

SANWADHA

Intelligent Assistant for Hearing Impairers to Interact with The Society

Software Requirement Specification Document

Comprehensive Design & Analysis Project - 2017
B.Sc. Special (Honors) Degree in Information Technology

Project ID: 17-092

Date of Submission: 02/05/2017

Project ID: 17-092



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DECLARATION

I declare that this is our own work and this software requirement specification does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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1. Introduction

The introduction of the Software Requirements Specification (SRS) document mainly provides a scope description and an entire overview of everything included in the Software Requirements Specification (SRS) document. This includes purpose, definitions, acronyms, abbreviations, references and overview of the SRS.

1.1. Purpose

The purpose of this document is to give a detailed description of the requirements for the project “Sanwadha” as an intelligent assistant for Hearing Impairers to interact with the society using Machine learning and Natural language processing. This document will illustrate the purpose and complete declaration of development of the system to give an in-depth insight of “Sanwadha”. It will also explain product’s target audience, system constraints, interfaces and interactions with other external applications, features of the system, functional requirements, nonfunctional requirements, data requirements, quality requirements, hardware requirements and software requirements. Issues related to the current system and actions to be performed by the development team are described in order to come up with a better solution. This document can be used to verify whether the software meets the user’s actual needs and requirements. In Development team’s perspective SRS is valuable as it describes scope of the project, plan system’s design and eventual implementation.

In short, the purpose of this SRS document is to provide a detailed overview in Text and Voice translation to Sign language and creating 2D model of the software product “Sawadha”, its parameters and goals.

The intended audience of this System Requirement Specification are, the members of the research group, project supervisor Prof. Samantha Thelijjagoda.

1.2. Scope

This document covers product perspective and details of the designing process functionalities of the “Intelligent assistant for Hearing Impairers to interact with the society”.

First and foremost, it wondered how hearing-impairers contract with their situation daily and if there are difficulties with the hearing society. Many deaf people feel challenging or become frustrated trying to communicate with ordinary people, especially when no interpreter is available. Regarding the communication approach of hearing impairers “Sign language” is the supportive language for them since they are not comfortable with human language. And again, there is a matter of unfamiliarity of sign languages among ordinary people. Certainly, there should be a way to bridge this gap. The proposed application would be the ideal solution for this problem. Using chat systems for communication has become a trend and the smartest way to link with people all around the world. This facility is restricted only to ordinary people. Yet people who are differently-abled are isolated and denied of this facility just because of their disability. Above all our intension is to reach the Sri Lankan deaf community using modern technologies to help people with disabilities is highly regarded. Project “Sanwadha” is the proposed application that would achieve the communication gap among hearing-impairers and ordinary people.

Software Requirements Specification covers all aspects in “Sanwadha” project related to Text to Sign language translation using machine learning techniques, Voice to Sign language translation using natural language processing techniques, GIF delivering using GZIP compression algorithm, creating 2D model using Maya Autodesk.

In particularly when considering about GIF conversion, the string output gain through text conversion is going to be converted into GIF format in a high accuracy level. The capacity of a GIF file is very high. Hence it would take some time to move a GIF file to user. This can be a drawback in our application since it is an instant messaging application. As per the solution these GIF files are send through the networks by compressing. For that, the “**GZIP Compression Algorithm**” is used for the compression. Additionally, Compressed GIF file can be send through Facebook Messenger to the Deaf user. As Facebook Messenger has become a prevalent communication media this attempt would be more successful. Then finally the output GIF is deliver to the deaf user under decompression.

1.3. Definitions, Acronyms and Abbreviations

SRS	A software requirements specification (SRS) is a description of a software system to be developed. It lays out functional and non-functional requirements, and may include a set of use cases that describe user interactions that the software must provide.
Sign language	A language which chiefly uses manual communication to convey meaning, as opposed to acoustically conveyed sound patterns. This can involve simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to express a speaker's thoughts.
Machine Learning	Machine learning is a type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed. Machine learning focuses on the development of computer programs that can change when exposed to new data.
Natural Language Processing	Natural language processing (NLP) is a field of computer science, artificial intelligence and computational linguistics concerned with the interactions between computers and human (natural) languages.
GIF	The Graphics Interchange Format is a bitmap image and lossless format for image files that supports both animated and static images.
API	Application program interface (API) is a set of routines, protocols, and tools for building software applications. An API specifies how software components should interact.
GZIP Compression Algorithm	GZIP is a file format and a software application used for file compression and decompression.

Table 1.1: Definitions

SRS	Software Requirement Specification
GIF	Graphic Interchange Format
NLP	Natural Language Processing
ASR	Automatic Speech Recognition
SLU	Spoken Language Understanding
SLG	Spoken Language Generation
TTS	Text to Speech Synthesis
IM	Instant Messaging
API	Application Program Interface
HDD	Hard Disk Drive
RAM	Random Access Memory
D-User	Deaf user

Table 1.2: Acronyms and Abbreviations

1.4. Overview

The proposed application would give the perfect solution for the gap in communication of hearing impairers and hearing people. The foremost outcome of the proposed application is to communicate using Sinhala sign language with a Text or Voice input in a high accuracy level. By emerging this application research team is willing to provide subsequent features to users.

The main intention of the investigation is to deliver excessive support by enabling hearing impaired people to communicate with others, share feelings and ideas, actively interact with the society and help that they require with minimum amount of effort and time. And, allowing the hearing impairs to play the role by way of ordinary people without having desertions. Gradually the specific objectives can be defined as follows.

- Improve the communication in-between ordinary people and hearing-impaired people

The vital issue here is the communication between ordinary people and hearing-impaired people. This proposed application will help to enhance the communication between them in a very effective manner.

- To reduce the complexity of learning sign language

On the other hand, there is a very slight knowledge about sign languages in Sri Lankan people. In fact, there is no any proper way to learn sign languages for the people who are eager to learn them. Again, it's not much easy to learn them. This gap will be reduced by proposed application in an impressive way.

- To determine the use of mobile applications

Deaf people can be observed as a diligence that allows them regardless to utilize to any need of learning and communication at any time anywhere.

- To emerge the application in Sinhala language

As per the intent to reach the Sri Lankan deaf community in an effective way and to spread among people broadly, this application is going to be developed in Sinhala language.

- To advance the text message to a Graphic Interchange Format (GIF)

Deliver the message in sign language with more accurate and attractive manner. As well as GIF files are image files that supports both animated and static images.

- To allow the generation of own sign language using 2D model

With the 2D model hearing impairers make more comprehend about the message they want to direct.

- To enhance Sinhala voice recognition algorithm
- To interact with the most prevalent social media like Facebook Messenger
- To provide maximum benefits to the people who are going to use the application
- To provides accurate and efficient service to the whole society

This SRS document contains detailed explanation about concluded functions of the application. It also provides product perspectives and details of the design process and covers the functionality proposed.

Section 2 of this document is covering overall description which includes product perspective, functions and operation with user interfaces. Also, it contains user characteristics and constraints which can be useful to customers/potential users.

Section 3 of this document is concerning specific requirements which include interfaces and performance requirements, design constraints, software system attributes and other requirements.

Section 4 of this document is about supporting information that contain table of content, indexes and appendices.

By analyzing all the sections of the document will deliberate all necessary information with respect to the character recognition process and the methodologies and approaches used to result in the final goal of the research.

When concerning about the users with the gathered information collected from different bases, research team essentially concentrated on major users in Sri Lankan Society, foremost users are;

- Hearing-impaired people
- Hearing people

Looking at the proposed application, it can gain several benefits alike;

- Help to link hearing impaired people with ordinary people
- To fully integrate the Hearing-impaired individuals in the society
- Avoids too much texting in chatting
- Make message sending effective
- Availability of offline messaging

2.Overall Descriptions

The proposed system is a mobile based application named as “Sanwadha”. The main ideology of the application is to provide a real-time communication tool between deaf persons and normal persons. It converts text into sign language and voice into sign language.

When considering the system architecture basically it is an instant messaging application. All user interfaces are in mobile phone. But then again, some processing parts are implemented in a web server. So, the consumption of the processor of the mobile phone is very low. Because of we needed to make an application which is light weighted and efficient. Text to sign conversion, Voice to sign conversion, GIF conversion and displaying are done in the mobile phone. Other functionalities suchlike creating signs using 2D model are implemented in web server.

Since this is a mobile application it supports for portability but need to support for the real-time communication. The algorithms used must be efficient enough to speed up the application. Also, must be produced most accurate outcomes. To satisfy above requirements developers need to be in good understanding of each and every functionality of the application.

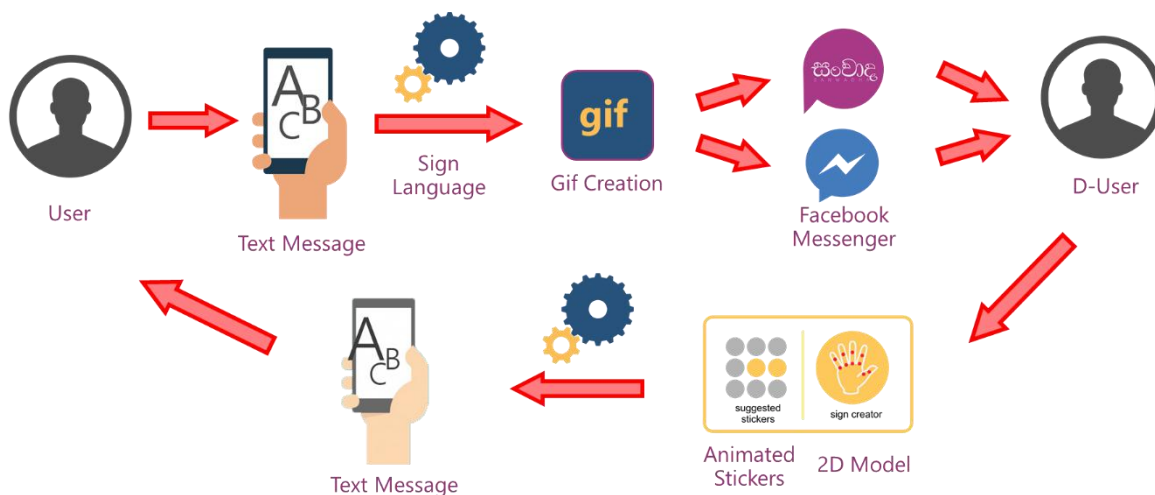


Figure 2.1: System diagram for Text conversion

Figure 2.1 mainly describes the text conversion of proposed application architecture. Text is entered and the text can be either Sinhala and Singlish. Input text would be converted into sign language which is in a format of String. Set of strings is transformed to the GIF format.

GIF can be send via either Facebook messenger or proposed application “Sanwadha” to the hearing-impaired user. In the reply scenario, deaf user can select either 2D model or animated stickers. Reply is delivered to the Normal user as a text message.

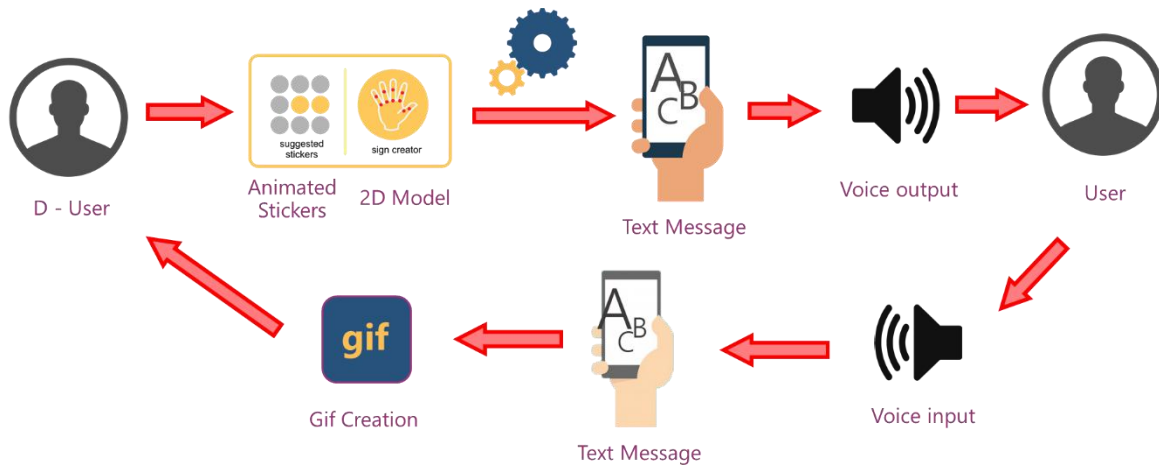


Figure 2.2: System diagram for Voice conversion

Figure 2.2 mainly describes the voice conversion of proposed application architecture. Deaf user can select either 2D model or animated stickers. That sign would be converted into text. Now the text to speech part is occurred in a high accuracy level. Finally, normal user get the voice output. In the reply scenario, reply is delivered to the deaf user as a GIF message through the process of speech to text.

2.1. Project Perspective

Considering the outcome of the literature review, it is conceivable to decide the most appropriate tools, technologies and software solutions for the implementation phase. In some cases of design conclusions, study more than one possible technologies and take performance and dependencies into deliberation. The projected solution can be divided to following key components:

- 2D Model creation
- Text Conversion Mechanism
- GIF file Compression and Extraction Mechanism
- Voice Recognition Module

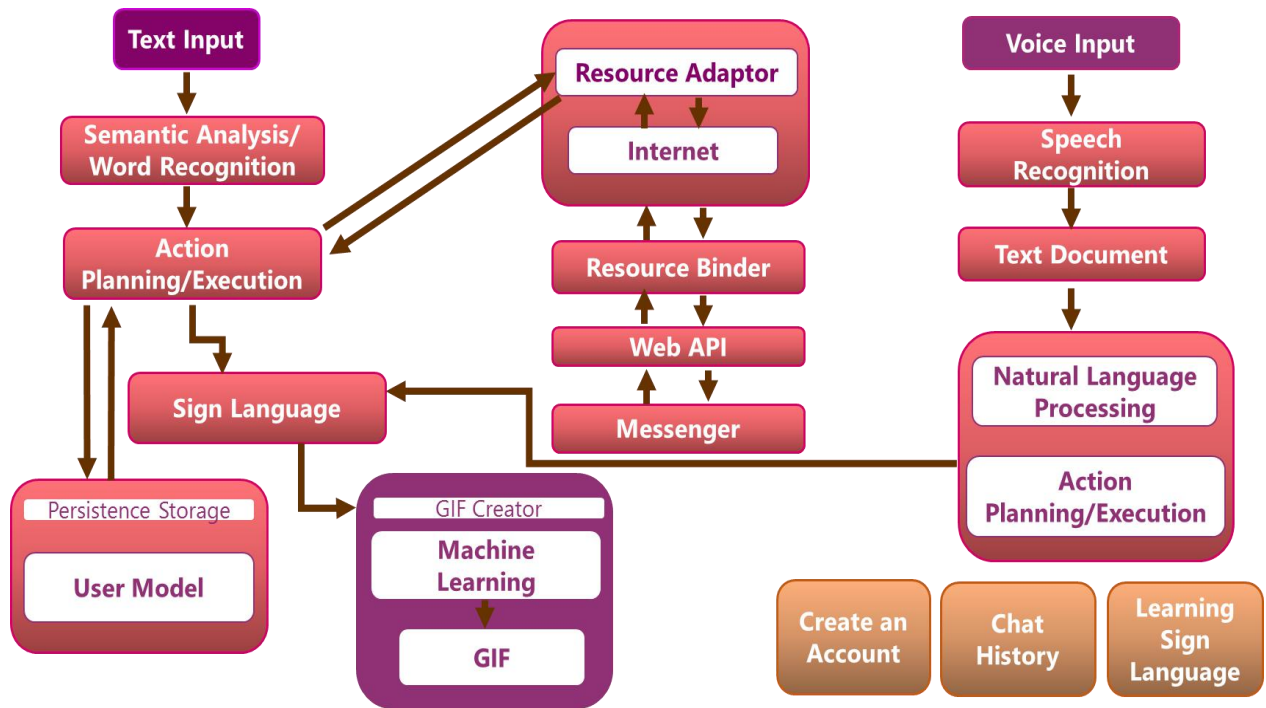


Figure 2.3: Technical diagram

GIF file Compression and Extraction Mechanism

Mainly in view of GIF conversion, the string output gain through text conversion is going to be converted into GIF format in a high accuracy level. The format supports up to 8 bits per pixel for each image, allowing a single image to reference its own palette of up to 256 assorted colors chosen from the 24-bit RGB color space. It also supports animations and allows a separate palette of up to 256 colors for each frame.

The capacity of a GIF file is very high. Hence it would take some time to move a GIF file to user. This can be a drawback in our application since it is an instant messaging application. As per the solution these GIF files are send through the networks by compressing to optimize the capacity. For that, the “**GZIP Compression Algorithm**” is used for the compression.

GZIP is a file format and a software application used for file compression and decompression.

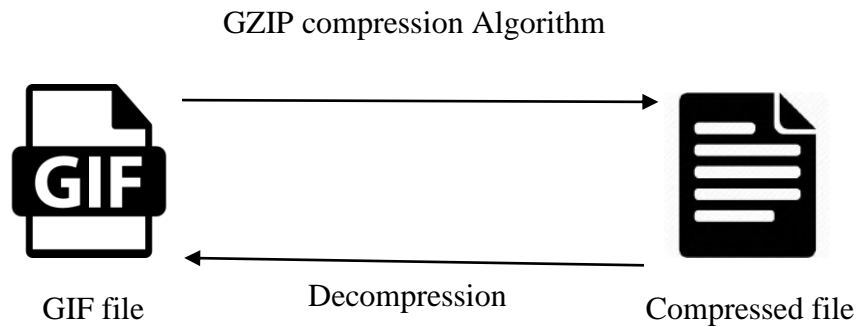


Figure 2.4: GZIP algorithm

Additionally, Compressed GIF file can be send through Facebook Messenger to the Deaf user. As Facebook Messenger has become a prevalent communication media this attempt would be more successful. Then finally the output GIF is deliver to the deaf user under decompression.

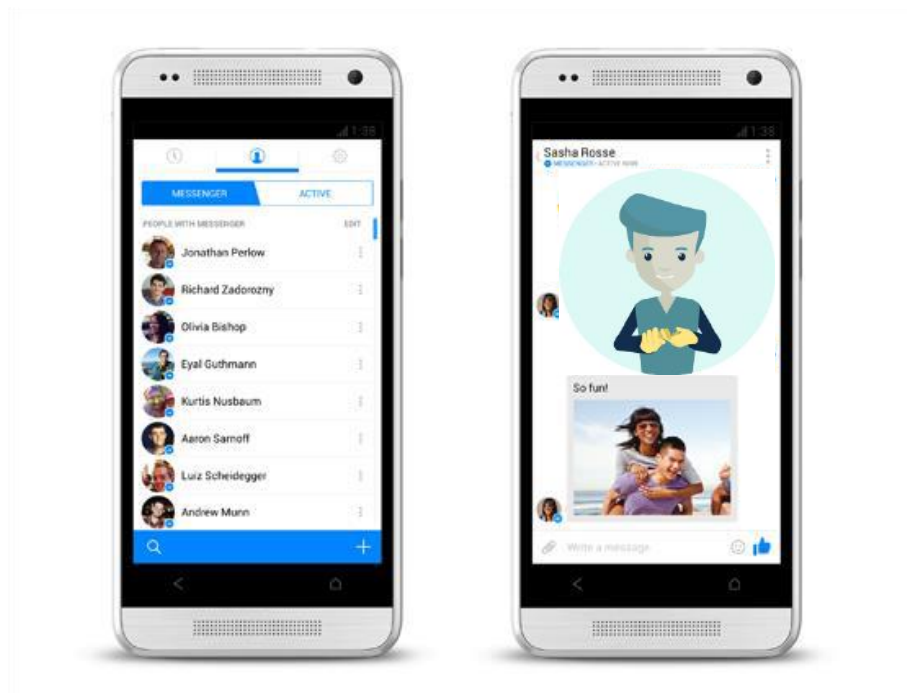


Figure 2.5: GIF delivery through Facebook messenger

There is very lesser amount of similar applications which are used around the world to support deaf people. But these systems have unresolved issues with it.

- Telecommunication

In order to communicate using a sign language between remote locations, deaf people use a video link through the internet, either a special-purpose videophone designed for use with sign languages or "off-the-shelf" video services designed for use on ordinary computers with webcams. The latter, though more widely available, often do not provide sufficient quality for sign language communication. The special videophones that are designed for sign language communication typically provide more frames per second than "off-the-shelf" services and may use data compression methods specifically designed to maximize the intelligibility of sign languages.

- Sign Language Interpretation

To communicate between deaf people and hearing people sign language interpreters are often used. To do the interpretation among them interpreters must have good knowledge about the sign language and they must put big effort to do this, because sign languages are distinct natural languages with their own syntax and it is different from any spoken language.

But these issues are resolved by our product and to offer flexible, reliable and accurate product for our end users.

2.1.1. System Interfaces

The proposed application will interact with API's listed below

- Facebook messenger
- Singlish API
- Rest API

2.1.2. User Interfaces

Proposed application is a mobile application connected with a remote server. Additional libraries will be used to improve the appearance of the GUIs and offline messaging. All user interfaces are described in detailed in section 3.1.1.

Key user interfaces

- Main user interface
- Secondary interfaces
 - i. Text messaging
 - ii. Voice approach

2.1.3. Hardware Interfaces

Hardware requirements will need to run the developed application without having any problem. For the designing, implementation and testing purposes we have identified few hardware requirements. Suchlike,

- Mobile phones – Android
- Microphone
- Speaker
- Windows 10, Windows 8, Windows Embedded Standard 7
- 32-bit (x86) or 64-bit (x64) processor
- Dual-core 2.66-GHz or faster processor
- 2 GB RAM

2.1.4. Software Interfaces

These software components are mainly used created in this application.

- Windows 10 Operating System
- Microsoft Visual Studio 2017 (.Net)
- Microsoft Azure
- SQLite Database
- MAYA Autodesk
- Photoshop CC
- CorelDraw X7

2.1.5. Communication Interfaces

- 4G - 3G connection of the mobile phone will be used for data transmission between the mobile app and the web server.
- Wi-Fi - If the mobile data is not available, user can connect to an available Wi-Fi router to get the internet connection in order to use the application. And this will also be used for data transmission between the mobile app and the web server.
- Required Connection bandwidth might differ time to time. Since large data load is travelling through the network, having a high bandwidth internet connection will help a lot for the users to use the application with ease.

2.1.6. Memory Constraints

- 512 MB RAM and 4GB HDD space in Android mobile phone.
- 4GB RAM 500GB HDD space in Server machine.

2.1.7. Operations

System User is capable of following operations

- Create profile – User can provide user name and password in order to login to the application.
- View and edit profile – User can view the profile and update any information.
- View chat history – User can view the previous chat threads.
- Save model – User has the privilege to save the generated 2D models.
- View design history – The application save models and user can view design history.
- Add features to model – User can enhance the sign by adding Time frames, Facial expressions.
- Input text – User can input text either in Sinhala or Singlish
- Input voice – User can feed in voice to interact with deaf people

System Administrator is capable of following operations

- Login – Admin can provide user name and password in order to login to the application.
- Manage the user details – Has the privilege to manage user details.
- Upload 2D models – Application allow admin to upload models.
- Approve relevant signs – Accept the signs created by the deaf users.

2.1.1. Site Adaption Requirements

- Both normal and Deaf people are the main users of the application. Hence, it is a requirement to build the application in a simple, understandable and innovative manner to make the application more users friendly.
- Internet access should be provided to the mobile.
- The voice output should be clear and accurate to the user from the beginning.

2.2. Product Functions

Our team has determined the following functions to be most important and pertinent for application to provide.

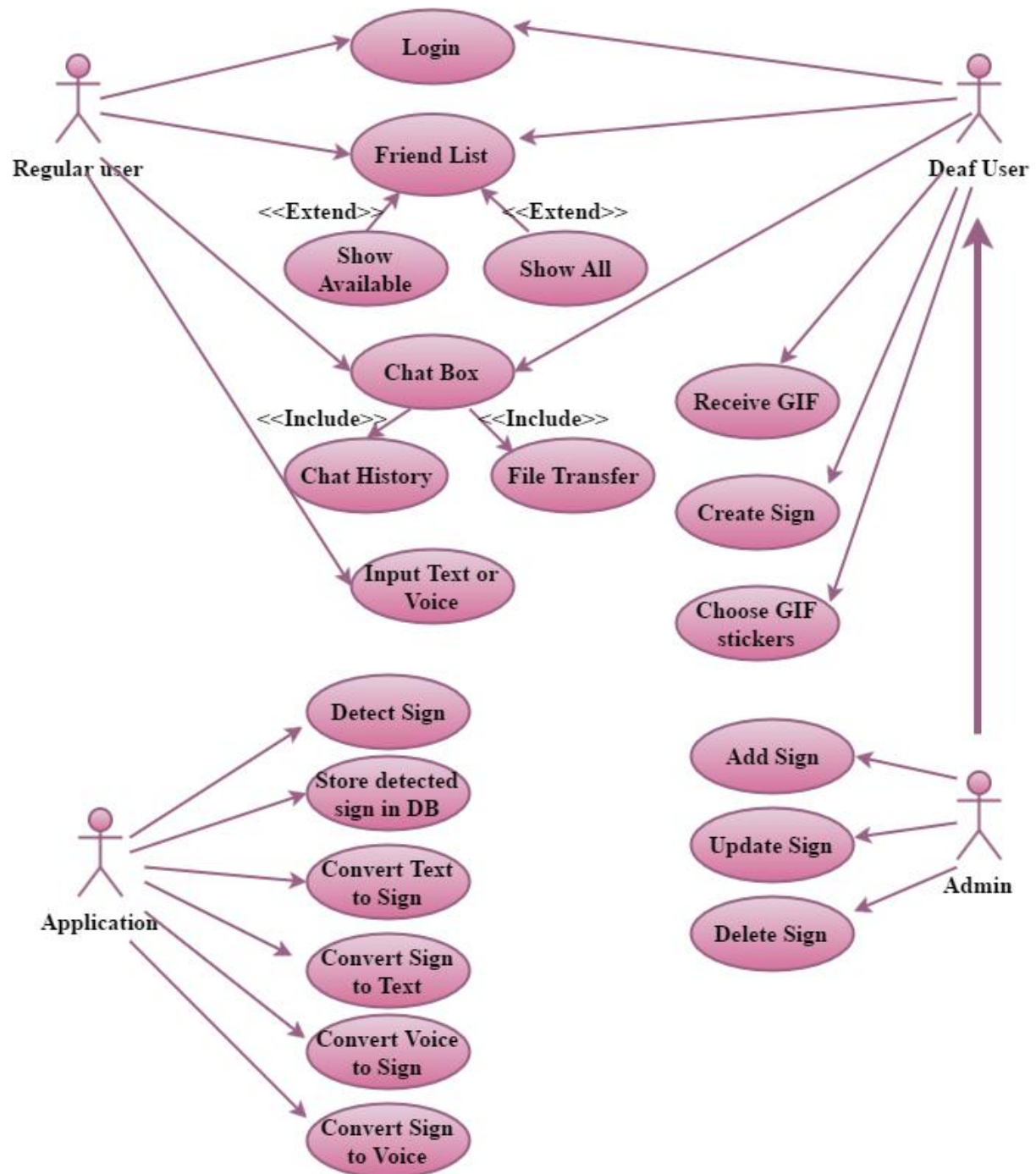


Figure 2.6: Use case diagram

Use Case Scenarios

Use Case Name	User Login
Preconditions	Should be a registered user in the application.
Successful End Condition	Redirect to the main interface
Actor	D-User/ User
Main Success Scenario	<ol style="list-style-type: none"> 1. Enter Username 2. Enter Password 3. Click Login button
Extensions	<ol style="list-style-type: none"> 1a. If the Username is invalid, application will prompt an error message and user should enter correct username again 2a. If the Password is invalid, application will prompt an error message and user should enter correct password again

Table 2.1: Use case scenario – User login

Use Case Name	GIF conversion
Preconditions	Should have an accurate String output from Text conversion.
Successful End Condition	Create the GIF file
Actor	Application
Main Success Scenario	<ol style="list-style-type: none"> 1. Identify the String output 2. Identify the sign for each word 3. Create the GIF for separate sentences

Table 2.2: Use case scenario – GIF conversion

Use Case Name	Delivery through Messenger
Preconditions	1. Should be a registered user in the application. 2. Should have a Facebook account
Successful End Condition	Deliver the GIF to messenger
Actor	Application/ User
Main Success Scenario	1. Identify the GIF created 2. Identify the relevant Facebook account 3. Compress the GIF file 4. Send to that account 5. Decompress the GIF file
Extensions	2a. If the Facebook account doesn't exist, application will prompt an error message and user should enter correct Facebook username again

Table 2.3: Use case scenario – Delivery through Messenger

Use Case Name	Add animated stickers
Preconditions	Admin should have access to add signs
Successful End Condition	Include signs
Actor	Admin
Main Success Scenario	1. Identify appropriate sign 2. Select the sticker category 3. Enter description if need 4. Click on add sticker button
Extensions	1a. If sign not detect correctly, application will prompt an error message and again Admin should identify the sign. 2a. If sticker category does not exist, display the message "Category not found. Select a valid category"

	4a. If the sticker adding failed display the message “System failed to add the sign”
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Table 2.4: Use case scenario – Add Animated stickers

2.3. User Characteristics

This application is developing for special determination of helping people who are deaf. Users for this application can be

- Hearing Impaired people
- Ordinary people
- Application Developers
- Any other people who need study sign language

Since this is not a critical application developers have not defined any priority levels to the users of the application. Deaf people can use this application when they communicate with a person who has no idea about the sign language. With the use of this application they can communicate without any intimidation or trouble. Using this application for hearing impaired people can communicate with other hearing impairs. Likewise, this application can be used for teachers who teach the students at Ragama Deaf School and also who guide for the hearing-impaired persons.

Application developer performs a main role here. Because updating the application and keep it bugs free is their responsibility. Research group will release new versions when this application and the database of this application have been updated.

As mention above sections, there is enormous communication gap between normal people and hearing impaired people in the Sri Lanka. Due to lack of knowledge about the sign language this problem has been occurred. Thus, this application can be used to get knowledge of the sign language. To get the support from ordinary person at any time anywhere. Furthermore communication can be done in between ordinary users and hearing impaired user as well as among hearing impaired users.

2.4. Constraints

In this development process of the Sanwadha application, development team had to consider about many types of constraints which were affected to the projected application. Those identified constraints are as follows,

- Hardware constraint

This proposed application going to develop as mobile application. Because of that development team had to consider about resource limitations. In order to perform best out of this application, it is a must to upright microphone and speaker of mobile phone. Otherwise this may cause wrong outcomes to the end user. Another hardware limitation of this application is, to run this application it is a must to AMD Phenom™ II or Intel® Core™ i3, i5 or i7 processor; 2GB RAM; USB 2.0 port 20GB free hard disk space and Internet connection.

- Software constraint

Use C# for Xmarine and Azure database to implement our application and custom the external library for offline messaging.

- Time constraints

The application should be completed by September 2017.

2.5. Assumptions and Dependencies

When designing this application there are some assumptions observed.

- Most of the deaf people uses mobile phones and prefer to update with the modern technologies.
- All deaf people and ordinary people who are willing to interact with the deaf community will download and install the application to the mobile phone.
- Users have at least a slight knowledge to operate the mobile phone and the application properly.
- Normal persons will help those deaf persons to communicate using the application.
(user involvement)

Dependencies observed throughout the application are as follows.

- The accuracy of the application depends on the input text. Thus, it is very important to have a meaningful sentence of Sinhala or Singlish language.
- Need to have a better network connection to access the internet.
- The speed of the GIF file transfer depends on the network connection and the processing power of the mobile phone.

Furthermore, moving to the future enhancements all the regional sign languages in Sri Lanka are going to be addressed within the application. Since a less number of day to day scenarios covered in the application by now, an enhancement is done by approaching more scenarios. Implement the application by mounting all the other sign languages in order to advance the communication all around the world. Implement the cross platform mobile application shall operate on android devices, IOS devices and windows phones.

2.6. Apportioning of Requirements

The requirements described in sections 1 and 2 in this document are referred as primary specifications. Details in section 3 referred as requirements specifications. The two levels of requirements are intended to be consistent. Inconsistencies are to be logged as defects. In the event that a requirement is stated within both primary and functional specifications, the application will be built from functional specification since it is more detailed.

Section 3 describes all the essential requirements which are going to implement in this version of Sanwadha application. In section 3.6 describe other requirements which contain desirable requirements and optional requirements. Desirable requirements are to be implemented in this release if possible, but are not committed to by developers. It is anticipated that they will be part of future release. Optional requirements will be implemented at the discretion of developers.

3. Specific Requirements

3.1. External Interface Requirements

3.1.1. User Interfaces

User interfaces are required to analyze the user friendliness of the application. These interfaces are the only interfaces that the user will interact with. All the functional requirements are implemented using the least number of interfaces to reduce any complexities and make the application much more user friendly.

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This interface will be appeared once the application loads successfully. Then user can enter username and password and sign in if the user is already registered

Figure 3.1: User Interfaces - Sign in

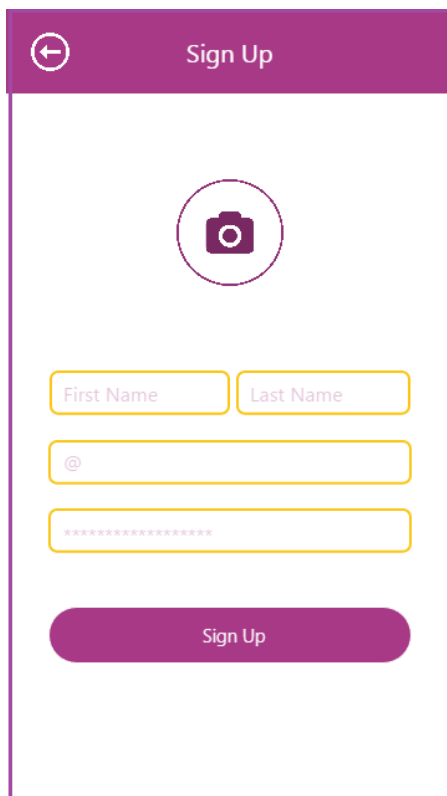
A mobile application interface for signing up. At the top is a purple header bar with a back arrow icon on the left and the text "Sign Up" in the center. Below the header is a white area. In the center of this area is a circular icon containing a camera symbol. Below the icon are four input fields: two for "First Name" and "Last Name", one for an email address (indicated by an "@" symbol), and one for a password (indicated by asterisks). At the bottom of the form is a large, rounded purple button with the text "Sign Up" in white.

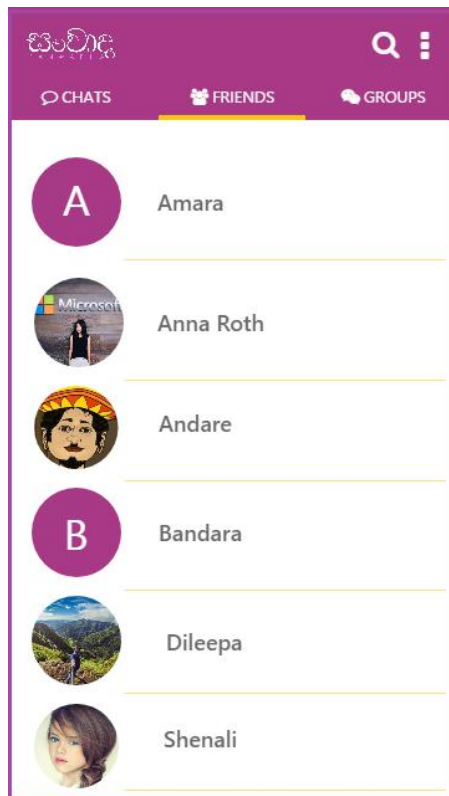
Figure 3.2: User Interface - Sign up

Users who are not registered will be directed to this interface. They are required to fill details and press “Sign up” button to complete the registration process. After that the user is directed to the user profile window.

A mobile application interface showing a user's profile. At the top is a purple header bar with a back arrow icon on the left and a menu icon (three vertical dots) on the right. Below the header is a large image of a young girl with brown hair and blue eyes. Overlaid on the bottom of the image is a yellow banner with the name "Shenali" in white. Below the image and banner is a white area containing the following text: "First name: Shenali", "Last name: Tissera", and "Email: shenali.tissera@gmail.com".

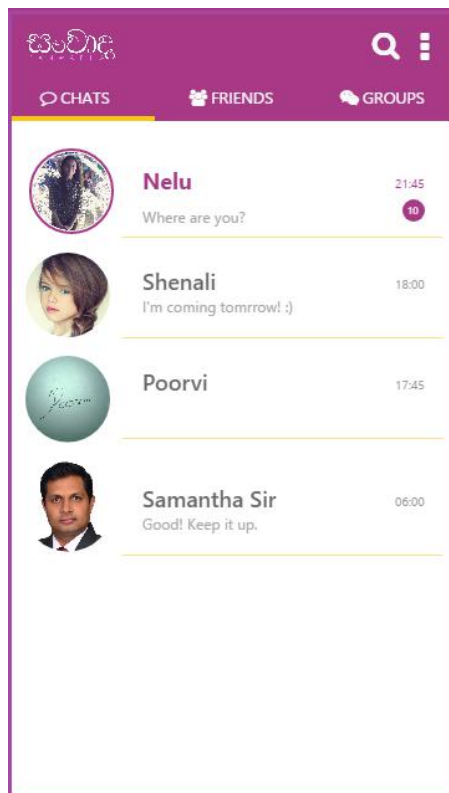
Figure 3.3: User Interface - Profile

This is the interface directed after user registration is completed. Here the created user profile can be viewed with relevant to user details.



This is the interface of friends list. This allows the user to choose a friend to have a chat. Relevant user details can be viewed by clicking on the contact.

Figure 3.4: User Interface - Friends list



This interface implies the Chat history. User can view previous chat threads also can delete any chat thread.

Figure 3.5: User Interface - Chat history

3.1.2. Hardware Interfaces

- Mobile Phone

This is the main hardware phone needed to use the application. There are various phones in Android platforms built by different manufacturers such as HTC, Motorola, Samsung, LG, Huawei, Sony etc. This application will need a smart phone of Android platform to use the application.

- Speaker and microphone of the mobile

Speaker and microphone of the mobile is used as the input and output streams for the application.

3.1.3. Software Interfaces

- Windows 10 Operating System
- Microsoft Visual Studio 2017 (.Net)
- Microsoft Azure
- SQLite Database
- MAYA Autodesk
- Photoshop CC
- CorelDraw X7

3.1.4. Communication Interfaces

- 4G - 3G connection of the mobile phone will be used for data transmission between the mobile app and the web server.
- Wi-Fi - If the mobile data is not available, user can connect to an available Wi-Fi router to get the internet connection in order to use the application. And this will also be used for data transmission between the mobile app and the web server.
- Required Connection bandwidth might differ time to time. Since large data load is travelling through the network, having a high bandwidth internet connection will help a lot for the users to use the application with ease.

3.2. Class / Objects

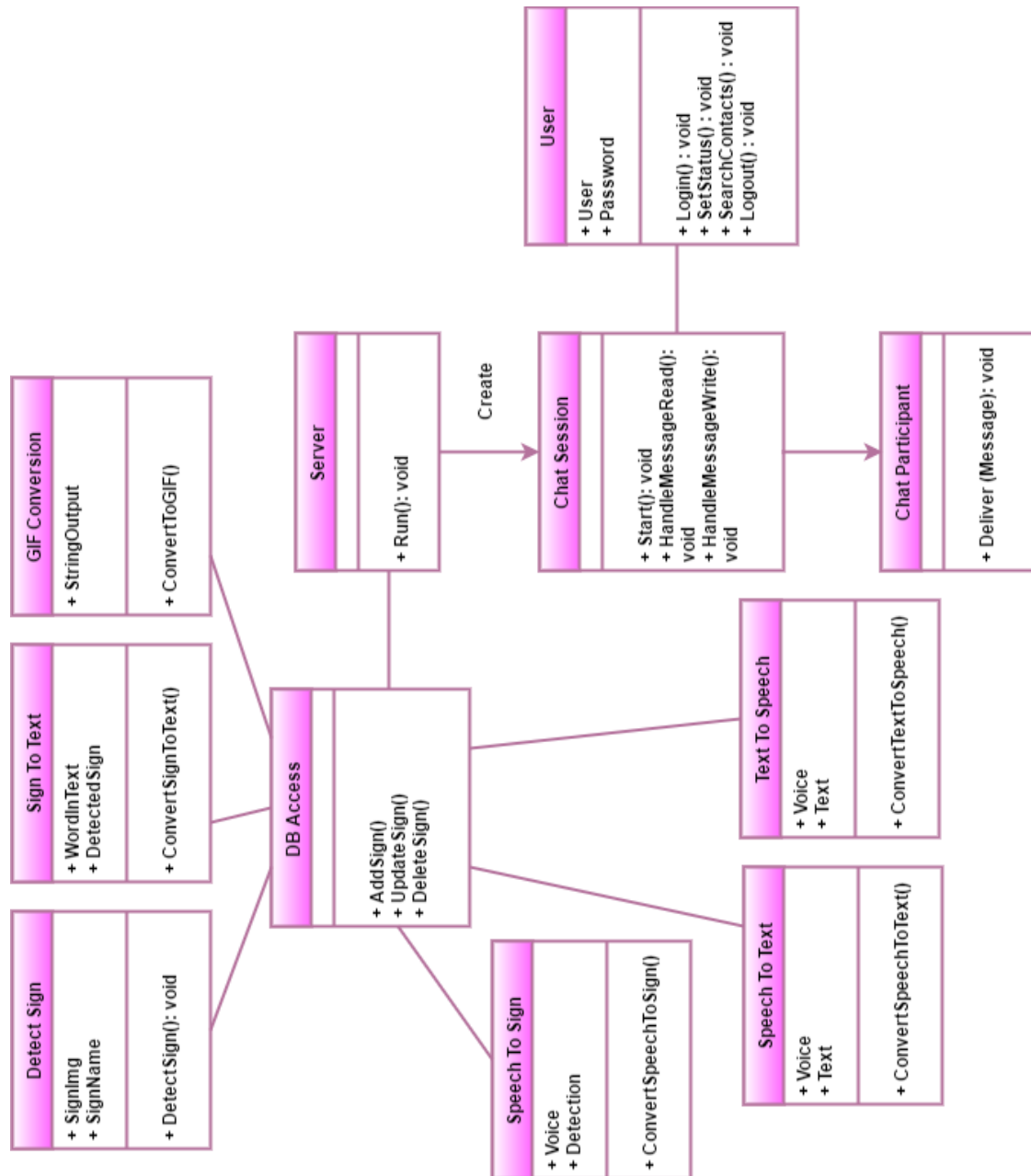


Figure 3.6: Class diagram

3.3. Performance Requirements

Performance requirements are required to enhance the new automated application under various circumstances. This application will be supportive to improve an effective communication between hearing-impaired people and ordinary people. Hence, using this application hearing-impaireders can do their day to day goings-on easily. All the hearing-impaireders and ordinary people can use this application in a straight way. All the details are deposited in the database and it will be automatically updated.

Text and voice to sign converting application must be able to meet following performance requirements after finalizing the entire application implementation.

- Main server should be able to handle only one client at a time.
- The application must have the ability to capture text and voice.
- The application must have efficiency comparison of the sign and database stored sign.
- Accurate sign interpreted from the text.
- That translates into the voice.

3.4. Design Constraints

The program does not support each kind of operation performed in different kind of file systems, but it will be updated constantly and will support additional actions and file systems.

- The application uses Microsoft Azure as the database engine.
- All programming logic, coding and processing will be in C# using Microsoft visual studio 2017.
- Application will use a login facility to restrict unauthorized access.

3.5. Software System Attributes

3.5.1. Reliability

Reliability is the probability that an application will accurately perform its specified tasks under stated environmental conditions. The proposed application will be developed to provide reliable and efficient service to end users. Application will not be operated with any external devices. Only be interacted with remote host. Results generated by Algorithms developed which are used to perform tasks in server are highly accurate. Also, latest configuration and technologies are used to provide high accuracy service within less time.

“Sanwadha” application has less probability of failure since it handles less amount of data but it may fail due to OS failures such as low battery or system crashes. This will always provide accurate results since this application contains transaction modules.

3.5.2. Availability

When there is an internet connection problems application will be unavailable because the application will be unable to interact with remote host. Battery state of mobile phone should not be in weak. Except above conditions for all other situations, application will available.

“Sanwadha” application has a high availability. This application is available at any time when the user installs the application in user’s mobile phone. The application will be available to be used fully, as long as the back end of the application is active and returns results when requests are made by the mobile application.

3.5.3. Security

Hearing-impairers and ordinary persons can get access to the application with a simple restriction since there are not as much of security issues regarding the use of the application.

“Sanwadha” application shall ask for user-name and password at the beginning. Passwords will be encrypted before saving. Users cannot proceed with the application without login to the application.

3.5.4. Maintainability

Maintainability is defined as the probability of performing a successful repair action within a given time. The proposed application will be easily maintained because application is developed according to the object-oriented principals and modularization. Also, the source code will be well commented and documented for any changes or modifications done in future.

“Sanwadha” application will be developed as version by version. A new version of Sanwadha will be released when the developers make any modifications to the application. Users can download and install the updated version of Sanwadha from Google app store.

3.6. Other Requirements

- 2D modelling
- Database requiremets

4.Supporting Information

4.1. Appendices

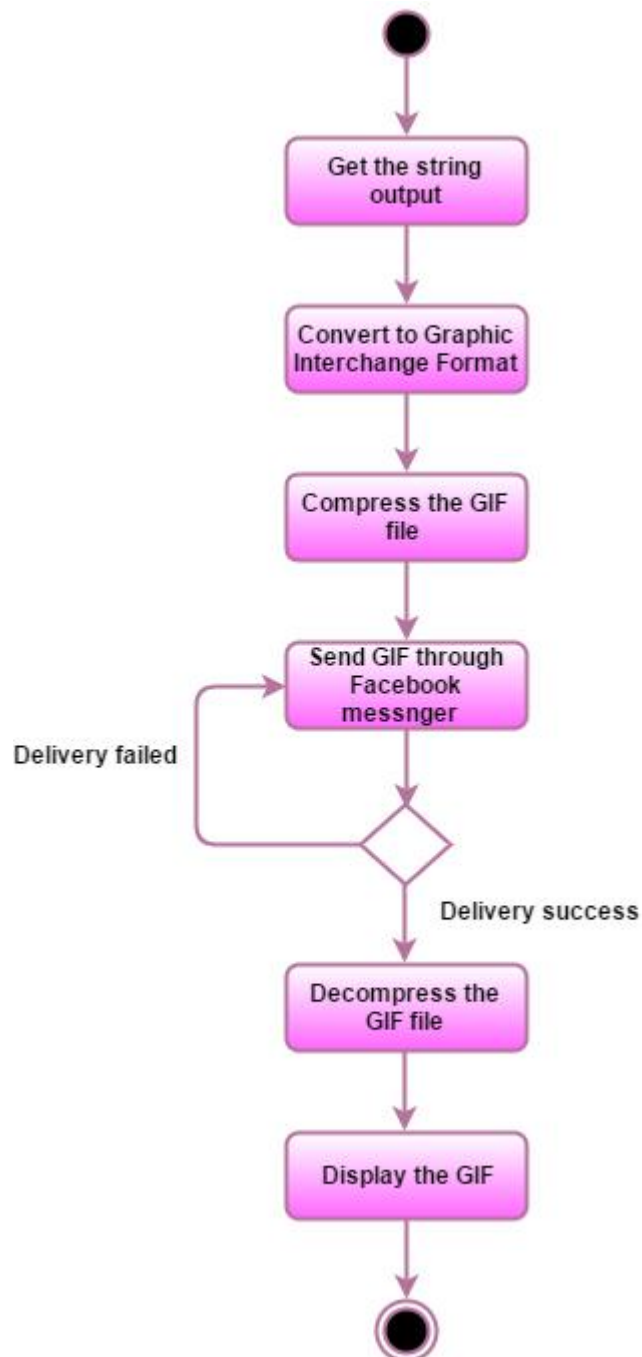


Figure 4.1: Activity diagram – GIF procedure

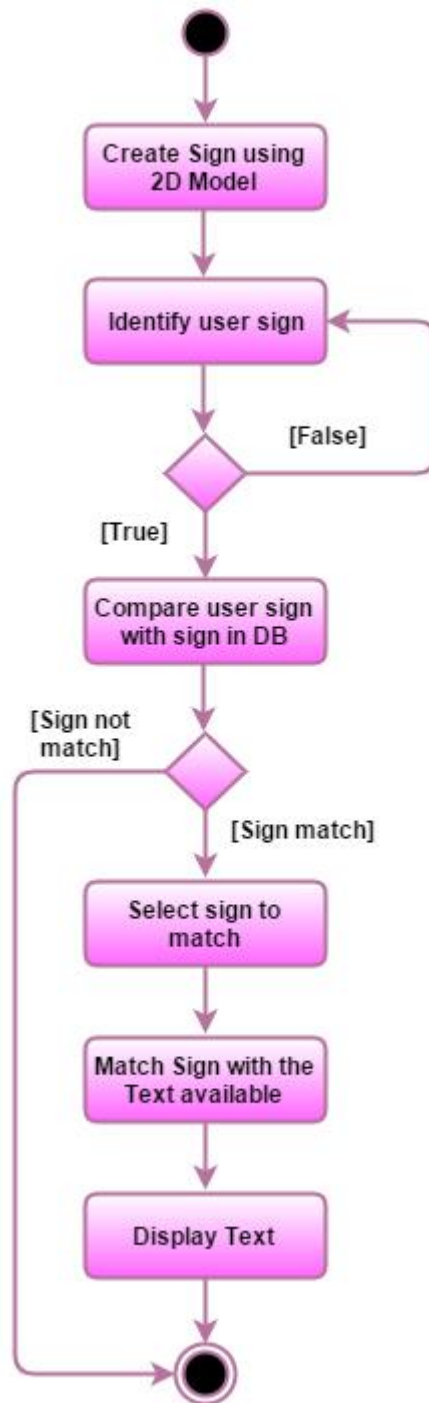


Figure 4.2: Activity diagram – Sign to Text conversion

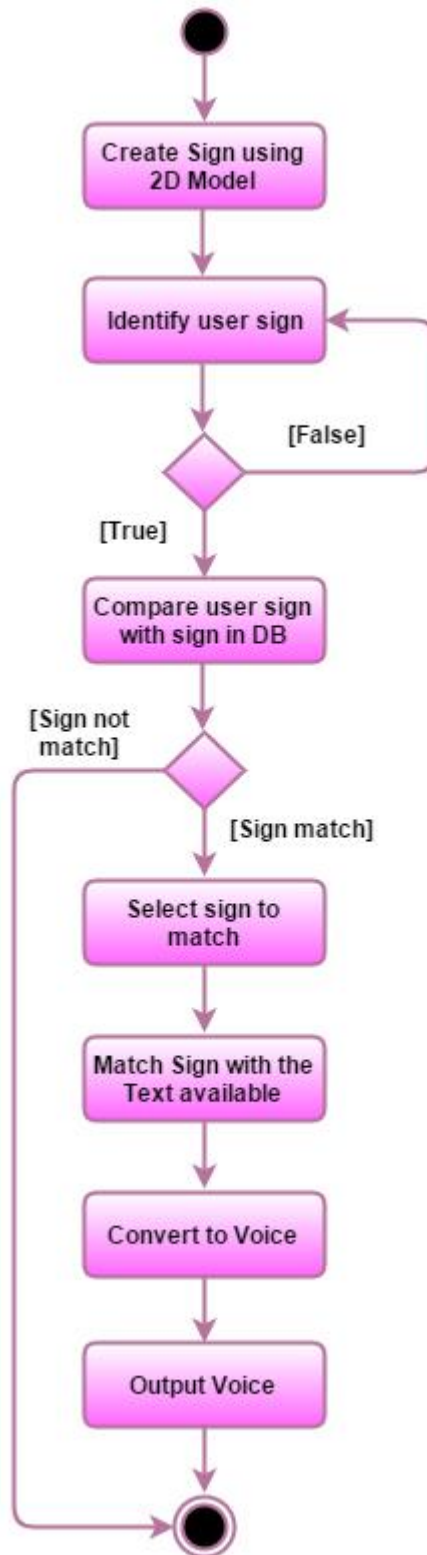


Figure 4.3: Activity diagram – Sign to Voice conversion

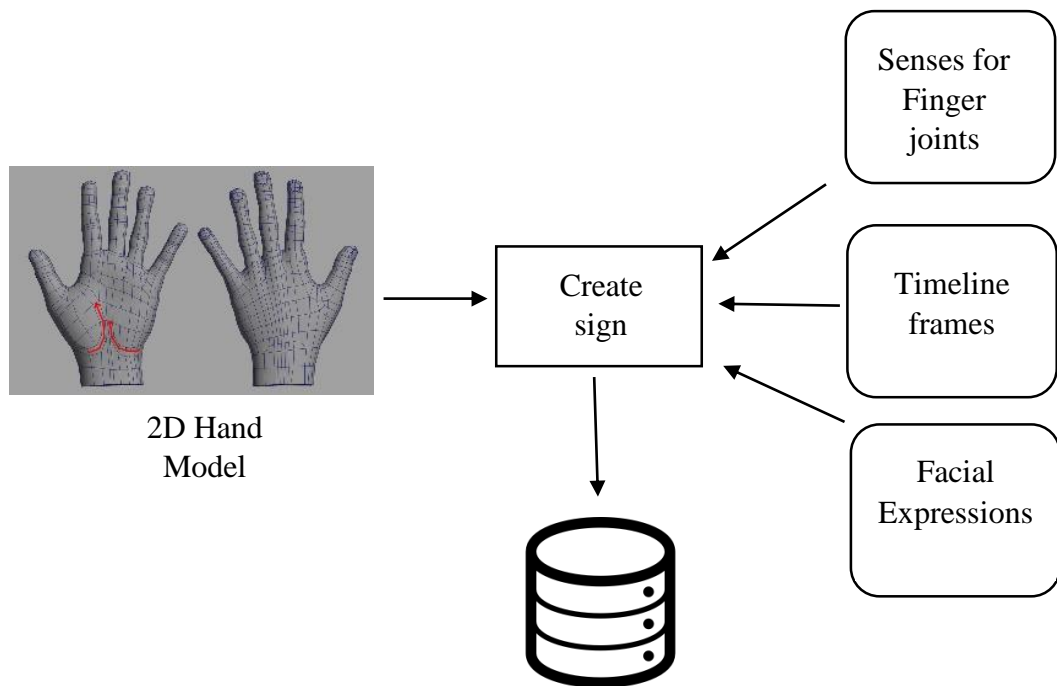


Figure 4.4: 2D Hand Model procedure

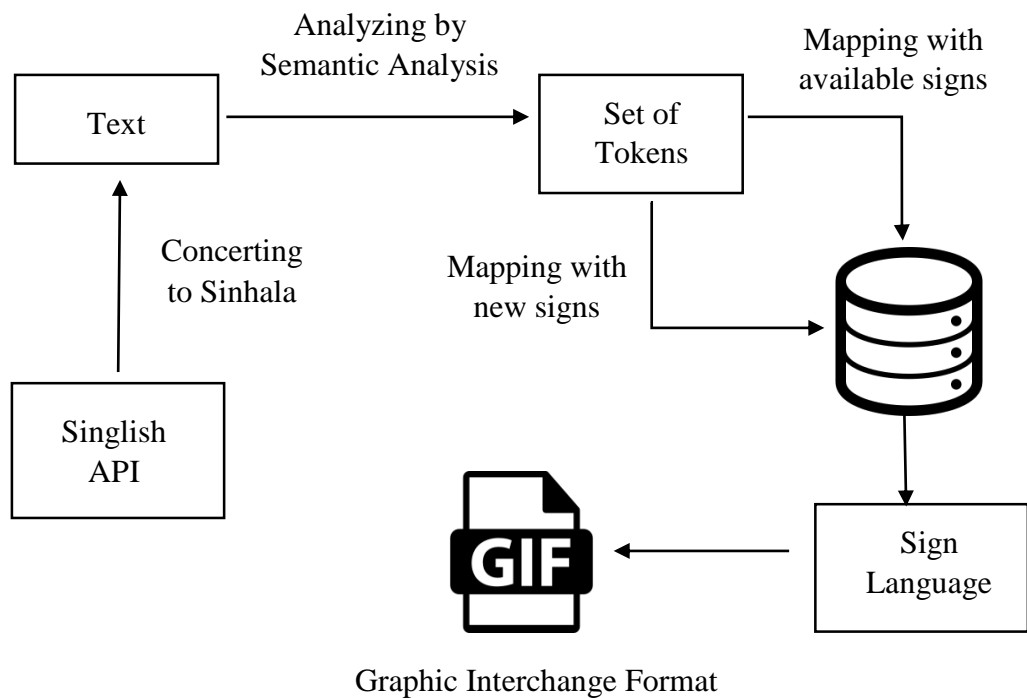


Figure 4.5: Text Adaption

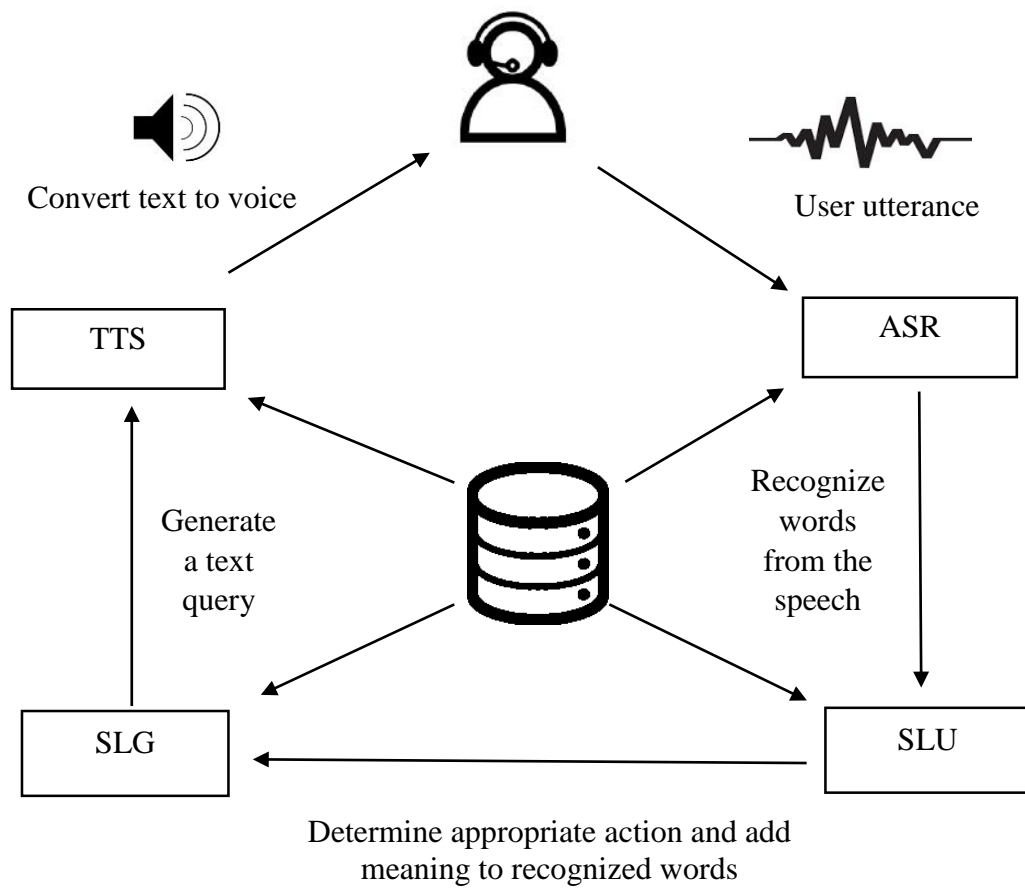


Figure 4.6: Voice Dialog circle

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