceed to the next sign or module.
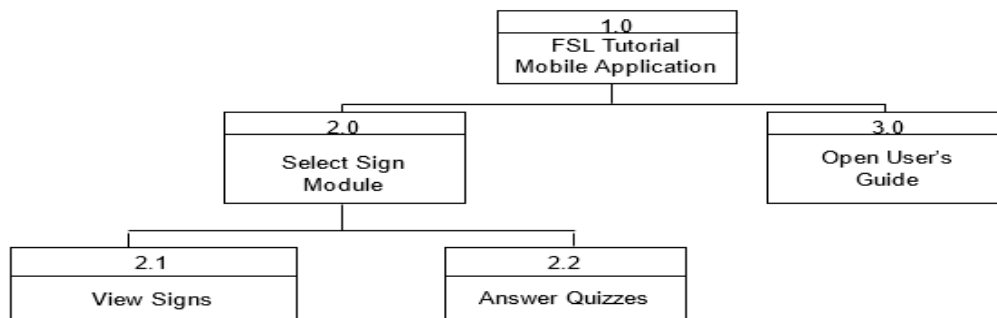
Figure 1. HIPO diagram of the FSL tutorial mobile application

Figure 2 presents the use case diagram of the Filipino Sign Language (FSL) tutorial mobile application. It shows that the end user may use the application to learn the basic signs of FSL. This is through viewing the animated FSL signs organized in modules and answering the quizzes included inside each module to assess their learning, and viewing the user's guide.
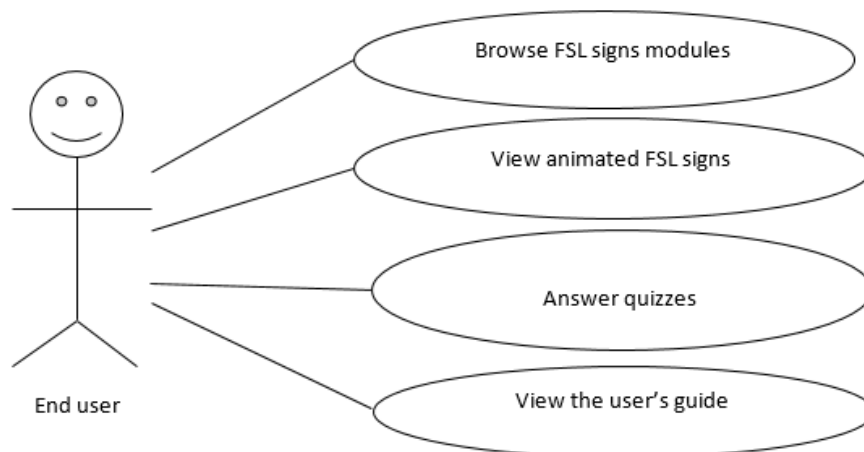

Figure 2. Use case diagram of the FSL tutorial mobile application

2.2 Project Development

The development of the sign language tutorial mobile application adapted the agile software development model with five iterative stages namely planning, requirements analyzing, designing, building, and testing.

2.2.1 Planning

In the planning stage, the researcher worked with the detailed planning of the exact tasks and features to be delivered to the intended users. Gathering of data, including the words and sentences included in the application, identifying the proper source of information and FSL signs, and researching about related applications was also conducted at this stage.

2.2.2 Requirements Analysis

The researcher collected more detailed information about the needs and requirements for the Filipino Sign Language tutorial in the requirements analysis phase. This was done through an interview with the Philippine Federation of the Deaf, Inc. and the Philippine National Association of Sign Language Interpreters. They were consulted about the features and the words and sentences that should be included in the application. They also recommended FSL signers and experts to ensure the accuracy of the signs that will be shown in the application.

2.2.3 Designing

After the planning and requirements analysis stages, each component of the system was designed. This includes the flow and user interface design. The product of the planning and requirements analysis phases was considered in designing the flow and user interface of the mobile application.

2.2.4 Building

The system was then built using the C# programming language and 3D animation, with tools such as Unity 3D, 3ds Max, and MonoDevelop. C# through MonoDevelop was used for the source code of the mobile application while 3ds Max and Unity 3D were used for the character creation, animation, and user interface.

2.2.5 Testing

System testing was conducted after the building phase. All the components of the system were checked to look for possible errors. The functionality and portability of the developed mobile application were tested. The functionality of the system was tested by testing all the buttons and features of the application while the portability of the mobile application was tested by installing and using it in mobile phones with different versions of Android operating systems and hardware specifications. Consultation with the FSL experts and intended users was done as the development progresses.

Delivery of the working product after these stages was done to assess the intended users' satisfaction and to get feedback. The performance of the application was evaluated in terms of functionality, usability, reliability, efficiency, and portability, adapted from the ISO 25010 quality model. Information technology experts, mobile application developers, educators, parents and teachers of Deaf, and Deaf and hearing end-users evaluated the application. The Likert Scale was used as the rating scale. The scores were tallied and the overall mean were interpreted using the descriptive interpretation of the mean shown in Table 1.

Table 1. Descriptive Interpretation of the Mean

Numerical Scale	Interpretation
4.51 – 5.00	Excellent
3.51 – 4.50	Very Good
2.51 – 3.50	Good
1.51 – 2.50	Fair

1.00 – 1.50	Poor

3.0 RESULTS AND DISCUSSION

Figure 3 shows the FSL tutorial mobile application home screen which shows the list of modules that can be accessed by the user in order. Upon clicking the first module, the tutorial page appears as shown in Figure 4. A number of quizzes is provided in each module to challenge and assess the memory of the user, as shown in Figure 5.
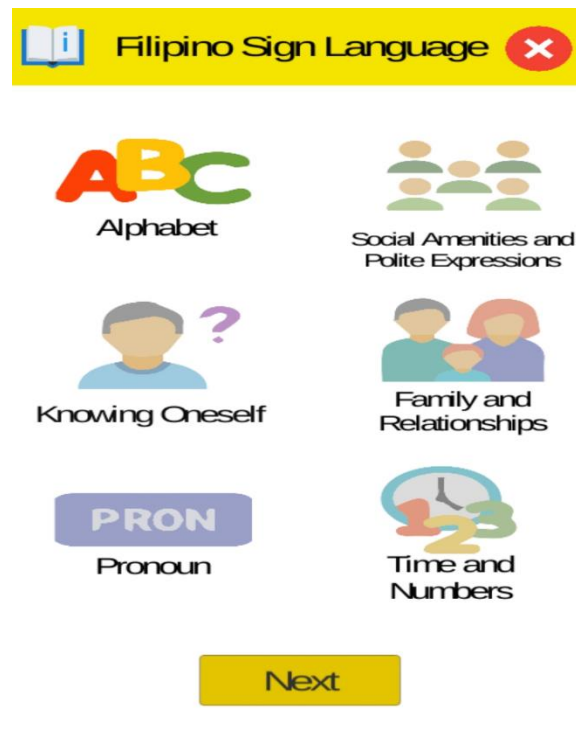

Figure 3. Home screen of the FSL Tutorial application

The tutorial is composed of 23 modules. These are the: (1) Alphabet, (2) Social Amenities and Polite Expressions, (3) Knowing Oneself, (4) Family and Relationships, (5) Pronoun, (6) Time and Numbers, (7) Place, (8) Colors, (9) Size and Shapes, (10) Quantity, (11) Action Words, (12) Adjective, (13) Emotions, (14) Attitude and Qualities, (15) At Home, (16) Food and Drinks, (17) Transportation, (18) Animals, (19) Romance, (20) Weather, (21) Occupation, (22) Hobbies, and (23) Technology.
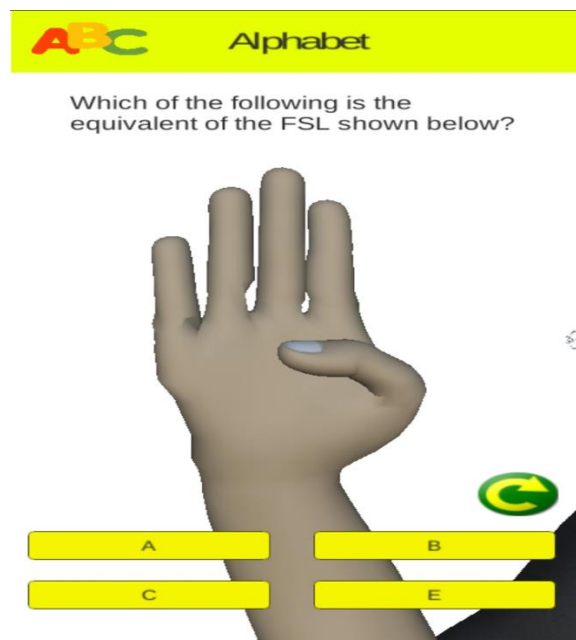
Figure 4. Content of the tutorial page

Figure 5. A quiz inside a module

3.1 Project Capabilities

The following are the capabilities of the project:

1. The application provides the FSL signs organized in modules.
2. The tutorial contains 705 FSL signs.
3. The FSL signs are shown in animation.
4. A guide is provided for an overview on how to use the application.

5. Quizzes are provided to challenge and encourage the user to learn more and to assess his/her memory and learning.
6. Modules are accessed in order to give a guiding track to user's learning of the FSL.
7. The application does not need an Internet connection to use.
8. The application is designed to be easy to understand and used by the end users by providing only a small number of icons that they may select and inputs that they need to provide.
9. The application can be installed and used on different Android mobile phones.

3.2 Project Limitations

The following are the limitations of the project:

1. The application is only for mobile phones with Android operating systems and cannot be installed and used in Apple and Windows devices.
2. The animation was created with a male character.

3.3 Evaluation

Table 2 summarizes the evaluation of the respondents showing the mean of each criterion and their corresponding qualitative interpretation. The table also presents the overall mean of these five criteria.

Table 2. Qualitative Interpretation of Respondents' rating of the application

Criteria	Mean	Qualitative Interpretation
1. Functionality	4.67	Excellent
2. Usability	4.61	Excellent
3. Reliability	4.61	Excellent
4. Efficiency	4.57	Excellent
5. Portability	4.51	Excellent
Overall Mean	**4.59**	**Excellent**

The functionality of the application was rated excellent with a mean of 4.67. This means that the application functions as intended and meets the needs of the users. The usability of the application was rated excellent with a mean of 4.61 which means that the users are satisfied with their interaction with the application. The reliability of the application was rated excellent with a mean of 4.61. This means that with the application's attributes, the user can rely on its performance. The efficiency was also rated excellent with a mean of 4.57 which means that the application can be used by the user without wasting too many resources by providing fast response to user interaction and reasonable processing times. Lastly, the portability of the application was also rated excellent with a mean of 4.51. This means that the application can be used in devices with different hardware and software environments. These yielded an overall mean of 4.59 which indicates that the developed application is excellent.

4.0 CONCLUSION

The results showed that the application is excellent as perceived by the respondents. With this, it can be concluded that the developed mobile application successfully met the necessary features useful to the intended users who want to learn the Filipino Sign Language. Further research can be conducted to measure the learning outcome of the users of the application.

REFERENCES

Almasoud, A., and Al-Khalifa, H. (2011). A proposed semantic machine translation system for translating Arabic text to Arabic sign language. Proceedings of the Second Kuwait Conference on e-Services and e-Systems (p. 23). ACM.

Chon, J. (2011). Real-time sign language video communication over cell phones (Dissertation). https://mobileasl.cs.washington.edu/downloads/Chon.pdf

Takács, G., Tihanyi, A., Bárdi, T., Feldhoffer, G. and Srancsik, B. (2006). Speech to facial animation conversion for deaf customers. 14th European Signal Processing Conference, Florence, Italy, 2006, pp. 1-5.

Ghaziasgar, M. (2010). The use of mobile phones as service-delivery devices in sign language machine translation system (Dissertation). http://hdl.handle.net/11394/2113

Haseeb, A. A., & Ilyas, A. (2012). Speech Translation into Pakistan Sign Language (Dissertation). http://urn.kb.se/resolve?urn=urn:nbn:se:bth-5095

Hoorn, R. (2009). Mobile Online Sign Language Dictionary to Improve English Literacy amongst the Deaf (Dissertation).

Kaur, R. (2014). Sign Language Automation (Dissertation). http://hdl.handle.net/10266/2859

Martinez, L. B. & Cabalfin, E. G. (2008). Sign Language and computing in a developing country: A research roadmap for the next two decades in the Philippines. Proceedings of the 22nd Pacific Asia Conference on Language, Information and Computation, pages 438–444, The University of the Philippines Visayas Cebu College, Cebu City, Philippines. De La Salle University, Manila, Philippines.

Motlhabi, M. B. (2014). Usability and content verification of a mobile tool to help a deaf person with pharmaceutical instruction (Dissertation). http://hdl.handle.net/11394/3346

Ong, C.Y., Lim, I.R., Lu, J., Ng, C., & Ong, T. (2018). Sign-Language Recognition through Gesture & Movement Analysis (SIGMA). https://doi.org/10.1007/978-3-319-76947-9_17

Sandjaja, I. N., & Marcos, N. (2009). Sign language number recognition. 2009 Fifth International Joint Conference on INC, IMS and IDC (pp. 1503-1508). IEEE.

Wilson, C. (2013). Portable Game Based Instruction of American Sign Language. https://tigerprints.clemson.edu/all_theses/1760

Xu, K. A. (2013). Facilitating American Sign Language learning for hearing parents of deaf children via mobile devices. http://hdl.handle.net/1853/47629