

# **ONLINE LEARNING PLATFORM FOR HEARING IMPAIRED PEOPLE**

Project ID: 2022-059

Project Proposal Report

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## DECLARATION

We declare that this is our own work, and this proposal 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.

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The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

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Date

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(Mr. Yashas Mallawarachchi)

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Date

## ABSTRACT

As a result of the current pandemic situation, most of the companies have taken steps to function through online systems. Schools and universities have taken steps to provide education to the students using online systems such as teams, zoom and google meet. In addition to these there are specific systems that are implemented to specific organizations to meet their expectations in providing education using online delivery of lessons. Although majority of people can learn using these systems still there is a portion of people who are unable to learn through these systems. The hearing impaired are unable to learn through these systems.

As a solution to the mentioned problem, we are proposing an online learning platform specifically for hearing impaired people of Sri Lanka. This specific research component of the proposed solution will give hearing impaired people the ability to gain knowledge through video resources. The content of an online video which is available in you tube will be converted to Sri Lankan sign language and will be displayed in the form of a 3D avatar which will be embedded to the video as a caption. The necessary processing steps will be done using Natural Language Processing, speech recognition and machine learning techniques.

Key words: *Hearing Impaired, Sign Language, Sri Lankan sign language, Online learning, Natural Language Processing*

# TABLE OF CONTENTS

DECLARATION .....	i
ABSTRACT.....	ii
TABLE OF CONTENTS .....	iii
LIST OF FIGURES .....	v
LIST OF TABLES .....	vi
LIST OF ABBREVIATIONS .....	vii
1. INTRODUCTION .....	1
1.1 Hearing impaired and Sign Language .....	1
1.2 Features of sign language .....	1
1.3 Area of Research .....	1
1.4 Component Overview .....	1
2. LITERATURE REVIEW .....	3
2.1 Background Study .....	3
2.2 Literature Survey .....	5
3. RESEARCH GAP .....	7
4. RESEARCH PROBLEM .....	8
5. OBJECTIVE .....	9
5.1 Main Objective .....	9
5.2 Specific Objective .....	9
6. METHODOLOGY .....	10
6.1 System Architecture Diagram .....	10
6.2 Software Solution .....	11
6.2.1 Requirement Gathering .....	11
6.2.2 Feasibility Study .....	11
6.2.3 Design and Implementation .....	12
6.2.4 Testing .....	13
6.2.5 Deployment and Maintenance .....	14
6.3 Work Breakdown Structure .....	14
7. PROJECT REQUIREMENTS .....	15

7.1 Functional Requirements.....	15
7.2 Non-Functional Requirements .....	15
7.3 User Requirements .....	15
8. GANTT CHART .....	16
9. COMMERCIALIZATION .....	17
REFERENCES.....	18

## **LIST OF FIGURES**

Figure 6.1.1 - System Architecture Diagram.....	10
Figure 6.2.1 - Stages of Software Development Life Cycle.....	11
Figure 6.3.1 - Work breakdown Structure.....	14
Figure 8.1 - Tentative Gannt Chart.....	16

## **LIST OF TABLES**

Table 3.1 - Comparison between existing studies and the proposed system .....	7
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## LIST OF ABBREVIATIONS

SLSL	Sri Lankan Sign Language
HIP	Hearing Impaired People
NLP	Natural Language processing
ML	Machine learning
ASL	American Sign Language
BSL	British Sign Language
WHO	World Health Organization
SER	Speech Emotion recognition
MFCC	Mel-frequency cepstral coefficients
MLPC	Multi-Layer Perceptron Classifier
AWS	Amazon Web Services
SDLC	System Development Life Cycle

# **1. INTRODUCTION**

## **1.1 Hearing impaired and Sign Language**

Hearing impaired means inability to hear. Therefore, speaking will not be an option to express HIP. Since they are familiar with sign language, most of the times

## **1.2 Features of sign language**

Facial expressions are an essential factor in sign language [3]. Facial expressions are used to express emotions when communicating. For example, if a person is happy, the greeting “Good morning” would be said with a smiling face, and if sad, it would be said with a sad facial expression, just like people who can speak and greet with a happy tone when happy and with a sad tone when sad. In sign language, if a person is right-handed, the right hand is used as the dominant hand to gesture signs.

## **1.3 Area of Research**

A lot of research has been done in breaking the barrier between HIP and who are not hearing impaired. Many chat applications [4], translating applications [5] and sign language teaching applications [4], [6], [7] has been developed over the years. This research focuses on studying and developing an automated learning platform for the hearing impaired taking some issues that they face to give them the opportunity to learn using online tools adapting to the new normal situations due to the pandemic.

## **1.4 Component Overview**

This research component focuses on developing a chatbot to user where user can find anything through Google. Therefore, this component works as an intermediate between user and Google search. User can ask the question using SLSL and Chatbot translates it into a Google. Then first ten results of the Google search will be converted into SLSL using the component and present it to the HIP user. If user selects one component reads and present

the content. Other than that user can ask for more results or retry the Google search in other way. That is the basic behavior of the component.

## **2. LITERATURE REVIEW**

### **2.1 Background Study**

Since the end of 2019, the world has been dealing with the pandemic which was caused due to the Covid-19 virus outbreak. This had initially caused much trouble for people around the world, and many had to suffer huge losses due to this. However, many industries began transforming towards online platforms to provide services and continue with their targets without being affected by the pandemic. As mentioned earlier, schools and other educational institutes adapted online learning to provide education to their students without being interrupted due to the pandemic. In Sri Lanka, Schools, universities, and other educational institutes used MS Teams, Zoom, and their systems were customized to cater to their way of providing education. Even though these systems were used, they were based on the traditional education system (Teacher to student). This transformation was successful for the majority, but it was not an ideal solution for some groups such as the HIP.

According to the article [8] the author has stated that according to the WHO approximately 9% of Sri Lankans suffer from hearing loss while 15% of them are completely deaf according to Sri Lanka Federation of Deaf. These numbers will keep increasing as for the statistics mentioned by author of [9] from 131 million to 267 million by 2050 in South Asia region where south Asia region consists of Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Maldives, Myanmar, Philippines, Sri Lanka, Thailand, Timor-Leste and Vietnam. According to these factors it is evident that the issues faced by this group of people needs to be addressed

Currently as the covid-19 situation is at minimum state most educational institutes move towards a hybrid delivery of education (on premises and online according to guidelines provided by health authorities). But according to a survey done by the research team of [10] 50% of students prefer online education in the future as well which is shown by the figure 2.1.1.

Figure 2.1.1 shows that while 21% of the students do not prefer online learning for the future half of the students prefer online learning in the future.

According to a study done in 2021 [11] on the effectiveness of online learning in India the authors have used a questionnaire to identify what motivates students to learn through online, their experiences, disturbances during online learning, the environment at home for online learning and devices used for online learning.

Figure 2.1.2 shows what motivates students to learn when using online learning. From the figure it is visible that 54.7% of the students which is the majority are motivated to learn using animations.

Figure 2.1.3 shows the learning experiences of students. 42.5% of the students have said that they are able to learn at their own pace comfortably through online learning.

Figure 2.1.4 shows that 76.1% of the students use a laptop or a desktop for their online learning purposes.

These survey results suggest that online learning is a successful learning method, and it would not dissolve and would be used by majority of students even after the pandemic situation is over. It is safe to say that online education has a place in the society for the foreseeable future.

According to [12] HIP face challenges such as limited access to tools to study and communication issues. Also, HIP face accessibility issues when using online learning platforms which makes their learning harder.

In [12] it is mentioned that many studies done on this area suggest of an online learning platform for hearing impaired to learn interactively. Hence an online learning platform is the best solution to issues of HIP.

## 2.2 Literature Survey

For the problems faced by HIP many solutions have been proposed and has been implemented. Most of these solutions has been implemented to break the communication barrier that is between HIP and normal hearing people. For instance, in [13] the authors have developed a mobile application which captures the signs performed and interpret in human readable language using computer vision and machine learning. This application is built to detect Sri Lankan sign language as the author has mentioned that many such applications has been developed for the use of American sign language.

EasyTalk [14] is another application that is developed based on Sri Lankan sign language. The authors gave mentioned that using this application users can convert verbal inputs to Sri Lankan sign language and vice versa. The users also mention Hand Gesture Detector uses pre-trained models to capture hand gestures. The detected hand signs are classified and translated by the Image Classifier. For detected hand signs, the Text and Voice Generator generates a text or an audio structured output. Finally, the Text to Sign Converter converts entered English text into animated graphics based on sign language. Many such research have been done on improving the accuracy and improving the ability to interpret sign language to text or speech.

In [15] the authors have developed an android based learning application for the hearing impaired. According to authors this application contains videos and materials posted by teachers on a variety of subjects. If necessary, it is possible to download it. It means that users can study whenever and wherever they want, without having to worry about time constraints or internet availability. Quiz, set a schedule, event, chat, and a memory game are among the app's other features as well as additional tools to help hearing-impaired people get the most out of online learning. This system is a teacher-based teaching environment which enables the hearing-impaired students to chat with each other if necessary. This system does not address the issue that majority of the HIP (deaf) do not know how to read written text. Many such research has been done and has developed learning platforms that can be used by HIP but many of these do not address the issue that majority of HIP are having trouble reading.

In [16] the authors have been able to develop a system which shows user the correctness of their gestures. The authors have proposed a platform that makes use of sign language to help students and tutors communicate more effectively while also providing sign language learning resources, practice opportunities, and Q&A sessions. The system includes a low-light enhancement module that enhances the videos submitted by the instructor, as well as a module that converts the uploaded lessons to American Sign Language and converts the sign language questions to text. In the paper the authors mention that for the uploaded lessons to be converted to sign language they have used the caption of the video as a text and a text to ASL conversion has been done. The expectation of the author is to provide a user the ability to get the content of the uploaded lesson on ASL.

### 3. RESEARCH GAP

According to the literature survey done above the following issues were found as research gaps,

- Most learning platforms are not based on SLSL
- Sign language Chatbots are existing but not as an intermediate between Google and User.
- The existing Chatbots are not return results through Sign Language.
- Any Sign language learning platform does not offer Chatbot service to find and learn through google

So, this research is done to provide a solution to these identified gaps by developing a system with the ability to work as a ChatBot service which works as an intermediate between Google and User. System will present all the outputs in SLSL through the 3D animated avatar.

**Table 3.1- Comparison between existing studies and the proposed system**

<b>Feature</b> <b>Research</b>	Based on SLSL	Sign Language identically dynamically	Text Content to Sign Language	Search on Google and return Search Results in Sign Language	Learning Platform	3D Avatar model with Expressive Emotions
Wadan	✓	✗	✓	✗	✗	✗
Nihanda Ridma	✓	✓	✓	✗	✗	✗
Sawadana	✓	✗	✓	✗	✗	✗
Nihanda	✓	✓	✓	✗	✓	✗
Snap E-Learning	✗	✓	✓	✗	✓	✗
ISL E-Learning System	✗	✓	✓	✗	✓	✗
Proposed system	✓	✓	✓	✓	✓	✓



#### **4. RESEARCH PROBLEM**

HIP Users are lacking resources to connect with the world. It can be Google or YouTube or in any platform. Therefore, within this pandemic and the evolution of the world to a digital world, it is suitable to go for online learning platforms to enhance education system of humans. Then comes to the special learning platforms to the HIP and we identified even in learning platforms not all the platforms focus on everything. We introduced a special feature to connect with google and search anything so HIP users can learn from multiple ways, and it is considered to be a better achievement because most of the obstacles will be destroyed.

## **5. OBJECTIVE**

### **5.1 Main Objective**

The main objective of this component is to give the opportunity for a HIP to search anything through Google and learn anything fast.

### **5.2 Specific Objective**

The following sub objectives should be fulfilled to achieve the specified objective.

- **An algorithm to identify SLSL and converts it to text then Google**

This objective focus on converting it to a text and search through Google in the next step. Then component identifies search results and identifies title of first ten search results.

- **Presenting search results using 3D Model.**

This objective aim on presenting SLSL using a 3D avatar model which we identified search results and content of selected search result.

## 6. METHODOLOGY

The objective as mentioned of this component is to provide the HIP the ability to get knowledge through Google search by converting the content to sign language and vice versa. To achieve this first the real time video is captured using Open CV. Then converted to a text and search through Google. Then system will identify search results in bundles of ten. Then title of first ten research bundles will be displayed using 3D avatar model.

### 6.1 System Architecture Diagram

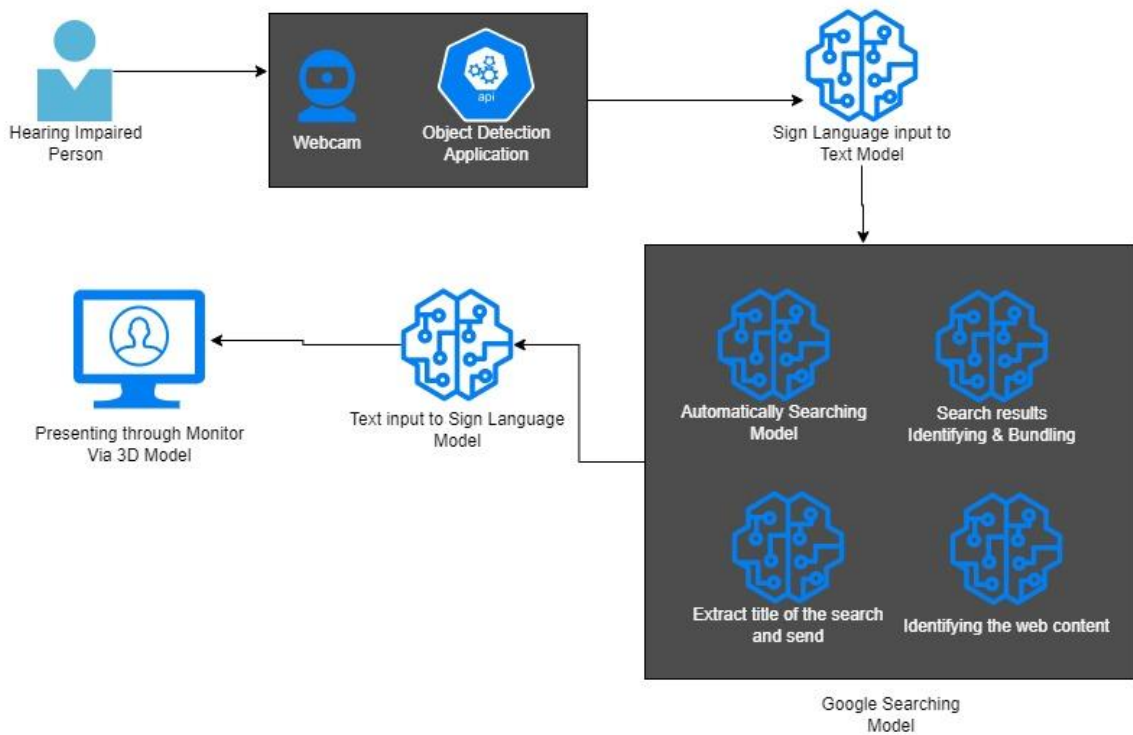


Figure 6.1.1 - System Architecture Diagram

## 6.2 Software Solution

We are following the method of SDLC which stands for System Development Life Cycle, a well known and established development method. The reason to follow this method is because this is a research. Therefore, everything should be clearly developed step by step and every step must be an advancement of the previous step. Our research team wants to develop this final product which consists of amazing four components, in a clear way. Following are the main steps of the SDLC.



*Figure 6.2.1 – Stages of Software Development Life Cycle*

### 6.2.1 Requirement Gathering

This stage is the first one in SDLC. Purpose of this stage is to get a clear understanding of the whole project. It includes planning, requirement identification and gathering and everything basic related to requirements will be collected.

### 6.2.2 Feasibility Study

#### 1. Schedule Feasibility

Schedule feasibility is something that needs to be done before everything but after the requirement gathering. Purpose of this step is to clarify whether the project can be done or not during the given period. It is necessary because if the team cannot be finishing the project in the specific time line, that project will be failed.

## **2. Technical Feasibility**

This feasibility studies on how possible to finish the project in terms of technology. Purpose of this feasibility study is to clarify whether this project can be done or not using existing technologies.

## **3. Operational Feasibility**

Operational feasibility is where we consider about the end user. In this project we need to clarify the project is useful and can easily used by HIP. That is the purpose of this feasibility study.

### **6.2.3 Design and Implementation**

In the design phase, what the developers do is sketching the whole system according to the requirement. Purpose of this design phase is to clarify whether which path, developers should implement the project. It can easily identify, and implementation phase of the project will be much easier when we do coding part in implementation after the design phase.

#### **6.2.3.1 User's sign language input to text model.**

First of all, system will take HIP user's input in SLSL and converts it to a text. Also after system presents the search results or web content, controlling the Chatbot part also done by this model. When HIP user wants another set of results, when choosing the result and reading the content likewise in each step controlling part according to HIP user's commands will handle by this module.

#### **6.2.3.2 Google Search model.**

This module works with the commands or search queries given by the previous model. In the initial step, this model bundles up the first ten search results and will present the title of each result to the user. If user wants to ignore all and go to the next ten results,

then the model presents next. When user selects a specific result, model will navigate to the web page and return the web content in SLSL

#### **6.2.3.4 Output in Sign Language**

Always output will be presented to the user using the 3D avatar model which we hope to develop using 3D Maya or Blender software. As per our research, we can easily design the model using one of mentioned softwares

#### **6.2.3.6 Tools and technologies**

- Python Libraries for modeling
  - Librosa
  - Numpy
- Visual Studio Code as the IDE for model implementation
- 3D Maya or Blender software for 3D Avatar model creation

#### **6.2.4 Testing**

- **Unit Testing** – Both sign language and google search model will be separately tested. For sign language we will give inputs, and for the google search model, we will use 3D avatar model.
- **Component Testing** – The whole component will be tested with subcomponents to clarify whether they are working properly together.
- **System Testing** – All the components of all members will be tested together before it implement on AWS environment as a website.
- **User Acceptance Testing** – Final system which is working as a website will be tested using actual HIP users in order to clarify whether system is working for them smoothly and efficiently.

### 6.2.5 Deployment and Maintenance

As per in the testing phase, in deployment, it is hope to be deploy using an AWS cloud environment. Once it is done, team will keep testing whether everything is working properly. The reason to choose cloud environment is more than 95% of the HIP users can easily access websites. Therefore to reach maximum audience, we deploy our project as a website.

### 6.3 Work Breakdown Structure

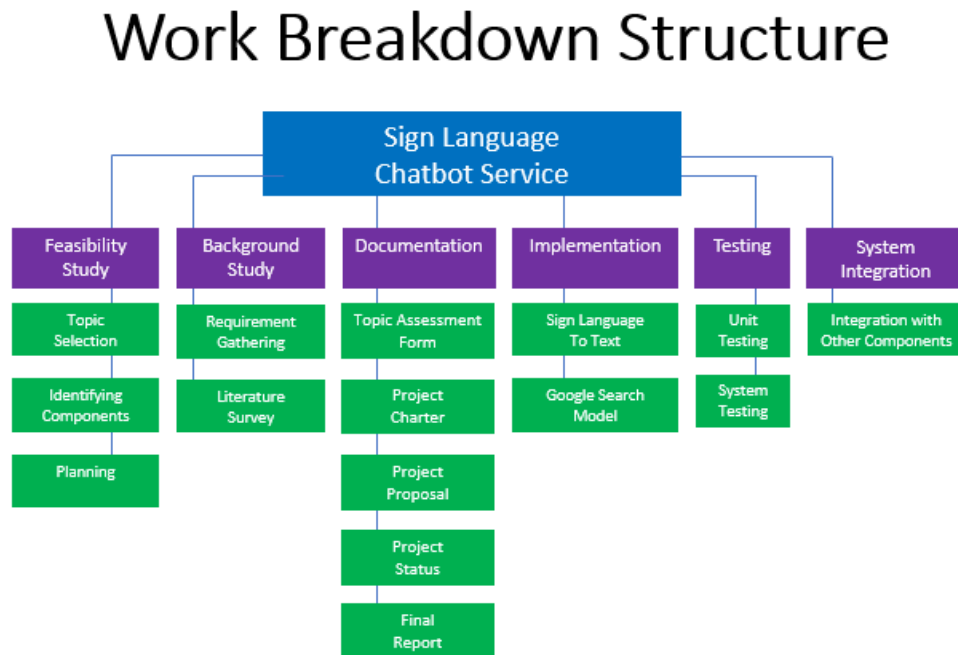


Figure 6.3.1 - Work breakdown Structure

## **7. PROJECT REQUIREMENTS**

### **7.1 Functional Requirements**

- Converting SLSL to text and vice versa.
- Identify web content and google search results.
- Present output using 3D avatar model

### **7.2 Non-Functional Requirements**

- Performance – To work efficiently and smoothly to give a really good experience.
- Accuracy – System should identify user's input correctly and give output correctly to maintain the communication of the user and the system's accuracy.
- Understandable – System should be understandable to make user clear about the system and what services can be done using the system.

### **7.3 User Requirements**

- HIP user can identify SLSL.



## 8. GANTT CHART

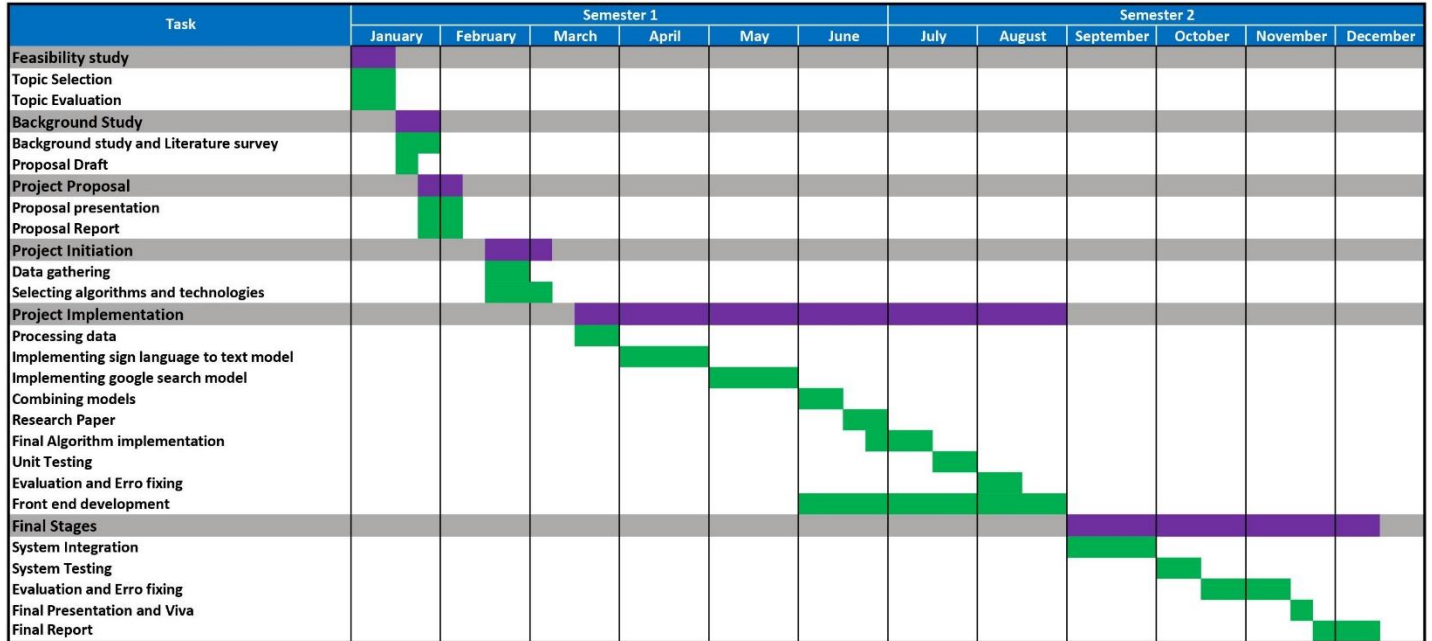


Figure 8.1 - Tentative Gannt Chart

## **9. COMMERCIALIZATION**

This web application will bring numerous new features for the HIP users in order to make their learning process in a very smooth and efficient way. Also, the system will be deploy in a cloud environment as a web application. Therefore, this system can reach most of the HIP users.

### **Target audience:**

- Deaf and dumb students
- People who work with HIP

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