

Speak4Me –Assistive Communication System for Deaf and Speech-Impaired Individuals

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Abstract: *Speak4Me is an assistive communication app that aims to aid deaf and speech-impaired people to interact effectively within their everyday environments. Communication barriers hinder the interactions of deaf people in social spaces, workplaces, hospitals, and emergency situations. This proposal provides a solution to fill the gap using a technology-based approach. The proposed system integrates STT and TTS technologies in one application. Speech entered by normal individuals is converted into text for deaf users. On the other hand, text entered by speech-impaired users is converted into voice. Additionally, the app features preprogrammed texts to facilitate rapid communication and an emergency warning function for emergencies. The application features a user friendly interface accessible to all age groups. It can be developed using mobile development platforms that support Firebase as a back-end database.*

Speak4Me encourages self-reliance and boosts confidence levels among differently-abled people. The proposed technology addresses the problem of communication barriers faced by deaf people through an innovative solution. Future developments such as multilingual support, offline mode, and advanced speech recognition systems will improve the efficiency of the technology..

Keywords: Speech-to-Text, Text-to-Speech, Accessibility, Assistive Technology, Deaf Communication, Mobile Application

I. INTRODUCTION

Communication is the most significant part of our lives. People use communication to convey their thoughts, feelings, and engage in social interactions. Deaf people and those with speech impairments often encounter significant difficulties while communicating with other people.

Standard forms of communication like gestures and sign language have certain limitations when used for interacting with other people in society. The development of modern communication solutions like Speech-to-Text and Text-to-Speech is helpful to address these issues.

The purpose of Speak4Me is to develop a smart communication solution that facilitates seamless twoway communication. It is designed to convert speech to text and text to speech. Speak4Me also offers a range of pre-set messages along with emergency services.

The primary aim of Speak4Me is to create an inclusive ecosystem where differently abled people can communicate on their own accord.

II. METHODOLOGY

The design and development of the Speak4Me application is carried out following an established methodology that includes the following stages:

2.1 Requirement Analysis

- An understanding of the communication issues among deaf and speech-impaired persons was gained.
- The required functionalities like STT, TTS, preset messages, and emergency notifications were established.



2.2 System Design

- Modules including User Interface, Speech Recognition, Audio Output, Database, and Emergency Module were included in the design.

2.3 Development

- The mobile application can be developed based on Android technology.
- Firebase can be utilized for backend functionality and storing data in the cloud.

Testing

- The individual modules were tested first, followed by integration testing.
- Real-time testing for the modules of speech recognition and audio output was performed.

Deployment

- Following successful testing, deployment can be initiated for making the application publicly available.

III. DISCUSSION

Speak4Me delivers a holistic communication system to people with disabilities. The system integrates different technologies to create an all-in-one package.

3.1 Key Features

- The application offers a feature for speech-to-text translation, which translates oral language to written text.
- The application allows text-to-speech translation, whereby messages typed on the screen are read out loud to the user.
- The application contains pre-installed messages that allow users to quickly send common messages through the system.
- The application is capable of sending alert messages in case of emergencies so that assistance may be acquired right away.
- The application is designed with an easy-to-use interface that makes its use very convenient.
- The application is capable of providing instant communication through instant messaging.

3.2 Limitations and Challenges

3.2.1 Technical Issues

- Background noises influence the efficiency of speech recognition since they make voices unclear.
- Variations in accent lower the accuracy of the system since different accents cannot be recognized easily.

3.2.2 Operational Issues

- Some systems require internet access for effective operation.
- Microphone quality influences the effectiveness of the system since low-quality microphones will not record voices accurately.

3.2.3 User Issues

- Senior users may need to be taught about how the system works before using it effectively.



IV. WORKING OF THE SYSTEM

This system, called "Speak4Me," aims to ensure that there is seamless and efficient communication between those who are deaf, mute, and speech-challenged people and everyone else. This is made possible by combining STT and TTS technologies into one platform. It also comes with pre-set messages and emergency functions to facilitate quick communication. The workings of this system are elaborated on as follows:

4.1 User Interface Module

The system starts with an easy-to-use user interface where users can choose their desired mode of communication. Some of the modes available on the home screen include:

- Speech to Text
- Text to Speech
- Pre-defined Messages
- Emergency Button

The user interface has been created keeping in mind the convenience of use by users of all ages.

4.2 Speech-to-Text Module

This module will be beneficial mostly for the deaf people. As far as a healthy person speaks the message into the microphone:

- the system records the voice message by using the microphone.
- the speech recognition process takes place.
- the message is converted from voice to text form.
- the text is displayed on the screen instantly.

It helps the deaf person to read and understand the message that another person sends without the need to use sign language.

4.3 Text-to-Speech Module

This module will be helpful mostly for people who have problems with speaking or for mutes. In case the user types a certain message:

- it is typed in the input box.
- the system converts the text by using TTS.
- text is transformed into audio.
- the sound message can be heard via the speaker.

The speech impaired people get an opportunity to make messages verbally.

4.4 Two-Way Communication Process

Combining STT and TTS technologies gives possibility to communicate verbally fully:

- healthy person speaks → the system transforms it to text for deaf people;
- deaf or speech-impaired person types → the message is transformed to speech for another person;

Conversation is held in natural way.

4.5 Predefined Messages Module

In order to reduce typing effort and save time, predefined common messages such as:

- Hello
- Thank you
- Please help me



- I need water
- Call my family
- Where is the hospital?

The user can select the message by tapping it, and the message would be either spoken or shown immediately.

4.6 Emergency Alert Module

This module is intended for emergencies. In case the user is in danger and needs help immediately, he/she should use this module:

- Select emergency option
- Show predefined emergency messages
- Send instant messages such as "help me", "medical emergency", or "call police".
- Location tracking and SMS alerts could be added in later versions.
- It guarantees user safety in emergencies.

4.7 Backend and Data Storage Module

In some cases, the system might use the following backend capabilities:

- Data storage
- Settings saving
- Message history
- Cloud synchronization
- Multiple users scalability
- Firebase could be used for backend support.

4.8 Output Generation

The output generated by the system is in two ways, depending on which mode was chosen:

- Visual Output: Text converted into visual display
- Audio Output: Sound generated via speaker

These two types of outputs make communication easier.

4.9 Total Process Flow

The user launches the Speak4Me application.

- Chooses a communication mode.
- Inputs either speech or text.
- The system processes the inputs.
- Outputs in text/voice are generated.
- Communication is smooth.



Speak4Me Application Flow-Chart



Generally speaking, the Speak4Me system bridges the gap between people with varying abilities and society through simplified and efficient communication.

V. LITERATURE SURVEY

The communication aids for deaf and speech-disabled people have seen great advances due to speech recognition and advancements in mobile technology. Several apps have been made available that make use of speech recognition technology in order to minimize the barriers in communicating via Speech-to-Text (STT), Text-to-Speech (TTS), and captions. The next part will provide an overview of various existing applications.

5.1 Google Live Transcribe

Google Live Transcribe is an effective accessibility software that converts voice into text in real-time. The software primarily serves individuals who are deaf and hearing impaired. It offers support in various languages and transcribes accurately. Nevertheless, its main function is converting voice to text without offering full two-way communication.

5.2 Speech Assistant AAC

The Speech Assistant AAC is a software that assists individuals with speech impairments. The software translates typed text to audio speech through text-to-speech technology. The user can also save frequently used phrases to facilitate quick communication. However, the software cannot convert voice to text and is therefore not very useful for the deaf population.

5.3 AVA Live Caption App

AVA is another example of a communication assistance program that generates live captions when communicating and attending meetings. It is highly effective in group discussions and classroom settings. Nevertheless, it offers some of its advanced features on subscription only.



5.4 Limitations of Current Systems

As a result of the current system study, the following limitations have been found:

Most systems offer only one main functionality like STT or TTS.

Most apps need to be connected to the internet constantly.

Some interfaces are difficult to use for older people.

Lack of emergency messaging.

Different apps must be used for different tasks.

5.5 Contribution of Proposed System

The new proposed system Speak4Me offers the combined functionality of both Speech to Text and Text to Speech features. Moreover, the system also incorporates pre-built quick messages and emergency messages. The proposed system is easy to use by any type of users.

From the literature review, it is clear that the existing applications have certain shortcomings in their functionalities. Speak4Me has filled the vacuum by offering an end-to-end communication tool for hearing impaired and speech impaired people.

VI. FUTURE SCOPE

Firstly, **Speak4Me: Assistive Communication System for Deaf and Speech Impaired Individuals** gives an appropriate solution to the problem of communication barrier. Nonetheless, there are several options available for further expansion and improvement in the future. Given the fact that Artificial Intelligence, Mobile Computing, and Accessibility technology are developing at high speed, the system can be enhanced to provide more intelligent, rapid and easier communication services.

One of the main future options for improvement lies in making the system **multilingual**. Presently, most communication systems use particular language only. However, in its future versions, Speak4Me will provide several options for regional, national and international languages for its users to communicate. This way, the program will become much more usable worldwide.

Furthermore, **offline capability** will be a significant improvement of the current version of the software. Offline capability means that the speech recognition system can function without internet connection due to built-in engines of Speech to Text and Text to Speech conversions.

The implementation of both **AI and ML technologies** in the application will increase its effectiveness. The **artificial intelligence** models will be able to recognize accents and unclear pronunciation as well as operate effectively in noise environment. Machine learning will be able to learn the behavioral pattern and commonly used phrases to provide users with smart suggestions, auto-completion, and individual settings.

Additionally, there may be the feature of **real-time language translation**. It will give the possibility to interact with people using different languages since it will translate users' voice or written message into another language in real time. This function may be helpful when traveling, studying, working in an organization or medical facility.

Moreover, the integration of **wearables devices** can be also taken into consideration, namely smart watch, hearing aid or smart glass. In such a way, users will be able to receive voice messages, notifications and caption texts on their wearables.

The next area that could be optimized in the application is the **user interface**. Making it more engaging and easy-to-use would improve the experience in terms of usage. Moreover, large buttons, voice commands, gestures, and accessibility features may be implemented to make the application available for elderly and physically impaired people.

The application could also be extended to include **cloud storage and chat history capabilities**. Important discussions and commonly used chats could be saved on the cloud for easy access anytime.

Further, **emergency services integration** could be created where one can contact hospitals, police stations, or families in emergencies via a single tap. Location sharing could also be included in order to get help more quickly.



In conclusion, there is huge potential in the future of **Speak4Me**. The use of cutting-edge technology and accessibility along with effective communication features can transform this application into a complete assistive system.

VII. CONCLUSION

Speak4Me is a highly functional assistive communication tool that is used by deaf and speech-impaired persons to communicate without any problems in their day-to-day lives. This system has been developed by integrating STT and TTS tools to enable effective and fast two-way communication between the user and other people in the society. It helps to convert spoken words to text as well as text to speech in an easy way.

In addition to that, functions like predefined messages and emergency alerts have been included in the application to improve usability and convenience in critical situations. Moreover, the application has been designed in such a way that anyone can use it without any problems.

To sum up, this tool encourages independence and confidence among differentially-abled persons. Furthermore, considering possible future upgrades of this application, Speak4Me has great potential as a communication tool.

REFERENCES

- [1]. "Google Live Transcribe Application," Available: <https://play.google.com/store/apps/details?id=com.google.audio.hearing.visualization.accessibility.scribe>
- [2]. "Speech Assistant AACApplication," Available: <https://play.google.com/store/apps/details?id=nl.asoft.speechassistant>
- [3]. "AVA –Voice to Text Application," Available: <https://play.google.com/store/apps/details?id=me.ava.android>
- [4]. "Firebase Documentation," Available: <https://firebase.google.com/docs/>
- [5]. "Android Accessibility Help –Live Transcribe Guide," Available: <https://support.google.com/accessibility/android/answer/9158064>
- [6]. S. K. Singh, R. Kumar, "Speech Recognition Systems for Assistive Communication," International Journal of Computer Applications, 2022.
- [7]. P. Sharma, M. Verma, "Text-to-Speech Technology for Disabled Users," International Journal of Engineering Research, 2021.
- [8]. Patil, S. Deshmukh, "Assistive Mobile Applications for Deaf and Mute Communication," IEEE Conference Proceedings, 2023.
- [9]. "Artificial Intelligence in Accessibility Applications," Springer Journal, 2024.
- [10]. "Mobile Based Communication Systems for Specially-Abled Users," IJAR CCE, 2025.

