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SIGN LANGUAGE TRANSLATOR

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we stand here today before you after long nights of hard work.
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Chapter 1

1.1. Introduction :

The problem of communicating between deaf and hearing individuals is a complex and challenging issue that effects many people worldwide.
Deaf individuals often face significant barriers when communicating with hearing people ,such as a lack of understanding of sign language or the inability to hear spoken language .This can result in feeling of isolation ,frustration, and exclusion from social activities and interactions.

On the other hand ,hearing individuals often struggle to communicate effectively with deaf individuals due to lack of knowledge of sign language or limited exposure to deaf culture .As a result,they may unintentionally rely on speech , which can be a significant communication barrier for the deaf. This problem has significant social , educational, and professional implication , as deaf individuals face unique challenges in accessing education ,employment opportunities ,and social services .Therefore ,it is crucial to develop effective communication strategies and technologies to facilitate communication between deaf and hearing individuals.

As we all know sign language is a visual language that uses combination of the hand gestures ,facial expressions ,and body language to communicate ,and it is the primary means of communication for many deaf individuals. However , not everyone knows sign language ,which can create barriers to communication and limit opportunities for social interaction and education .

1.2. Communication :

1.2.1. Definition and background :

Communication is the process of sharing information, ideas, and thoughts between individuals or groups. It involves the exchange of messages between a sender and a receiver through a channel or medium. Communication can take various forms such as verbal, nonverbal, written, or visual.

The history of communication can be traced back to prehistoric times when humans communicated with each other through cave paintings, gestures, and sounds. With the development of language, communication became more structured and sophisticated. The invention of writing in ancient civilizations such as Mesopotamia, Egypt, and China allowed for the recording and transmission of messages over long distances.

The invention of the printing press in the 15th century revolutionized communication by making it possible to produce and distribute written materials on a large scale. The telegraph in the 19th century and the telephone in the 20th century made it possible to transmit messages over long distances in real-time.

In the 21st century, the development of digital communication technologies such as email, instant messaging, social media, and video conferencing has transformed communication even further, making it faster, more efficient, and more accessible to people around the world.

Overall, communication has played a vital role in human history and continues to be an essential aspect of our personal and professional lives.

1.2.2. Types Of Communication :

There are several types of communication, including :

1. Verbal Communication :
   This is the most common type of communication and involves the use of spoken words. It can be in the form of face-to-face conversations, phone calls, speeches, and presentations.
2. Nonverbal Communication :
   This type of communication does not involve spoken words, but instead, it uses gestures, facial expressions, body language, sign language, and tone of voice to convey meaning.
3. Written Communication :
   This type of communication uses images, graphics, and videos to convey meaning. It can include things like charts, graphs, diagrams, and presentations.
4. Visual Communication :
   This type of communication uses images, graphics, and videos to convey meaning. It can include things like charts, graphs, diagrams, and presentations.
5. Interpersonal Communication :
   This type of communication occurs between two or more people and involves sharing ideas, emotions, and information. It can be verbal or nonverbal and can take place in a variety of settings, such as at home, work, or school.
6. Group Communication :
   This type of communication occurs between two or more people and involves sharing ideas, emotions, and information. It can be verbal or nonverbal and can take place in a variety of settings, such as at home, work, or school.
7. Group Communication :
   This type of communication occurs among a group of people, and it can be formal or informal. It can take place in meetings, conferences, or team discussions.
8. Mass Communication :
   This involves the use of mass media, such as television, radio, newspapers, and social media, to reach a large audience. It is typically used to inform or influence people on a large scale.

Overall, these are just some of the different types of communication that people use in their personal and professional lives. Each type of communication has its own strengths and weaknesses and can be used in different situations to achieve different goals.

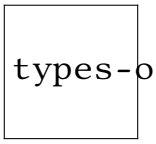

Figure 1 – Top 3 most common types of communication

1.3. Sign Language :

Sign language is a visual form of communication that uses hand gestures, facial expressions, and body language to convey meaning. It is used by people who are deaf or hard of hearing, as well as by those who can hear but may have difficulty speaking.

There are many different sign languages around the world, each with its own unique set of signs and grammar rules. For example, American Sign Language (ASL) is used primarily in the United States and Canada, while British Sign Language (BSL) is used in the United Kingdom.

Sign language is a fully-fledged language with its own grammar, syntax, and vocabulary. It is not simply a visual representation of spoken language, but a distinct language with its own linguistic structure and rules.

The history of sign language can be traced back to ancient civilizations such as Greece, Rome, and China, where it was used to communicate with people who were deaf or mute. However, it was not until the 18th century that sign language was recognized as a legitimate language with its own grammatical structure and syntax.

In the 19th century, sign language was used in schools for the deaf, where it was used to teach academic subjects and facilitate social interaction among students. American Sign Language (ASL) was developed in the United States in the early 1800s and is now one of the most widely used sign languages in the world.

In the 20th century, sign language began to gain more recognition as a legitimate language, and efforts were made to promote its use and recognition. Today, sign language is used in a variety of settings, including schools, workplaces, and social situations, and there are many different sign languages used around the world.

Overall, sign language has played an important role in facilitating communication and social interaction for people who are deaf or hard of hearing, and it continues to be an essential part of their lives.

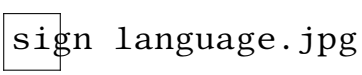

Figure 2 – Sign Language

1.3.1. Sign language apps background :

The history of sign language apps can be traced back to the development of software programs that were designed to help people learn sign language on personal computers in the 1990s. These early programs were primarily aimed at teaching American Sign Language (ASL) and featured video clips of sign language instructors demonstrating different signs and gestures.

With the rise of smartphones and tablets in the 2010s, sign language apps became more accessible and widely available. Many of these apps were developed by non-profit organizations and advocacy groups, with the goal of promoting deaf culture and increasing awareness of sign language.

One of the earliest and most popular sign language apps was ASL Dictionary, which was launched in 2008 by Software Studios LLC. This app featured over 5,000 signs and gestures and allowed users to search for specific signs using text or a visual search tool.

Since then, a wide variety of sign language apps have been developed, including apps for learning different sign languages, translation apps that convert written or spoken language into sign language, and communication apps that allow users to communicate using sign language over video calls.

Sign language apps have also been developed for specific industries and fields, such as healthcare, education, and emergency services. For example, the ProDeaf app, developed in Brazil, provides healthcare professionals with a visual dictionary of medical signs and terminology to communicate with deaf patients.

Overall, sign language apps have become an important tool for promoting inclusivity and bridging communication gaps between deaf and hearing individuals. They continue to evolve and improve, using advanced technology such as artificial intelligence and machine learning to enhance the user experience and improve accuracy.
Here are some of the most famous sign language apps :

1. SignSchool : a comprehensive sign language learning app that includes videos, quizzes, and a dictionary of signs. It is available for both iOS and Android.

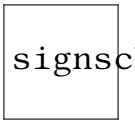

Figure 3 – SignSchool App Logo

2. ASL dictionary : an American Sign Language dictionary app that includes over 5,000 signs and allows users to search for signs using keywords. It is available for both iOS and Android.

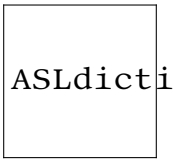

Figure 4 – ASLdictionary App Logo

3. ProDeaf Translator : a real-time sign language translation app that allows users to translate spoken or written text into sign language. It is available for both iOS and Android.

Figure 5 – ProDeaf App Logo

1.3.2. The advantage of sign language apps :

There are several advantages of sign language apps, including :

1.Convenience : Sign language apps make it possible to learn sign language anytime and anywhere, without the need for attending classes in person.

2.Flexibility : Users can learn at their own pace, and can revisit lessons as many times as they need to fully understand the material.

3.Accessibility : Sign language apps make sign language learning accessible to anyone with a smartphone or tablet, regardless of their location or physical abilities.

4.Promotes Inclusivity : Sign language apps help to promote inclusivity by making sign language more accessible to people who are deaf or hard of hearing, as well as to people who want to communicate with them.

5.Variety : Sign language apps provide access to a variety of sign languages, including American Sign Language (ASL), British Sign Language (BSL), and other regional sign languages.

6.Interactivity : Some sign language apps offer interactive features such as quizzes, games, and video lessons, which can make learning more engaging and effective.

Overall, sign language apps provide an accessible and convenient way to learn sign language, which can help to promote communication and inclusivity for individuals who are deaf or hard of hearing.

1.4. Our initial scope and vision :

Sign language is an important means of communication for people who are deaf or hard of hearing.There are a lot of educational apps that help people learn and understand this language but not much apps that translate sign language to text or vise versa .
That's why we thought that an app for sign language can be very important because it can help bridge this gap by providing a way for people to translate and understand the language anytime anywhere.

Sign language is a powerful and expressive form of communication, but it can be difficult for those who are not familiar with it to understand. That's why we thought that a sign recognition app can help the hard of hearing individuals to be understood wherever they are .Our mobile app provides a simple solution to this problem by allowing users to translate sign language into text or speech, and vice versa.

With our app, users can easily input an image or upload a video of them preforming sign language gestures, and receive a clear and accurate translation in real time. This makes it easy for hearing-impaired individuals to communicate with those who do not know sign language .

Chapter 2

2.1. Mobile apps :

Mobile apps are software applications designed to run on mobile devices, such as smartphones and tablets. These apps can be downloaded and installed from app stores, such as the Apple App Store or Google Play Store. Mobile apps are often developed to provide specific functionality or services, such as social networking, entertainment, productivity, gaming, or educational tools.

Mobile apps can be developed for different mobile operating systems, such as iOS, Android, or Windows. Developers typically use programming languages such as Java or Swift to create mobile apps, and often use development frameworks or platforms such as React Native or Xamarin to speed up the development process.

Mobile apps can be either native, web-based, or hybrid. Native apps are developed specifically for a particular mobile platform using the platform's native programming language and tools. Web-based apps are accessed through a mobile device's web browser and use web technologies such as HTML, CSS, and JavaScript. Hybrid apps combine elements of both native and web-based apps, using web technologies to build the app's user interface, but accessing device features and functions through native APIs.

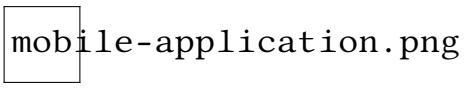

Figure 6 – Different Mobile Apps

Mobile apps have become an integral part of modern life, providing users with easy access to information and services on the go. Many businesses and organizations also use mobile apps as a way to reach their customers and provide value-added services.

2.2. Mobile Apps Classification

According to their modes of operation, mobile applications are divided into two criteria : type and category.

2.2.1. According to types :

1. Web applications :

Web applications, are software programs designed to run on a web browser. They are accessed through a network connection, usually the internet, and are not installed on the user's device. Web apps can be accessed from any device with a web browser, making them highly accessible and platform-agnostic.

Web apps are built using web technologies like HTML, CSS, and JavaScript, and are usually hosted on a web server. The user interacts with the web app through the web browser's user interface. Web apps can range from simple applications, such as a calculator or a weather app, to complex applications like a CRM (customer relationship management) system or an online store.

Web apps offer several advantages over traditional desktop applications. They do not require installation or updates, and users can access them from any device with an internet connection, making them highly portable. They can also be easily updated by the developer, without requiring the user to install any updates.Examples of web apps include Google Docs, Gmail, and Facebook.

2. Native appliactions :

Native apps are software applications that are designed and developed specifically for a particular operating system, such as iOS or Android. They are built using the native programming languages and tools provided by the platform, such as Swift or Objective-C for iOS and Java or Kotlin for Android. Native apps are downloaded and installed directly onto the device, and can be accessed without an internet connection. Examples of native apps include Instagram, Snapchat, and Uber.

Here are some key characteristics of native apps :

-Platform-specific : Native apps are built specifically for a particular platform and can take advantage of the platform's native capabilities, providing a better user experience.

-High Performance : Native apps are designed to be fast and responsive, as they are built using platform-specific programming languages and tools.

-Access to Hardware : Native apps can access the device's hardware, such as the camera, GPS, and accelerometer, providing a richer and more immersive user experience.

-Offline Functionality : Native apps can work offline, storing data on the device and syncing with a server when an internet connection is available.

3. Hybrid applications :

Hybrid apps are a combination of web and native apps. They are built using web technologies such as HTML, CSS, and JavaScript, but are wrapped in a native app wrapper that allows them to be downloaded and installed onto a device like a native app. Hybrid apps can access some of the device's hardware and features, but not as much as native apps. Examples of hybrid apps include Instagram, Airbnb, and Evernote.

Here are some key characteristics of Hybrid apps :

-A single source code for all platforms therefore a development time scaled down.

- Relatively cheaper development cost.

- These programs are less bulky than other applications, more varied and can be used for all types of use.

- It can be hosted in a web server or on the device.

2.2.2. According to categories :

The classification by category is quite simple to do :
- Mobile games : LeageOfLegends...
- Applications for educational purposes : Babbel...
- Geolocation applications : Google Map...
- Audio applications : Spotify. . .
- Applications for Internet consultation : Safari...
- Social network applications : Intagram...

2.3.1. Mobile Operating Systems :

An operating system (OS) is a software program that manages computer hardware and software resources and provides common services for computer programs. It acts as an interface between the computer hardware and the user, providing a platform for applications to run on the computer.

The operating system is responsible for managing the computer's memory, processing power, input and output devices, and other system resources. It also provides a user interface for interacting with the computer, such as a graphical user interface (GUI) or a command-line interface (CLI). There are many different types of operating systems, including desktop operating systems like Windows and macOS, mobile operating systems like Android and iOS, and server operating systems like Linux and Windows Server.

2.3.1. Common Mobile Operating Systems

These are some of the most commonly used operating systems :

a) IOS :

IOS is the operating system developed by Apple Inc. for their mobile devices such as the iPhone, iPad, and iPod Touch. It is a closed-source, proprietary operating system that is designed to work specifically with Apple's hardware.

IOS is known for its ease of use, security, and overall reliability. It features a user-friendly interface with a set of pre-installed apps and allows users to download additional apps from the Apple App Store.

Some of the key features of iOS include Siri (a virtual assistant), FaceTime (a video calling feature), iMessage (an instant messaging app), and Apple Pay (a mobile payment system).

IOS also includes features like Touch ID and Face ID for biometric authentication and security, as well as a wide range of accessibility options for users with disabilities.

Overall, iOS is a popular operating system due to its user-friendly interface, consistent updates, and the high level of security it provides for its users.

b) Android :

Android is an open-source operating system developed by Google, and it is used primarily on smartphones and tablets. It is one of the most popular mobile operating systems in the world, and it is used on a wide range of devices from many different manufacturers.

Android is known for its flexibility, customization options, and wide range of apps available in the Google Play Store. It allows users to customize their devices with widgets, home screen layouts, and more. It also includes features like Google Assistant, which is a virtual assistant that can help users with a variety of tasks.

One of the key features of Android is its ability to be customized by device manufacturers and users. Different manufacturers may include their own custom user interfaces or pre-installed apps on their devices, and users can also download and install custom ROMs to modify their devices further.

Android also includes a range of security features, such as the ability to set a lock screen passcode or pattern, and Google Play Protect, which scans apps for malware and other security threats.

Figure 7 – Mobile Apps Classification According To Their Types

Figure 8 – The Most Poppular Apps Of 2022

Figure 9 – Some Of The known Operating Systems

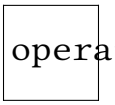

Figure 10 – Mobile Operating Systems

Figure 11 – IOS Logo

Figure 12 – Android Logo

c) Windows Phone :

Windows Phone was a mobile operating system developed by Microsoft, which was designed for use on smartphones. It was first released in 2010 and was the successor to Windows Mobile.

Windows Phone featured a distinctive user interface, known as "Metro," which was characterized by large, colorful tiles that represented different apps and functions. The operating system was designed to be fast and responsive, and it included a number of features such as Microsoft Office integration, social media integration, and voice recognition.

Windows Phone also included the Windows Store, which provided a centralized location for users to download apps and games. However, the app selection on Windows Phone was relatively limited compared to other mobile operating systems like Android and iOS.

Despite initial enthusiasm for Windows Phone, the operating system struggled to gain market share, and Microsoft eventually decided to discontinue it in 2017. Today, users are encouraged to use Windows 10 Mobile, which is a version of Windows 10 that is optimized for mobile devices. However, even this version is no longer actively developed or supported by Microsoft.

Figure 13 – Windows Phone Logo

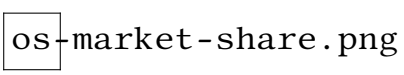

Figure 14 – Os Market Share For The Most Used Mobile Operating Systems

2.4. Methods used in creating the app :

Our app is built with Python and Flutter, Python is a powerful programming language that can be used for data analysis, machine learning, and natural language processing, making it an excellent choice for developing sign language recognition algorithms. Flutter, on the other hand, is a user interface (UI) toolkit that allows developers to create beautiful, high-performance mobile apps for iOS and Android. The app works by using the device's camera to capture a video of a person using sign language . The video would then be analyzed by the Python code, which would use computer vision techniques to recognize the signs being made. Then it would display the corresponding text or spoken translation of the signed message.

2.4.1. Python :

Python is a high-level, interpreted programming language that is known for its simplicity, readability, and versatility. It was first released in 1991 by Guido Van Rossum and has since become one of the most popular programming languages in the world.

Some of the key features of Python include :

1.Easy to learn and use : Python has a simple syntax and a large standard library, which makes it easy to learn and use for both beginners and experienced programmers.

2.Interpreted : Python code is interpreted rather than compiled, which means that it can be executed line by line, making it easier to debug and test.

3.Dynamic typing : Python is dynamically typed, which means that the type of a variable is determined at runtime. This can make coding faster and more flexible, but can also introduce some potential errors.

4.Object-oriented : Python is an object-oriented language, which means that it supports encapsulation, inheritance, and polymorphism, allowing for more efficient and organized code.

5.Large standard library : Python has a large standard library that provides

a wide range of modules and functions for tasks such as file handling, string manipulation, and networking.

6.Versatility : Python is a general-purpose language that can be used for a wide range of applications, including web development, data analysis, artificial intelligence, scientific computing, and many more.

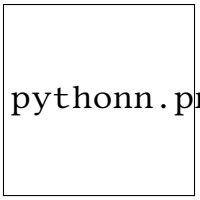

Figure 15 – Python Logo

2.4.2. Flutter :

Flutter is an open-source mobile app development framework developed by Google. It uses the Dart programming language and allows developers to create high-performance, visually appealing, and natively compiled apps for mobile, web, and desktop platforms from a single codebase.

Some of the key features of Flutter include :

1.Hot Reload : Flutter has a fast development cycle with its "hot reload" feature, which allows developers to instantly see the changes they make to the code without having to restart the app.

2.Widgets : Flutter uses a reactive and component-based architecture that allows developers to create complex and interactive user interfaces using pre-built widgets.

3.Natively compiled code : Flutter compiles code into native machine code for the target platform, which results in faster performance and smoother animations.

4.Cross-platform development : Flutter allows developers to create apps that run on multiple platforms, including Android, iOS, web, and desktop, from a single codebase, which reduces development time and costs.

5.Large community and ecosystem : Flutter has a growing community of developers and a rich ecosystem of plugins, packages, and tools that make it easy to integrate with other technologies and services.

flutter-logo-sharing.png

Figure 16 – Flutter Logo

2.4.3. VS Code :

VS Code (Visual Studio Code) is a free, open-source code editor developed by Microsoft. It is a lightweight, cross-platform tool that supports a wide range of programming languages and frameworks, making it a popular choice for developers.

Some of the key features of VS Code include :

1.IntelliSense : VS Code has intelligent code completion, syntax highlighting, and error checking that can help speed up coding and reduce errors.

2.Debugging : VS Code has built-in debugging support for a wide range of programming languages, making it easy to debug code within the editor.

3.Extensions : VS Code has a large and growing library of extensions that can add new features, support new languages and frameworks, and enhance the overall development experience.

4. Integrated terminal : VS Code has an integrated terminal that allows developers to run commands and execute scripts within the editor.

5.Git integration : VS Code has built-in Git integration, making it easy to manage version control and collaborate with others.

vscode.jpg

Figure 17 – VScode Logo

2.5. Why Python and Flutter :

Using Python for the back-end development of a sign language app can be useful because it provides a wide range of tools and libraries for handling complex data

processing tasks. Additionally, Python's simplicity and ease of use make it an ideal choice for building the logic behind the app's translation capabilities.

Flutter, on the other hand, is useful for developing the front-end of the app. Flutter is known for its fast development process, its ability to create visually appealing designs, and its cross-platform compatibility, which allows for the development of apps that can run on both iOS and Android devices. With Flutter, developers can create engaging, responsive, and user-friendly interfaces that enhance the overall user experience of the app.

Together, Python and Flutter provide a powerful combination for building a sign language app translator. Python's robust data processing capabilities enable accurate translation of sign language gestures, while Flutter's visually appealing and responsive user interface ensures that users have a seamless experience using the app.