

# Voice Vision: Simplifying Communication for the Visually Impaired

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**Abstract:** *The visually impaired have always faced many challenges in their daily lives. One such challenge is communication. Smart phones have simplified communication over the years, however they still remain inaccessible to the visually impaired. Voice Vision is an android application which aims to make smart phones more accessible. Voice Vision provides an interface for easy mail management through voice control. Android Libraries and Automatic Speech Recognition algorithms based on Hidden Markov Models are utilized for fast and accurate voice recognition. Along with email functionalities other communication tools such as making phone calls and text messaging is possible via voice commands. Voice Vision consumes minimal resources enabling it to perform well on a wide range of android devices and provides a cost effective efficient tool for communication.*

**Keywords:** Visually Impaired, Smart phone, Gestures, Speech Recognition, Communication

## 1. Introduction

Smart phones have revolutionized the way people communicate, but development in smart phones in favor of visually impaired has not progressed much. The existing inbuilt accessibility features present in current smart phones are often not intuitive and present a steep learning curve for new users. Some of the existing solutions for this problem are Project Ray [1], GeorgiePhone [2], Android's talk back feature [3], iOS's voice over feature [4] among others. Project Ray was started with an initiative to assist the visually impaired community in using smart phones. Ray phone uses text to speech and touch as their primary mode of interaction. Many users of RAY found the application helpful but navigating across different features was a time consuming task. Georgie phone is an application which tries to make smart phones more user friendly to the visually impaired, however it requires separate add ons to perform various functions, hence is not a one app solution to the existing problem. Android's talk-back and iOS's voiceover features cannot act as an independent solution since they are devoid of a special user interface and performs the basic task of reading out the content that is tapped by the user on the screen. This lets the user know what he is tapping on, however it does not guide him in doing his intended task. Syamala Rao P et al [5] have proposed a system which attempts to address the issues pertaining to location, surrounding environment and emergency contacts. This paper has made extensive use of touch gestures to identify the user's request; While this approach fulfills some of the basic functionalities as mentioned above, it fails to provide facilities such as email management, web searches and other smart phone features. Rahul Anwani et al [6] have developed

an android application, VMAIL, which enables the visually impaired to send and receive E-Mails. It uses android's text to speech and voice recognizer and serves the purpose of sending and receiving E-Mails. In this paper we have proposed an approach which provides an efficient way for the visually impaired to use smart phones productively. Rest of the paper is organized as follows. Section II describes the proposed method. Section III discusses the implementation and finally section IV concludes this paper along with scope for the future enhancement.

## 2. Proposed Method

The proposed model utilizes touch gestures to determine the particular task requested by the user. The touch gestures are in accordance with the initial letter of the Braille word for that task chosen by the user. The model contains five basic modules for task accomplishment. The features proposed in the system for the smart phone are –

- Call Module
- Text Module
- Mail Module
- Location Determiner
- Basic Settings

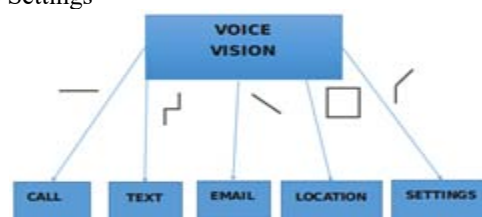


Figure 1: Touch Gesture Actions

Figure 1 illustrates the touch gestures used in the application and the corresponding actions.

### 2.1 Call Module

The proposed model which works basically on voice interaction and touch gestures requires the user to draw the letter C from the Braille alphabet which can then be followed by a name or a number. Figure 2 shows the actions needed to be performed in the call module. If the given input is a string, it will be matched with the name in the contact list of the user's phone and dials the number associated with that particular contact. If the input is a number, then, it makes a call to that particular number. On taking the voice input of the user, the talkback feature is activated which allows the user to confirm the call to a particular contact.

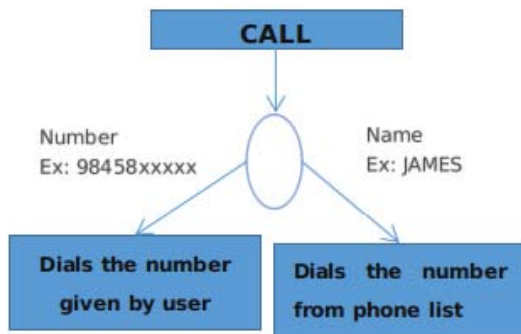


Figure 1: Call Module

### 2.2 Text Module

Text module provides two basic functionalities of sending and reading the text messages on phone. The send feature is in exact symmetry as the call module's working. Figure 3 illustrates the working of the Text module. After the gesture input for the text by the user, based on the requirement, the user says 'read' or 'send'. For 'read', the app fetches the list of unread SMS and numbers them and reads out the number and the corresponding sender of the SMS. The user can tap on the screen to pause the talk-back and tell a number to read that SMS content. For 'send', the user speaks out a name or a number followed by the SMS content which is then read back for confirmation and the message is sent.

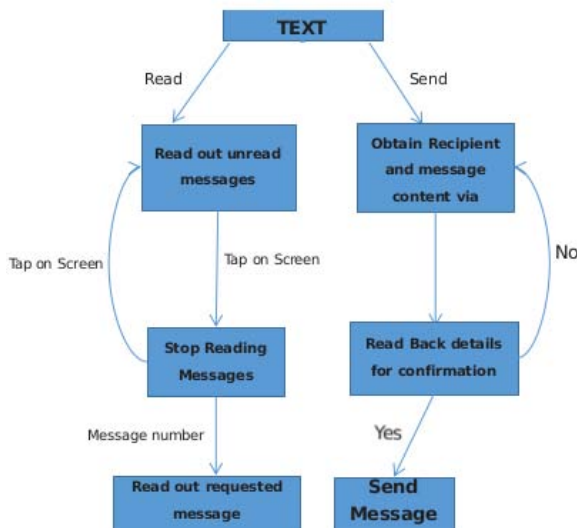


Figure 3: Text Module

### 2.3 Mail Module

The two commands 'read' and 'compose' can be given as voice input by the users for the respective functions. A simple tap on the screen pauses the reading of the unread mails in a sequential numbered order and a second tap resumes the same. The read command calls the function which lists out the number of unread mails and the sender's name in a sequential fashion. To fetch details about a particular mail, a single tap and voice input of the particular mail number should be followed by the user. Composing the mail requires the user to voice input the key word command which then directs him to voice input the required details such as, the sender's address, subject and the content which are all then verified by the user with the aid of the talk-back feature. The working of the Mail module is shown in Figure 4.

### 2.4 Location Determiner

In order to assist the visually impaired determine the current location during their travelling, this feature makes use of the global positioning system in order to inform the person about the same. To access this feature, one has to make use of the touch gesture input which is the letter G in the braille set of alphabets. The application turns on the GPS feature in the phone and then speaks the name and address of the particular location he is situated at.

### 2.5 Settings Module

The application includes some of the basic settings which can be controlled using voice input to either turn on or turn off the features and also to obtain information about a particular feature. It includes three information oriented features - Battery level, Date, Time and Notifications. The application obtains the information from the smart phone and lets the user know about the features mentioned above, through voice. Any incoming call, new text message and new mail would be notified to the user by voice. Modifiable features - Mobile Data, Wifi, Airplane mode and Sound profiles requires the user to change the status of the feature from on to off or vice versa through voice by giving commands like "data on" or "data off".

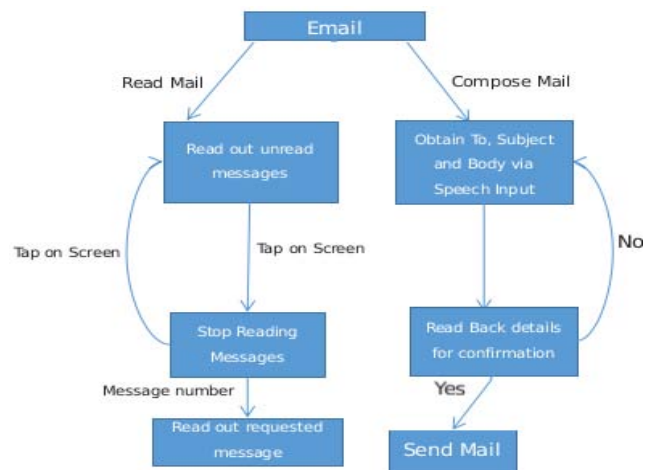


Figure 4: Mail Module

### 3. Implementation

This application was designed with the goal of increasing the smart phone accessibility to the visually impaired. Voice vision when reviewed at a braille training unit at Matruchaya was found to be user friendly and useful to the visually impaired people, since the application was voice interactive and simple. Additional features such as music playback and FM Radio were suggested to be included in the application. Figures 5-7 shows the screen shots for the sequence of actions in the Call module. Figure 8 describes the different touch gestures for Mail module, Settings, Text module and Location module respectively



Figure 5: Call Gesture

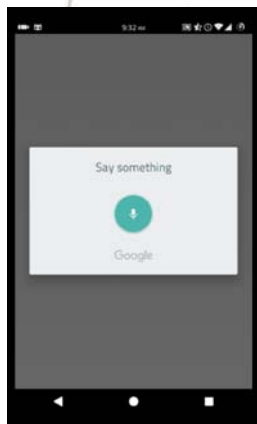


Figure 6: Recording number

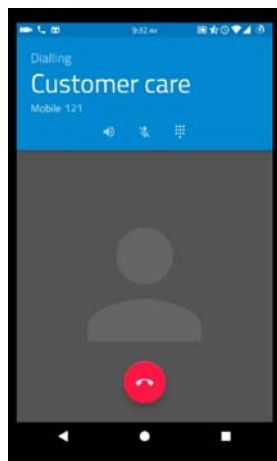


Figure 7: Calling the number recorded

### 4. Conclusion and Future Enhancement

This paper proposes an android application for easier and simple access of the smart phone designed for the visually impaired. The application enables the use of features such as making calls, sending and receiving text messages, determining current location and sending and receiving E-mails exclusively through voice and gesture input allowing efficient access to the visually impaired. The application also includes an easier way of accessing the basic settings of the phone like the Battery status, Mobile Data, Wifi, Date, Time and Sound profiles. For the ease of use, it also includes the voice notifications for any incoming call, new text message or an Email. The application can be further improved by the addition of features such as web searches and object identification. Considering the suggestions provided, the future works include the addition of a music player and FM Radio.

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