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Text To Sign Language in Banking Sector

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ABSTRACT *- **Speaking languages have a large number of machine translation systems at their disposal, but there aren't many systems that translate spoken to sign language. Our initiative provides real-time translation of text-based banking transactions into sign language animations, with the goal of bridging the communication gap between financial institutions and consumers with hearing impairments. The system examines textual inputs including account statements, transaction data, and customer inquiries. It then gives related sign language animations from our directory that effectively express the information.***

1. INTRODUCTION

In order to achieve financial inclusion for every individual, regardless of their abilities or disabilities, it is essential to have banking services that are easily accessible. However, conventional banking interfaces sometimes fail to meet the diverse requirements of clients with hearing loss, impeding efficient communication and transactional interactions. Our ground-breaking solution, a text-to-sign language converter designed specifically for the financial industry, offers a remedy to this issue.

Interactions with financial institutions can pose specific challenges for individuals who are deaf or hard of hearing.

These difficulties can vary from struggling to grasp intricate financial jargon to navigating automated phone systems that predominantly rely on auditory prompts. Such obstacles not only impede the deaf community's ability to access vital banking services, but also foster sentiments of alienation and irritation among its members.

1.1 INTRODUCTION TO SIGN LANGUAGE:

Around the world, deaf and hard of hearing individuals utilize sign language, a rich and sophisticated method of communication. Sign languages use the visual-manual modality, which combines hand shapes, facial expressions, body motions, and spatial grammar to convey meaning, in contrast to spoken languages, which rely on auditory information. Sign languages are essential for promoting cultural identity and communication among deaf populations since they are complete natural languages with their distinct grammatical structures, lexicons, and regional variances.

Sign language has its roots in prehistoric human history, when people with hearing problems mostly interacted with one another through gestures. These gestural systems developed into codified sign languages throughout time, influenced by the linguistic and cultural environments of the communities in which they were used.

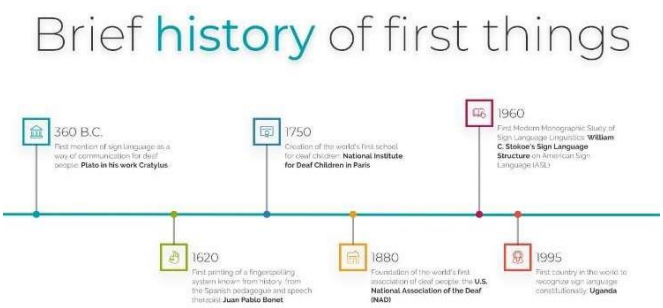


Figure 1.1(a)

Figure 1.1(a) Outlines the timeline of the evolution of sign language

Sign language stands out due to its visual-spatial nature, which permits the simultaneous conveyance of numerous thoughts using hand shapes, gestures, and facial expressions. This inherent adaptability empowers sign language users to accurately and clearly communicate intricate meanings, emotions, and abstract ideas. Additionally, sign languages incorporate linguistic concepts like phonology, morphology, syntax, and pragmatics, which govern the arrangement and structure of signs and their combinations.

Sign languages have evolved into various dialects and forms due to a range of factors including social interactions, historical influences, and geographical proximity. These languages exhibit notable regional and cultural differences. For example, British Sign Language (BSL) is commonly used in the United Kingdom, while American Sign Language (ASL) is predominantly used in the United States and some parts of Canada. Similarly, countries like France, Japan, and Australia have their own distinct sign languages with specific grammar, vocabulary, and cultural characteristics.

Figure 1.1(b)

Figure 1.1(b) gives information about the basic difference in the sign languages of three different countries namely America, France and the United Kingdom. All the three countries have different sign languages which are stated as American Sign Language (ASL), French Sign Language (FSL) and British Sign Language (BSL).

The development of sign language synthesis and recognition technologies has proven to be highly beneficial in enhancing communication between individuals who use sign language and the general public. By analysing and producing sign language motions from spoken or written input, these systems take advantage of advancements in computer vision, machine learning, and natural language processing to enable real-time communication and engagement across linguistic barriers. Around the world, sign language is an effective means of identity, communication, and cultural expression for those who are deaf or hard of hearing. Through acknowledging the linguistic diversity and depth of sign languages and advocating for their accessibility across all domains, we may strive towards constructing a more fair and inclusive society in which every person is able to connect, communicate, and prosper.

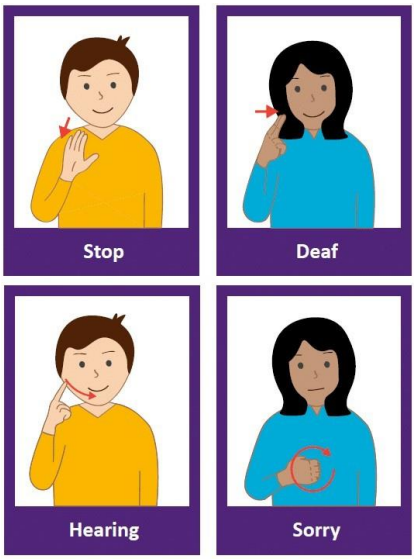


Figure 1.1(c)

Figure 2.1.3 is an example of expressing basic feelings using sign language.

2. LITERATURE REVIEW

2.1 OVERVIEW OF SIGN LANGUAGE:

A rich and sophisticated form of communication, sign language is mainly used by people who are deaf or hard of hearing, while it is also used by people who have trouble speaking, people who have certain neurological disorders, and others who may not be able to communicate verbally for other reasons. Sign languages use the visual-manual modality of communication, which uses hand shapes, facial expressions, body motions, and spatial grammar to transmit meaning, in contrast to spoken languages, which rely on auditory and vocal channels.

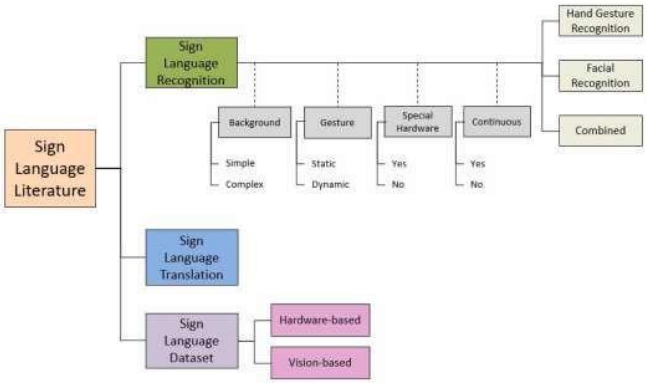


Figure 2.1(a)

Figure 2.1(a) gives overview about sign language history

2.2 Characteristics of sign language:

Linguistic Nature:

Complete, natural languages with distinct grammatical structures, vocabularies, and syntactical patterns are sign languages. Their morphology (the study of word formation and structure), semantics (the study of meaning), syntax (the study of sentence structure), and phonology (the study of distinguishing sounds or signs) are among the linguistic characteristics that they share with spoken languages.

Regional and Cultural Variations:

As a result of social interactions, historical influences, and geographic proximity, numerous dialects, accents, and variations of sign languages have emerged, showcasing the significant regional and cultural differences in sign languages. For example, British Sign Language (BSL) is extensively employed in the United Kingdom, while American Sign Language (ASL) is predominantly used in the United States and certain parts of Canada. Likewise, countries such as France, Japan, and

Australia have their own unique sign languages, each with its own grammar, vocabulary, and cultural peculiarities.

Grammar and Syntax:

The unique grammatical rules and structures of sign languages play a crucial role in the creation, fusion, and interpretation of signs to communicate meaning effectively. These rules encompass various aspects including palm orientation, handshape, movement, and positioning. Moreover, non-manual cues like body language and facial expressions enhance the grammatical complexity of sign languages. Spatial grammar is another key feature, utilizing the space in front of the signer's body as a visual reference point for indicating verb agreement, subjects, objects, and other grammatical components

Cultural Identity and Community:

Sign language is indispensable in cultivating cultural identity and fostering a strong sense of community among the deaf and hard of hearing. It is an integral part of the deaf community's cultural and linguistic identity, reflecting their shared values, traditions, practices, and experiences. Through sign language, social interactions, creative expression, and educational opportunities are enriched, serving as a vital tool for communication, expression, and connection.

Recognition and Accessibility:

The significance of sign language, with its profound linguistic heritage and cultural worth, has unfortunately been overlooked or dismissed in mainstream society. Consequently, deaf and hard of hearing individuals have been deprived of essential services such as employment and education. However, recent endeavors to enhance awareness, advocate for legal acknowledgment, and develop technological innovations for better communication and inclusivity have sparked a renewed surge in initiatives aimed at promoting sign language accessibility and recognition.

3.3 *Types of Signs in Sign Languages:*

Sign languages are comprehensive, natural modes of communication that utilize a spectrum of gestures to convey meanings and enable individuals with hearing challenges to engage in conversations. Acquiring an awareness of the numerous sign languages is essential for understanding their linguistic diversity and expressive capacities. The list below outlines some standard sign language categories.

Lexical Signs:

In sign languages, lexical symbols are utilized to convey specific words or concepts, serving as the fundamental building blocks of meaning. Adjectives, adverbs, verbs, nouns, and other lexical elements are all part of the comprehensive category of linguistic categories known as lexical signals.

Classifier Signs:

The use of classifier signs is essential in representing objects, individuals, or actions within a given space. These signs are sometimes referred

to as representation or indicating signs. Through the use of classifier signs, signers are able to describe and illustrate the size, shape, movement, and placement of items within a designated signing area. For instance, in American Sign Language (ASL), a classifier may utilize one hand shape to symbolize the head and torso of a person, and another hand shape to indicate the legs and arms. This technique enables a comprehensive representation of human attributes and behaviours.

Iconic Signs:

Iconic signals are visually similar to their referents or have an iconic link with them; they communicate meaning by analogy or metaphor. Since iconic signs accurately portray the traits or behaviours of the things, occasions, or ideas they stand for, they are intuitive and simple to comprehend. As an illustration, the ASL sign for "rain" can entail fluttering fingers down from above the head to simulate the sight of droplets falling.

Arbitrary Signs:

Within the domain of sign language, arbitrary signs are those that do not inherently represent their meanings; rather, they are established through social norms and consensus within a community. Sign languages encompass a wide array of arbitrary signs, whose forms are acquired through usage and familiarity rather than any inherent connection to their referents.

Fingerspelling:

Through the use of physical motions, the technique known as fingerspelling allows signers to spell out names, proper nouns, technical phrases, and words that do not have established signs. The vocabulary of sign languages is expanded by fingerspelling, which offers a way to communicate words or ideas for which there are no existing signs.

For instance, When fingerspelling in ASL, handshapes that correspond to specific alphabetic letters are used, with each letter being a component of a continuous sequence of manual gestures.

Numerical Signs:

By using hand gestures or shapes that match numerical values, numerical signs are utilized to convey numbers and numerical concepts. Within the framework of sign languages, numerical signs allow signers to express measures, counts, amounts, and other numerical information.

3. PROBLEM IDENTIFICATION AND OBJECTIVES

3.1 PROBLEM STATEMENT

The banking industry frequently falls short in meeting the needs of people who are hard of hearing or deaf, which causes communication problems and restricts access to necessary financial services. Current means of communication are primarily oral or written, thus deaf people cannot participate completely in banking transactions, queries, or exchanges. Because of this, deaf and hard of hearing people have difficulty obtaining account information, making transactions, and contacting banking professionals for help. This causes the deaf community to feel excluded and frustrated.

3.2 OBJECTIVES:

Develop an all-encompassing database for Sign Language:

The gathering of a diverse array of sign language animations portraying various banking-related concepts, gestures, and feelings is of utmost importance. It is imperative to encompass significant financial terms and situations within these animations.

Design an Easy-to-Use Interface:

We aim to develop a user-friendly interface that incorporates accessibility features such as keyboard shortcuts and screen reader compatibility. This will greatly assist individuals who are deaf or hard of hearing in effortlessly inputting text-based inquiries and engaging in interactions.

Customize Sign Language Output:

In order to accommodate the diverse linguistic and cultural needs of our users, we offer customization choices that allow them to modify the sign language output. These options support a variety of sign language dialects, communication preferences, and user preferences, ensuring a personalized experience.

Assure Security and Privacy:

It is essential to adhere to industry standards and legal regulations by implementing stringent security measures to safeguard confidential financial information and ensure user privacy when converting text to sign language.

Encourage Awareness and implementation:

It is important to promote wider acceptance and utilization of the technology by informing banking institutions, deaf advocacy organizations, and the public about the benefits and availability of the text-to-sign language converter.

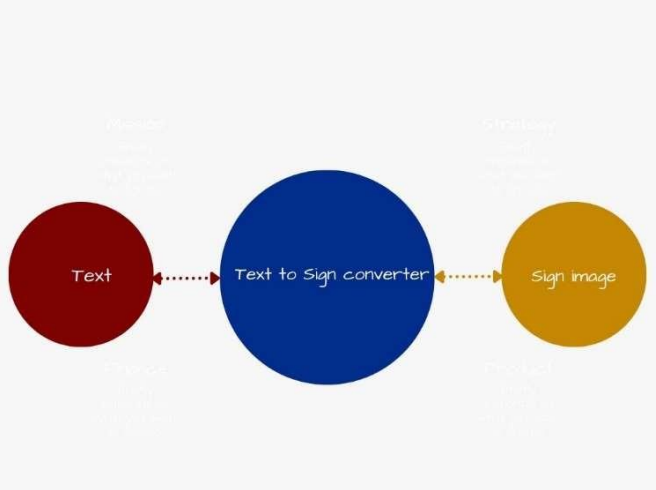


Figure 3.2(a)

Figure *3.2(a)* gives the main goal of our project

4. SYSTEM METHODOLOGY

Developing a system methodology for text to sign converter in banking sectors involves defining the steps, processes, and technologies required to implement the solution effectively. Below is a systematic approach to building such a system:

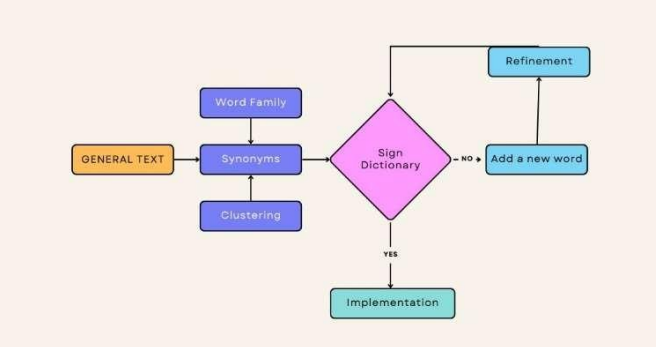


Figure 4(a)

Figure 4(a) gives information about the working of text to sign converter in the form of a flow chart.

Figure 4(a) consists of general work-flow of our converter where, the text is entered as an input, after using the techniques of clustering the word families, synonyms of that particular it by far gets into the dictionary. Where the decision is made on the bases of availability of the word.

4.1 UML DIAGRAMS:

4.1.1 USE CASE:

A use case is a written description of how users will perform tasks on your website. From a user's point of view, it outlines a system's behaviour as it responds to a request. Each use case is represented as a sequence of simple steps, beginning with a user's goal and ending when that goal is fulfilled.

WORKING OF CONVERSION AND IMAGE UPLOADING:

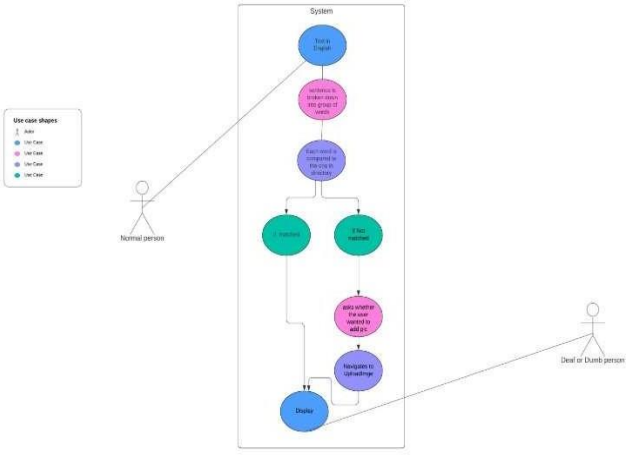
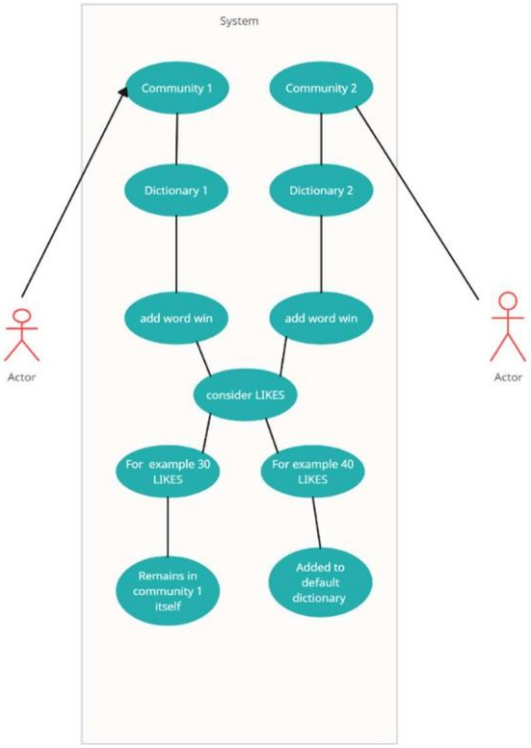


Figure 4.1.1(a)

Figure *4.1.1(a)* gives the working of text to sign language conversion and upload of missing images

WORKING OF COMMUNITIES:



(Figure 4.1.1(b))

Figure 4.1.1(b) gives the working of communities and independent allocation of images and for duplicate upload of images in different communities leads to implementation of likes so for the image with more likes is added in to the default dictionary.

4.1.2 SEQUENCE DIAGRAM:

Sequence Diagrams are interaction diagrams that detail how operations are carried out. They capture the interaction between objects in the context of a collaboration. Sequence Diagrams are time-focused, showing the order of the interaction by using the vertical axis of the diagram to represent the time, what messages are sent, and when.

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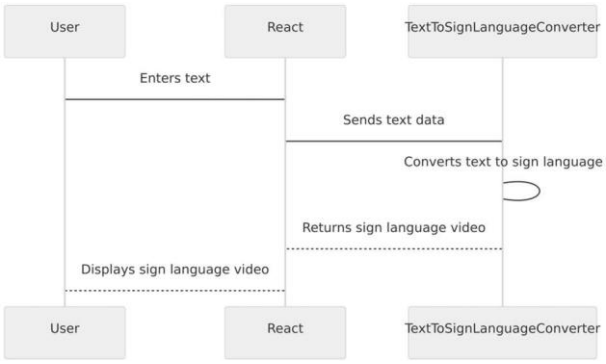


Figure *4.1.2*

Figure 4.1.2 gives the working using the Sequence diagram.

4.1.3 CLASS DIAGRAM:

Developers use class diagrams, a sort of UML (Unified Modelling Language) diagram, to visually express the relationships and organization of classes in a system. A standardized modelling language called UML is useful for software system design and documentation. They assist with both the design and documentation stages of the software development process, making them a crucial component.

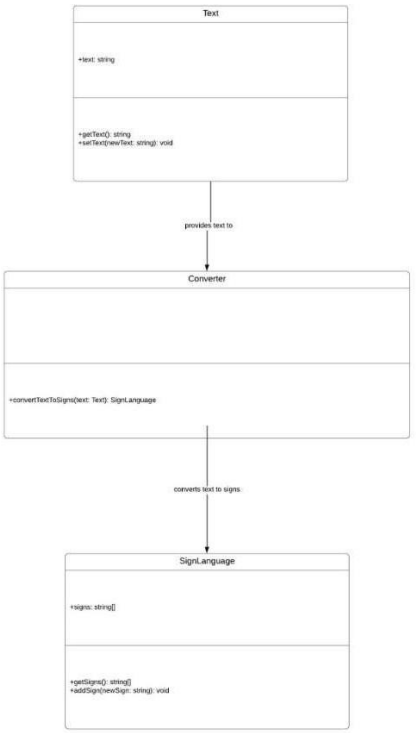


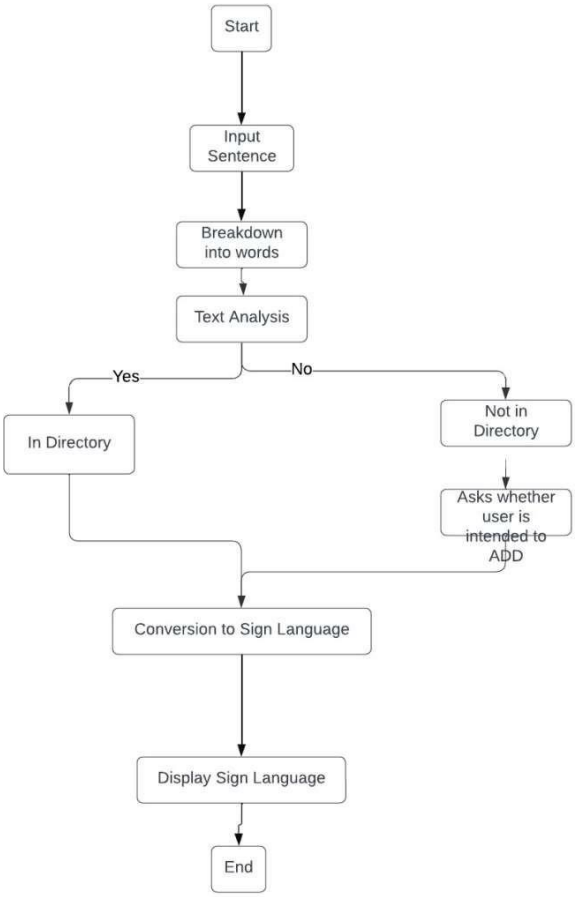
Figure *4.1.3*

Figure 4.1.3 shows the class diagram of the text to sign converter

4.1.4 ACTIVITY DIAGRAM:

Activity Diagrams are used to refer to the stages involved in carrying out a use case and to show how control flows through a system. An activity diagram, which focuses on the state of flow and the order in which it occurs, is a sort of behavioural diagram that we may use to show both sequential processing and concurrent processing of activities. We use an activity diagram to explain what leads up to a specific occurrence. An activity diagram shows the several choice pathways that can be taken while carrying out an activity by illustrating the control flow from a start point to an end point.

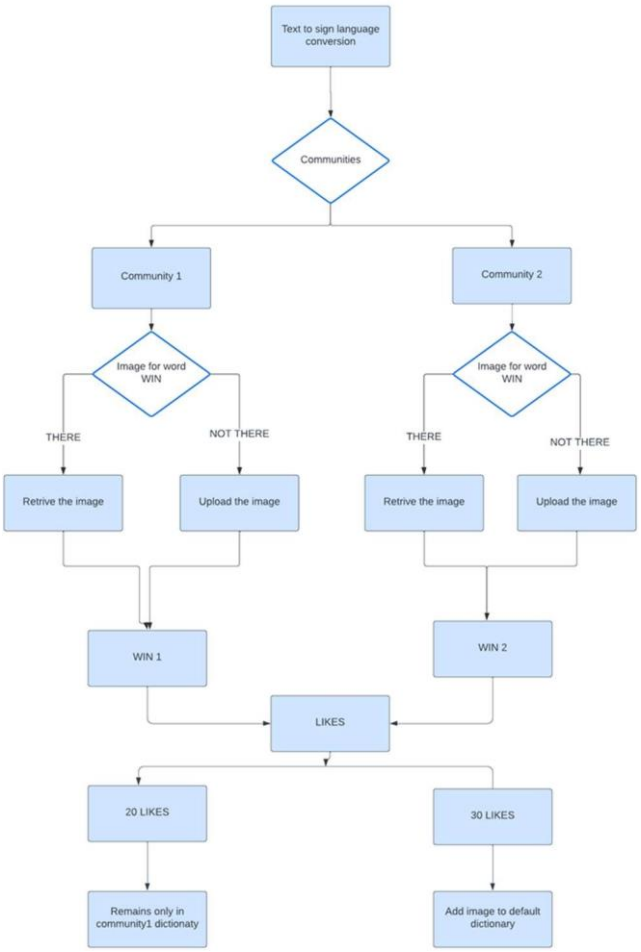
WORKING OF CONVERSION AND IMAGE UPLOADING:



(Figure 4.1.4a)

Figure 4.1.4a shows the working of activity diagram of text to sign converter

WORKING OF COMMUNITIES:



(Figure 4.1.4b)

Figure 4.1.4b gives the working of communities and independent allocation of images and for duplicate upload of images in different communities leads to implementation of likes so for the image with more likes is added in to the default dictionary.

5. OVERVIEW TECHNOLOGIES

A dictionary of signs used in a particular sign language is a useful tool for learning about signs. Below is a quick summary of the contents of a sign language dictionary:

Sign Entries:

Each sign entry in a sign language dictionary represents a word, idea, or expression in the sign language that is being recorded. Every sign entry could contain the sign itself: An image of the sign that is typically provided by pictures, videos, or graphics. Sign descriptions can be expressed orally or in writing, and they should include information on the locations, motions, and hand shapes as well as non-manual indicators like body language and facial emotions.

Alphabetical Organizations:

Sign language dictionaries are typically organized alphabetically, allowing users to easily find signs in either sign language or English. Entries can be sorted by English term or by the sign language alphabet. Some dictionaries may also group similar signs together using classification or categorization systems. By examining thematic connections, semantic domains, or grammatical categories, users can gain a deeper understanding of the language's vocabulary and structure.

Classification and Categorization:

Sign language dictionaries categorize signs based on grammatical categories, semantic fields, or thematic categories. This classification system facilitates the identification of related signs and helps users understand how signs are organized in terms of lexical and grammatical structures. Variations in signs can arise from factors such as community preferences, historical influences, methods of deaf education, or geographical location. By providing users with a range of sign options, dictionaries showcase the remarkable linguistic diversity and adaptability of sign languages.

Cultural and Linguistic Notes:

Sign language dictionaries often include cultural and linguistic notes to provide a deeper understanding of the sign language being documented. These notes offer valuable advice on effective communication in sign language and shed light on the origins, development, and cultural significance of signs. Cultural notes delve into the history of sign language development, the deaf community, and deaf culture, encompassing aspects such as history, identity, cultural norms, and advocacy work. Linguistic notes, on the other hand, delve into the grammatical structure, syntax, and conversation patterns of sign languages, offering detailed insights into language concepts like classifiers, spatial grammar, verb agreement, and rhetorical techniques used in sign language communication

Multimedia material:

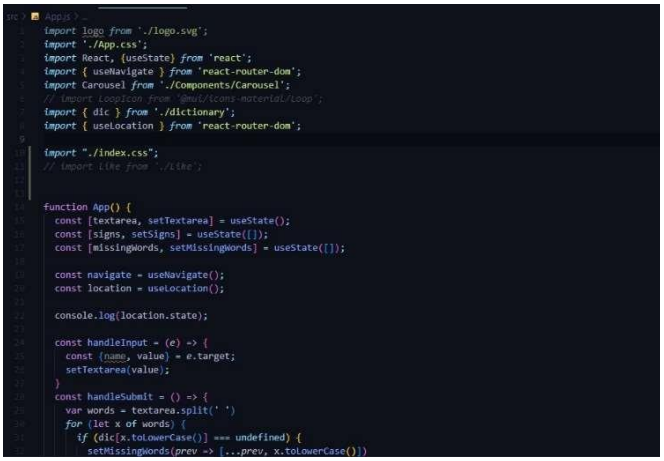
Contemporary sign language dictionaries have embraced the use of multimedia materials, such as movies or animations, to provide visual

representations of signals in motion. This enhancement greatly improves the usability and accessibility of the dictionary, especially for individuals who are learning sign language or prefer visual learning. By incorporating multimedia technologies, these dictionaries allow users to observe signs in action and gain valuable insights from the accompanying video clips or animations.

Sign language dictionaries are valuable resources for individuals interested in learning about sign languages and deaf culture, as well as educators, researchers, and sign language users. These dictionaries provide a comprehensive reference guide to the statements, signs, and symbols that form the basis of sign languages used globally for communication. By enhancing language accessibility, promoting linguistic diversity, and facilitating effective engagement with sign languages, dictionaries play a crucial role in fostering inclusivity. They are designed to be easily accessible across various platforms and devices, catering to the diverse needs and preferences of users. This may involve features such as screen reader compatibility, customizable display settings, and alternative text for images. Additionally, dictionaries may offer functions like bookmarks, search filters, and notes to enhance the user experience and support personalized learning.

6. IMPLEMENTATION

6.1 CODING:



(Figure 6.1.1)

Figure 6.1.1 shows the code related to app.js

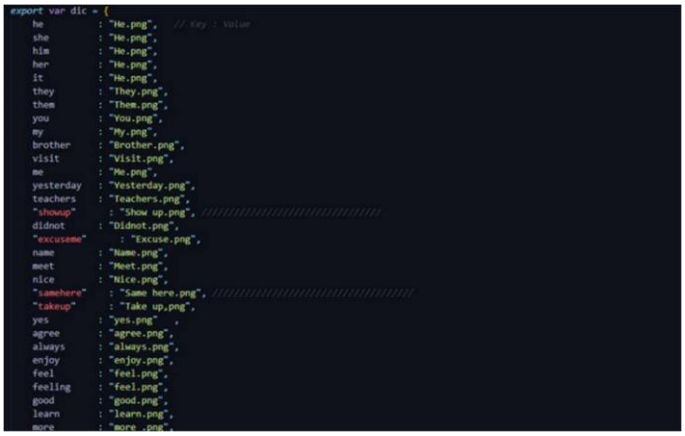
(Figure 6.1.2)

Figure 6.1.2 shows the code related to add.js

(Figure 6.1.3)

Figure 6.1.3 shows the codes related to carousel.js

The carousel is a slideshow that uses a little bit of JavaScript and CSS 3D transforms to cycle between various pieces of material. It may operate with a collection of pictures, text, or unique markup. Support for previous and next buttons and indicators is also included.

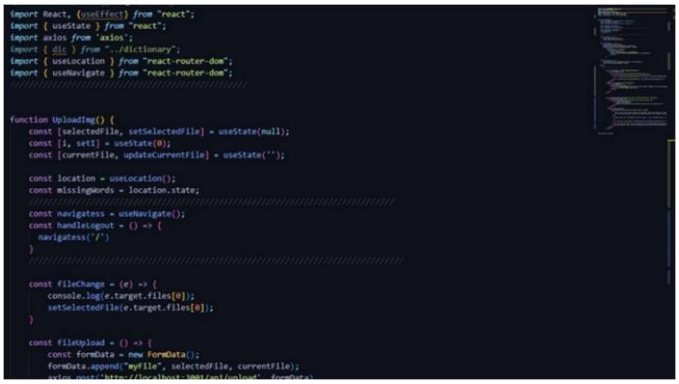


(Figure 6.1.4)

Figure 6.1.4 shows the code related to dictionary.js The above JavaScript code is to generate the dictionary on which the text to sign language converter is going to work.

(Figure 6.1.5)

Figure 6.1.5 is the code which is related to handsign and it is in JavaScript



(Figure 6.1.6)

Figure 6.1.6 is the image of JavaScript code which is formulated to upload an image for every word which is not there in the dictionary by default

(Figure 6.1.7)

Figure 6.1.7 is the JavaScript code which is formulated for the working of login page

(Figure 6.1.8)

Figure 6.1.8 is the code which showcase the JavaScript code for index

6.2 EXPLANATION:

- **Frontend (React):** A well-liked JavaScript package for creating user interfaces is called React. Your text-to-sign language converter application's frontend interface was probably made with React in mind. Your React application would consist of many components to handle user input, show results, and communicate with the backend. You may have a component where users enter text for the text-to-sign language conversion capability. When the user submits the text, the frontend sends a request to the backend for processing.

- **Backend (Node.js):** JavaScript code may be executed on the server side with the help of the JavaScript runtime environment Node.js. Node.js is probably utilized in your project to manage database communication and server-side functionality. In order to handle text input, retrieve sign language translations from the database, and deliver results back to the frontend, your Node.js application would have endpoints (API routes). The frontend makes a request to the relevant backend endpoint when a user submits text for conversion. After processing the text, the backend delivers it back to the frontend after retrieving the matching sign language translation from the database.

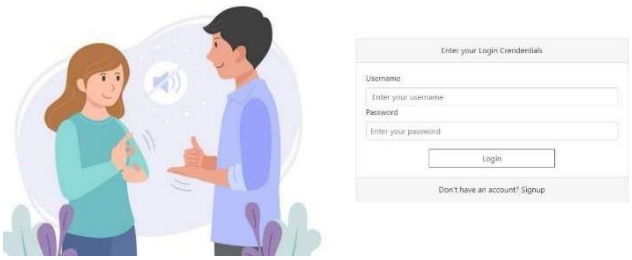
- **Database (MongoDB)**: MongoDB is a NoSQL database that stores data in JSON-like documents. In your project, MongoDB is likely used to store sign language translations and possibly other data related to the banking sector. You would have collections in your MongoDB database for storing sign language translations, user data, and any other relevant information. When the backend needs to retrieve sign language translations for a given text input, it queries the MongoDB database to fetch the relevant data.

- **Carousel (Assuming for UI Enhancement):** A carousel is a user interface element that rotates material or graphics. The carousel in your project might be utilized to provide relevant text or animations in sign language, improving the user interface. Your React application would utilize the carousel component to display animations in sign language that were created based on text input.

Overall, the architecture of your project consists of a frontend with a React constructed user interface, a backend with Node.js implemented server-side functionality and database interaction, and a MongoDB database used to store data such as sign language translations. For UI improvement, the carousel component is utilized to offer users relevant material or animations in sign language.

6.3 INTERFACES:

6.3.1 Login Page:



(Figure 6.3.1)

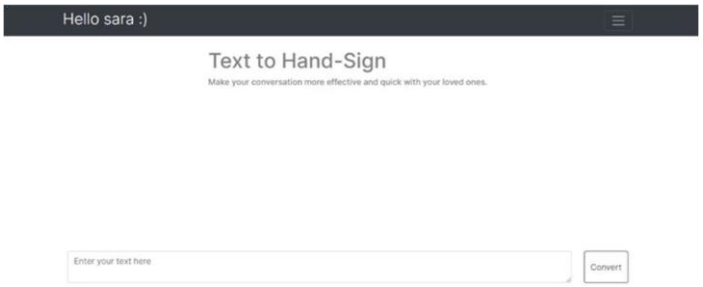
The figure 6.3.1 represents the login page

6.3.2 Register Page:

(Figure 6.3.2)

The figure 6.3.2 represents the Register page

6.3.3 Input Page:



(Figure 6.3.3)

Figure 6.3.3 represents the input page

6.3.4 Output Page:

(Figure 6.3.4)

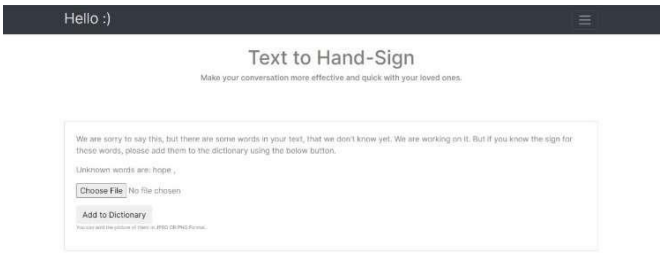
Figure 6.3.4 represents the output page

6.3.5 Intend to upload page:

(Figure *6.3.5)*

Figure *6.3.5* represents the Intend page which leads to upload a new image

6.3.6 Upload Page:



(Figure *6.3.6)*

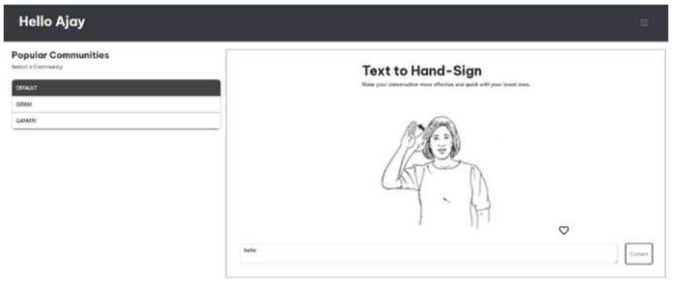
Figure 7.2.6 represents the upload page for the dictionary

6.3.7 Communities:

(Figure 6.3.7)

Figure 6.3.7 represents the different communities like GITAM and Gayatri in this case

6.3.8 Liking system interface:



(Figure 6.3.8)

Figure 6.3.8 represents the liking system for the image

7. RESULTS (First implementation) AND DISCUSSIONS

This includes a thorough evaluation of the work carried out and highlights the study's contributions. The discussion shall logically lead to inferences, conclusions, and scope for possible future employment.

Here's how this might be structured:

7.1 RESULTS:

- **Overview of Text-to-Sign Language Conversion:** The text-to-sign language converter system was created to translate text-based banking transactions into sign language animations, hence facilitating communication between deaf or hard- of-hearing people and financial organizations. The system was designed to improve deaf users' inclusion, independence, and accessibility in the financial industry.

- **Evaluation of System Performance** Using a mix of animation rendering methods and sign language synthesis techniques, sign language animations were produced based on the processed text.

7.2 DISCUSSION:

The text-to-sign language converter system has the potential to significantly enhance accessibility and inclusivity for individuals who are hard of hearing or deaf within the financial industry. By providing equal access to banking services, this technology helps to eliminate communication barriers and empowers deaf users to engage with financial institutions independently and confidently. Despite its accomplishments, there are various technical challenges and opportunities for enhancement that have been identified. These include the integration of additional features such as speech recognition and multi-modal input support, optimization of animation rendering algorithms for real-time performance, and enhancement of the sign language lexicon in terms of breadth and quality. To further enhance the system's capabilities, future research endeavors could explore the utilization of machine learning and deep learning methodologies

8. CONCLUSION AND FUTURE SCOPE

8.1 CONCLUSION

The implementation of the text-to-sign language converter represents a significant progress in enhancing banking accessibility and inclusivity for individuals who are hearing impaired or deaf. This innovative technology effectively eliminates communication barriers that have existed for a long time, facilitating equal access to financial services by facilitating smooth communication between deaf customers and banking establishments through the incorporation of sign language animation technologies.

The utilization of a text-to-sign language converter has proven to be advantageous in enhancing communication between individuals

who are deaf and professionals in the banking industry, as evidenced by its effective implementation. By generating accurate and contextually relevant sign language interpretations through meticulous parsing and analysis of text-based interactions related to banking, this system empowers deaf individuals to confidently comprehend and address inquiries, transactions, and account details on their own.

We've learned a lot about how effectively the system is functioning for users from usability testing and user views. The participants commended the system for its clarity, responsiveness, and real-time performance and mentioned how effectively it would boost financial management autonomy and confidence. Positive user feedback has directed iterative revisions to the system's functionality, accessibility features, and user interface, ensuring that it meets the various needs.

The banking sector is not the only one affected by the text-to-sign language converter; emergency response, education, healthcare, and customer service are just a few other areas. Through the use of innovative technical solutions, the system promotes accessibility and inclusion, hence fostering an inclusive society. This guarantees that everyone has an equal chance to participate in society, regardless of their capacity for hearing.

Future-focused research, development, and cooperation in sign language technology are critical to advancing the potential and scope of these systems.

8.2 FUTURE SCOPE

In the financial sector, the text-to-sign language converter project has made great strides toward improving accessibility and inclusion for the deaf and hard of hearing. Going forward, there exist several avenues for innovation, cooperation, and continuous system development to enhance its impact, utility, and scope:

1. **Expansion of Sign Language Dictionary:** The sign language dictionary serves as the system's cornerstone for converting text to sign language. Future work will focus on expanding the dictionary's coverage to include a wider range of terms related to banking, specialized terminology, and regional variations. Cooperative ties with linguists, sign language experts, and members of the deaf community will be essential to the dictionary's longevity and enrichment in order to ensure its relevance and accuracy.

2. **Integration of Advanced Technologies:** The fields of machine learning, deep learning, and natural language processing (NLP) provide exciting opportunities to enhance the functionality of text-to-sign language converter systems. Modern algorithms and models may be used to improve the accuracy of text analysis, sign language synthesis, and animation rendering, producing more intricate and contextually relevant translations. Research on the production of personalized sign language and adaptive learning techniques will enable further system customisation to meet individual user preferences and communication styles.

3. Multimodal Interaction Support: Future iterations of the system will incorporate multimodal interaction support to accommodate a variety of user needs and preferences. This might include including voice input capabilities for users with speech impairments, gesture detection for users with movement impairments, and haptic feedback for tactile communication. By using a multimodal approach, the technology will give deaf individuals a more adaptable and inclusive platform for communication across several modalities.

4. Cross-Platform Compatibility: Improving cross-platform compatibility will increase the text- to-sign language converter system's usability and accessibility across a variety of hardware and operating systems.

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