



CSN-254

Software Engineering

SignBot

Feasibility Study

Group 17:

Aniket Umesh Kathare (20114010)

Arnav Vyas (20114015)

Deepesh Garg (20114032)

Shaurya Rana (20114086)

Shaurya Semwal (20119048)

Customer

Sign-Bot is developed for an open market specifically for people who have no pre-requisite knowledge of sign language and hence have difficulty in communicating with deaf people. The software receives the audio input and then converts it into the corresponding sign language which is displayed on the monitor screen.

Visibility Plan

The importance of communication within the team cannot be overstated, which is why weekly progress meetings will be held. Here, all the team members will provide updates regarding the task that they had been assigned. Discussions will be held on the quality of the work completed, as well as difficulties encountered during execution and potential solutions. Also, further tasks will be assigned to the team members. Because all team members are on campus, we will be conducting in-person meetings that follow the COVID protocols. If it becomes difficult to attend in-person meetings, we will hold the meetings using online communication tools such as MS Teams or Google Meet.

Communication with the customer is also essential. Hence our team will ensure maximum efforts to increase the visibility of the project and establish effective communication with the end-users. The team will communicate with the customer after completing each milestone to know their opinion. These will also be done using online modes of communication.

Statement of the Task

The undertaken task given by the customer is to create a web-application. It takes either audio or textual input from the user and shows the corresponding sign language representation for each word. Initially, when the input is taken from the user, all the words are separated, and each word is checked in the local database (contains the animations of all words). For each word, if the animation for the word is found, then the corresponding animation is shown as an output video.

Preliminary Requirement Analysis

The concerned problem is the development of a software which makes it easier to communicate with people who are unable to hear. The web-application intended to be developed takes the speech/text input from the user and converts it into sign language which can be understood by a deaf person.

The requirements for the proposed application are analysed in the following steps:

Data inputs and outputs for the system: The input data for the web-application is an instruction or sentence which needs to be conveyed to the targeted

person. This input can be entered by the user in two ways, i.e. by either speaking the command into the microphone or by typing it. For the speech input, the command is intermediately converted into text.

The output for the web-application is a small video animation depicting the sign language representation of the command entered as input.

Complexities: The inherent complexities for the intended software are:

- The selection of appropriate AI library which converts the speech input to text.
- The animations for all the recognisable words has to be done individually for each word.
- The time difference from when the input is taken till the output is displayed has to be minimised.

Data Interchange formats: The description of the proposed software makes it inherent that various types of data must be transformed and exchanged amongst the interface and the backend.

Initially, when speech input is taken from the user, it is to be converted into text which is done by JavaScript Web Speech API.

After the speech is converted to text, individual words are identified and matched with a pre-existing database which contains animations as mp4 files with names as the respective words they represent . Hence the corresponding animations for the words are extracted.

Finally, these animations are shown on our web-application.

Process and Functional Requirements: The iterative waterfall model has been used throughout the development process. Our system needs to have these functional requirements:

- Web Interface
 - An option for users to sign-in and log-in to the system.
 - An option for the user to input a command through voice.
 - An option for the user to type an input command.
- A local database to store all the word-animation mappings.
- A database to store the login credentials for the users.

Suggested Deliverables

Deliverables may include source code, design document, SRS document, user's manual etc.

Source code: Source code comprises of a set of programs that are written in a suitable efficient high-level language.

Design Document: The design document shows complete information of the resources, features the use cases with which an end user can interact.

SRS document: The SRS document (Software Requirements Specification document) describes what the software will do and how it will be expected to

perform. It also describes the functionality the product needs to fulfil all stakeholders (business, users) needs.

Test documentation: Test Documentation involves the documentation of artefacts that should be developed before or during the testing of Software. Documentation for software testing helps in estimating the testing effort required, test coverage, requirement tracking/tracing, etc.

User Manual: The User Manual contains all essential information for the user to make full use of the information system. It includes a description of the system functions and capabilities, contingencies and alternate modes of operation, and step-by-step procedures for system access and use.

Process to be Followed

The project is relatively small, well-defined, clearly understood and has fairly stable requirements. As such, substantial changes to the requirements are unlikely. Due to the small size of the project, the overhead required to develop multiple revisions would not be paid off, so it will be best to deliver a final finished product. We have chosen to use the iterative waterfall model for our project for these reasons.

Outline Plan

For this software,

- Firstly, the project proposal is created and a thorough feasibility study regarding user requirements, cost, timeline, and resources is carried out.
- After this, SRS documentation is prepared in order to be used by users and various stakeholders. And finally, team members with the help of SRS document prepare the design of software.
- Next Coding phase begins where the development of audio to text conversion, development of backend for identifying key words in text using NLP followed by development of website and interface which includes login-logout system will be carried out.
- Creating animations required for the sign language in Blender 3D
- Linking the modules and testing of the integrated website.
- Deployment and maintenance of site, also updating the features and functions from time to time as per the customer feedback.

Milestones:

Phase-1 : Project Proposal, Feasibility Study, Software Requirement Specification(SRS) document and Design Documents are prepared.

Phase-2 : Coding and Implementation of Software and making animations.

Stage 1 – Development of backend which includes speech recognition using web speech API to convert audio to text and text processing using Natural

language toolkit to identify key words from the text followed by development of frontend part of website and interface for login-logout system.

Stage II – Creating required animations for the sign language using Blender 3D tool.

Stage III – Monitoring of various flaws or presence of bugs in the code, also trying to make animations smoother.

Phase-3 : Testing and Deployment of the software

Risk Analysis

The project is not entirely risk-free. The identified risks are provided in the following section:

- **Schedule slippage:** It is the most common risk associated with all software products due to the intangible nature of the software. In order to tackle this risk, the most critical part is to increase the visibility of the software. Visibility can be provided by producing documents related to the developments and creating milestones at frequent intervals.
- **Time:** As the project is expected to be completed within one academic semester, the amount of functionality that can be provided gets somewhat compromised. Moreover, there are chances of additional pressure on the team due to the shortage of time. The solution to this problem is by taking a buffer time.
- **Functionality:** There is an expected risk of the functionalities of the system. The expected user interface may be somewhat not user-friendly, taking into consideration the complexity accompanied by the software. In order to reduce this risk, the best solution is to avoid using functions that are not of much use to the user, as decreased functionalities will decrease the risk associated with them. Making the best optimal decision on the functionalities will reduce the risk associated with the software.
- **Technological risk:** This risk is associated with the technology that the team is using in order to develop the software. Due to some constraints, the team may not be able to use the best resources to complete the software. With a team of 5 members with a different background and experience with the technological resources previously used, the amount of time each member would need to be familiar with the technology used will be different, which will definitely affect the time required to deliver the software.

Technical Requirements

SignBot will take audio as input and display the corresponding sign language translation on the screen. In order to accomplish this process following technology and tools will be required:

- HTML5
- CSS 3
- Javascript
- Python

- Django
- SQLite
- Javascript Web Speech API
- Natural Language Toolkit
- Blender

HTML, CSS and Javascript will be used in developing the front-end part.

Javascript Web Speech API will be used to convert the audio text, which is received as input, to intermediate text output. Natural Language Toolkit is required to preprocess the text to get the keywords from the text. Blender is used to create 3D animations of sign language. Python is used in order to link all these components. SQLite is used as a database to store all the information about the user. Django is a python framework that enables the rapid development of secure and maintainable websites