TED UNIVERSITY

CMPE 491

Senior Project

Gesture Guide: Virtual Assistant for the hearing-impaired

Project Specification

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1. Introduction

1.1 Description

Gesture Guide is a project for providing both a virtual assistant and a sign language interpretation tool that is specialized for the usage of the hearing-impaired. Gesture Guide brings a new approach to accessibility applications by making the application controllable with hand gestures in order to solve the problems hearing-impaired go through in their daily lives. In a casual day the hearing-impaired face a lot of communication related problems with people who do not use sign language. In most cases they are required to carry notebooks and write down their statements, and this is an uncomfortable situation for them[1]. A more comfortable way of communication for the hearing-impaired is nonetheless using sign language and hand gestures. Here the Gesture Guide comes to aid of the hearing-impaired by creating a communication interface between the hearing impaired and ordinary people who cannot understand sign language. Gesture Guide aims to create this interface using a machine learning model which handles sign language interpretation using image classification. In addition to sign language interpretation, Gesture Guide also aims to produce a virtual assistant which uses hand gestures to obtain input from users. The projected workflow of the virtual assistant will consist of obtaining hand gestures as input, classifying the hand gesture and executing the unique function mapped to the gesture, helping the users at the end of the process. This way Gesture Guide will provide a natural way of interaction with the virtual assistant which could not have been possible with modern virtual assistants which rely on speech recognition.

1.2 Constraints

Gesture Guide provides many features that will improve both communication of hearing-impaired and provide a gesture-based interface using virtual assistants. Even though these features bring a new approach that will change how the hearing impaired will interact with virtual assistants, the specific target users of the Gesture Guide also require a detailed analysis of some constraints and considerations as listed below.

- **Communication**: Target users of the application requires this application to rely on optical communication rather than speech or audio-based communication.
- **Usage**: Hearing-impaired either lose their vocal capabilities or are never born with vocal abilities. Therefore, the virtual assistant should not be controllable with speech but should be controllable with hand gestures.
- **Notifications**: Application should use visual stimulants in place of auditory stimulants like alarms or beeps.

- **Security**: To follow data encryption laws, the application should hide personal history of users hidden. Taking target users into consideration makes security extra important for the Gesture Guide project.
- **Responsive Performance:** Since the aim is to make the communication of a disabled person as close as possible to the way an able-bodied person establishes communication, The application must provide as fast a response time as possible for user interactions to ensure a smooth and seamless experience, and it should maintain this response time throughout interaction cycles.
- **Maintenance:** Software should be open to taking actions such as adding new features and enhancing optimization when deemed necessary, and it should be designed with an iterative approach.
- **Intuitive User Interface:** The application's interface should be simple, user-friendly, and based on gesture responses to facilitate ease of use for people with disabilities.

1.3 Professional and Ethical Issues

Taking the target users of the application into account there should be numerous professional and ethical issues that require attention.

- **Accessibility**: The application aims to provide features that will specifically benefit hearing-impaired as an accessibility application. The application choses to target hearing-impaired rather than targeting the majority of people.
- **Privacy**: For an application that will only serve the hearing-impaired, it is essential that users' data should be stored hiddenly and should not be visible to other users. Personalized accounts are the solution that can be taken in order to enhance privacy and strengthen data security.
- **Data Security:** Users' data should be preserved in compliance with CCPA standards in order to regularize data collection practices and protect our consumers(users)[2].
- **Informed Consent:** It will be presented to the users with a text explaining how the data inputs received from the users within the application will be processed and for what kind of situations they are used. A confirmation will be obtained from the user stating that user has information about these transactions and that user consents to user's data going through these transactions.
- **Continuous Improvement and Feedback:** Users should be provided with a mechanism to provide feedback about their experiences on the application. The application should continue to be developed by trying to meet the user's needs and concerns.

- **Usability:** While using the application, users should not experience any problems in achieving the main purpose of the application. Therefore, a user-friendly user experience must be provided.

2. Requirements

Taking all the problems the Gesture Guide as an accessibility application aims to solve into account, we can further analyze requirements as functional and non-functional requirements.

Functional Requirements:

- **Sign Language Interpretation**: The Gesture Guide application should provide users with a sign language interpretation function. With this requirement the Gesture Guide aims to improve the communication of hearing-impaired with people who cannot use the sign language.
- **Hand Gesture based Virtual Assistant**: Gesture Guide application should offer users a virtual assistant interface that will obtain input from users as hand gestures. Each hand gesture should have a unique function which helps users with very basic tasks like opening YouTube. With this requirement Gesture Guide aims to adapt a more natural way for the target users to interact with the virtual assistant.
- **Personalized Accounts:** The application should provide users with an interface that will let them create personalized accounts, set preferences and view virtual assistant history.

Non-Functional Requirements:

- **Accuracy:** The Gesture Guide is a project that will depend heavily on machine learning models. Therefore, the models should be able to solve classification problems at a high accuracy. The models accuracy score will be parallel to how good the application work from the users' standpoint.
- **Performance:** The application should be able handle multiple users' requests and should be able to response to all users in the desired way.
- **Security:** The application should be able to handle authentication/authorization to identify users and keep their privacy. Security is also critical in order to be compliant with CCPA and data security laws.
- **Compatibility:** The Gesture Guide project should be available as a web site and a mobile application with slight differences between mobile application and web site. The primary

mobile device the Gesture Guide aims to be compatible is android devices. In future iterations, the application may also be migrated to a wider scale of mobile devices.

3. References

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2. Mattsson, U. (2020, May 13). Practical Data Security and privacy for GDPR and CCPA. ISACA. https://www.isaca.org/resources/isaca-journal/issues/2020/volume-3/practical-data-security-and-privacy-for-gdpr-and-ccpa
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