

# **SPEECH ASSISTANT**

*Mini project report submitted in partial fulfillment of the requirements for the award of  
the degree of*

## **Bachelor of Technology**

**in**

**Computer Science and Engineering**

**by**

**14027075: JISHNU JEEVAN**

**14027102: WRENI STANLEY**

**14027060: ANU JOSEPH**

**Under the guidance of**

**Ms. SINI JOY P J**



**Albertian Institute of Science and Technology (AISAT) - Technical  
Campus**

**Archbishop Angel Mary Nagar,  
Cochin University P. O., Kochi – 682022  
April 2017**



**Department of Computer Science and Engineering  
Albertian Institute of Science and Technology (AISAT) - Technical Campus  
Archbishop Angel Mary Nagar,  
Cochin University P. O., Kochi – 682022**

## ***CERTIFICATE***

***This is to certify that the project entitled***

***Speech Assistant***

***Submitted by***

**Jishnu Jeevan, Wreni Stanley, Anu Joseph**

***is a bonafide account of the work done by him/her under our supervision.***

**Project Guide**

Ms. Sini joy pj  
Assistant Professor,  
CSE, AISAT

**Project Coordinator**

Mr. Sebin Jose  
Assistant Professor,  
CSE, AISAT

**HOD- CSE**

Ms. Jessy George,  
Assistant Professor,  
CSE, AISAT

**Internal Examiner**

**External Examiner**

## **Acknowledgment**

We express our deep sense of gratitude and indebtedness to our institution Albertian Institute of Science and Technology, Kalamassery which provided us the opportunity to fulfill our goals. We extend our sincere thanks and regards to Prof. Dr. Philip Kurian, Principal, AISAT for giving us this opportunity to carry out this work in the college. We sincerely acknowledge the encouragement and support given to us by our guide Ms. Sini Joy P.J., Assistant professor, Dept. of CSE, AISAT and our project coordinator Mr. Sebin Jose, Assistant professor, Dept. of CSE, AISAT and Mr. Jeswin Roy D'couth, Assistant professor, Dept. of CSE, AISAT in completion of our project. We would thank the god almighty, our family members, friends and faculty's of the CSE department without whom this project would be impossible.

## **Abstract**

Speech assistant is software that can be used to help paralyzed people who cannot speak and write. People who are paralyzed will be having difficulty to write text using the keyboard as they will have difficulty going over to the entire keys in the keyboard. Our software can help them to type text to convey messages with the help of mouse. The mouse need not be dragged to the required key or to the required function like the speak operation. They can use the left and right mouse button to type the text. The right mouse button is used to scan through the list of keys and functions while the left mouse button is used to select the scanned key or function. An email facility is provided which will help the user to send email to a person that they rely on the most. A database is used to store a set of words that the user can choose from it. Here suggestions are provided for the most frequently used words, so that they don't have to write the entire word. They can just select the required word from the database. New words written by the user are added into the database. The user interface in a 4x8 matrix format which includes alphabets, white space, backspace, alert button, speak button, email button to send email and list button for suggestions.

# Table of Contents

<b>Sl. No.</b>	<b>Pg. No.</b>
List of Figures	iv
List of Tables	v
List of Abbreviations	vi
1. Introduction	1
2. System Study	2
3. Software Requirements Specification	3
4. Project Design	9
5. Detailed Design	12
6. Implementation Details	19
7. Conclusion	27
8. Future Scope	28
9. References	29

## **List of Figures**

<b>Figure No</b>	<b>Figure name</b>	<b>Page No</b>
3.1	How the user interface will look like	6
4.1	Class diagram	9
4.2	State diagram	10
6.1	User interface	19
6.2	Table Savedwords	20
6.3	Table Sender	21
6.4	Table Receiver	21
6.5	Email button pressed	22
6.6	Message that says email was successfully sent	22
6.7	Receiver gets the email	23
6.8	First row highlighted	23
6.9	Second row highlighted	24
6.10	Second row selected and first column highlighted	24
6.11	Second column highlighted	25
6.12	Second column selected	25

## **List of Tables**

<b>Table No</b>	<b>Table Name</b>	<b>Page No</b>
5.1	Savedwords	13
5.2	Sender	15
5.3	Receiver	16

## **List of Abbreviations**

DB – Database

TTS – Text to speech convertor

IDE – Integrated development environment

JDBC – Java database connectivity

API – Application programming interface



## **Chapter 1**

### **Introduction**

It is standalone software that can be made to run in any laptop. This software is to help paralyzed people to convey message to others. Our aim is to create an environment that supports people who are suffering from brain damage (like small stroke) which causes a life-altering effect on both the survivor and family members. All involved find themselves trying to come to terms with changes ranging from physical and sensory loss to loss of speech and language. So we are trying to help them to give a successful socialization. A Text to speech converter (TTS) is used, which is a technology that convert text to speech. Here the users can use the mouse to type text. Right mouse button is used to scan the alphabets and left mouse button is used to select the required letter. This is much less fatiguing than typing texts using the entire keyboard. Patients with movements in their fingers but not in their shoulders and wrist can also use this software to type texts. Email facility is provided so that the user can communicate with the person that they rely on the most. A DB is included to show suggestion of frequently used words, so that users don't have to write the entire words again and again. They can just select it from the DB which is much faster than typing the words again and again. If a new word is written by the user then it will be added to the DB. The predefined set of words is shown as a list based on the frequency of their occurrence. If a word has a large frequency of occurrence then it will show at the top of the list. The list shows words based on the decreasing order of frequency. EMAIL facility is also provided so that user can make use of it to send mails. The mail id of user and the receiver can be modified. The mail can be send to only one person at a time. The words written in text field for sending email are also added to the database.

## **Chapter 2**

### **System Study**

#### **2.1 Existing Systems**

There are text to speech converters available in our computer and there are on screen keyboards available also.

##### **Disadvantages:**

But in those systems we need to make use of whole keyboard for typing text. Text will remain there even after speak operation is performed. Database is not used to store words in the TTS convertor. Our computers have on screen keyboards but it also contains unnecessary keys like ctrl, shift etc. These keys are not required when talking to a person. Two application, the on screen keyboard and the text to speech convertor, needs to opened at the same time to convert text to speech.

#### **2.2 Proposed System**

This software uses the mouse for typing. So that it can be used by paralyzed people who are not able to move their whole hands for typing but has some minute muscular movement.

##### **Advantages:**

Letters can be typed with the help of a mouse. Step scanning is used. An alert button is provided which can be used in emergency situations. Email facility is provides so the user can send an email to a person. Database is included to save new words and for suggestions of frequently used words. New words will be added into database from text field. If words already exist in DB then its frequency of occurrence is incremented. The suggestion list is displayed initially by following descending order of count of each word.

## **Chapter 3**

# **Software Requirements Specification**

## **3.1 Introduction**

### **3.1.1 Purpose**

The purpose of this document is to provide the software requirement specification report for the speech assistant. Speech assistant can be used to produce artificial human speech. This software can be used for augmentative and alternative communication. This is a single system. By using this software user can communicate freely with anyone.

### **3.1.2 Document Conventions**

DB – Database

TTS - Text to speech

API – Application programming interface

IDE – Integrated development environment

JDBC – Java database connectivity

### **3.1.3 Intended Audience and Reading Suggestions**

This project is a college level project and is implementing under the guidance of college professors.

This project is useful to those people who are paralyzed and cannot speak but have some minute muscular movement.

### **3.1.4 Product Scope**

The purpose of speech assistant is to help paralyzed people, who cannot speak and write. By using this software they can convey messages to others without any translators. But they should be able to do some muscular contractions strong enough to use a mouse. Even if they are only able to move one of their fingers, they can use step scanning to type and send text messages. So we hope to provide a comfortable way of communication for them.

### **3.1.5 References**

1. Switch access scanning : [en.wikipedia.org/wiki/Switch\\_access\\_scanning](http://en.wikipedia.org/wiki/Switch_access_scanning)
2. Text-to-speech (TTS) Overview: [www.voicerss.org/tts/](http://www.voicerss.org/tts/)
3. Text-to-speech technology: [www.linguatec.net/products/tts/information/technology](http://www.linguatec.net/products/tts/information/technology)
4. Step Scanning: [www.lindaburkhart.com/handouts/stepping\\_stones\\_chart\\_10\\_12.pdf](http://www.lindaburkhart.com/handouts/stepping_stones_chart_10_12.pdf)
5. SQLite database: [www.tutorialspoint.com/sqlite/](http://www.tutorialspoint.com/sqlite/)

## **3.2 Overall Description**

### **3.2.1 Product Perspective**

Few paralyzed people communicate through various methods like letters on a spelling card, but in those methods user requires more help from a nurse or a caretaker. In our project we implement speech assistant software same as letters on a spelling card along with some additional features. This is actually a modification of TTS converter.

### **3.2.2 Product Functions**

This software works by using the mouse to type text onto the screen. The right mouse button is used to scan each button and the left mouse button is used to select the corresponding button. It also has additional features like emergency alert button, email facility and database for storing and suggestion of words.

### **3.2.3 User Classes and Characteristics**

This software can be used by people who are having paralysis and cannot type text using keyboard. This software cannot be used by people who have locked in syndrome (complete paralysis of their body even though they have intact minds), and also cannot be used by people whose language processing area of the brain is affected. This method can be quite useful, as the equipment are readily available whereas the training needed for them are easy. This method becomes a last resort for many patients.

### **3.2.4 Operating Environment**

This software can be implemented on a laptop that supports java. This software uses a free TTS.jar API that converts text to speech. It SQLite 3 as a database to store predefined words. It uses mail.jar API to send mail from the users account. The software is developed in java using eclipse IDE. To connect the database to the software we need a SQLite JDBC driver.

### **3.2.5 Design and Implementation Constraints**

A few constraints/limitations about our project is that,

Our project cannot be used by people with locked in syndrome.

Cannot be used by people whose linguistic area of the brain is affected.

Their nurse/caretaker has to open the software for them.

They should have enough movements in their finger so that they can at least press the two mouse buttons.

### **3.2.6 User Documentation**

A few things that the user needs to know about our software is that the mouse is used to write text onto the screen. Right mouse button is used for scanning and the left mouse button is used for selecting the required key. This way a whole sentence can be written and spoken out by the software. For sending mail the senders mail ID, password and the receivers mail ID and password must be set by the patient's caretaker or nurse. Once the ID is set the user can send mail to the specified person (if required the mail ID can be changed).

## 3.3 External Interface Requirements

### 3.3.1 User Interfaces

The user interface mockup consists of several components:

- A list of words: WATER, FOOD, TELEVISION, HUNGRY, BATHROOM, HELLO, HOW, ARE, YOU.
- A keyboard grid with letters A through Z arranged in four rows.
- Form fields for "FROM", "PASSWORD", "TO", "SENDER'S MAIL ID", and "RECEIVER'S MAIL ID".
- Buttons labeled "DONE" and "OK".
- A large empty rectangular area at the bottom.

Fig 3.1: How the user interface will look like.

Here when the software is opened the spell card is displayed. When the user presses the right mouse button the first row will get highlighted. The right mouse button is used for highlighting of the row and column. If the user wants to select a highlighted letter they will have to press the left mouse button. The left mouse button is used for selection of row or column.

### 3.3.2 Hardware Interfaces

The only hardware that is being used in this software is a laptop and the mouse. No other external hardware devices have to be used. .

### 3.3.3 Software Interfaces

The software's that will be used along with our project are:

A TTS convertor that will take the text written by the patient in our software and pass it as input to the TTS convertor and the TTS convertor will speak out the written text. The TTS convertor used here is the java free TTS.jar

Also we use a DB to store predefined words and frequently used words. The DB used here is SQLite3.

### **3.4 Communication features**

Our software can be used to send EMAIL by the user. The user can send email to someone they depend on the most. Our software uses a mail.jar API to send email from the users Gmail account.

### **3.5 System features**

#### **3.5.2 Description and Priority**

3.5.2.1 Software will be able to take text from paralyzed patients.

3.5.2.2 TTS will take the text written by the patient and convert it to speech.

3.5.2.3 A DB is used to store predefined words.

3.5.2.4 Email can be sent by the patients.

#### **3.5.3 Stimulus/Response Sequences**

3.5.3.1 The patient can start the software to using the right mouse button.

3.5.3.2 The right mouse button is used for highlighting each row or column of the spell card.

3.5.3.3 The left mouse button is used for selection of the highlighted row or column.

#### **3.5.4 Functional Requirements**

3.5.4.1 The TTS won't accept any symbols or special characters.

## **3.6 Other Nonfunctional Requirements**

### **3.6.2 Performance Requirements**

Here the rate at which the patient can write the text onto the screen depends on how strong the patient's fingers are to click the mouse button and how agile their finger is.

### **3.6.3 Software Quality Attributes**

This software can be opened by double clicking on the icon. The user can send mail to a person. Database is used to add words into it for suggestion.



## Chapter 4

# Project Design

### 4.1 Class Diagram

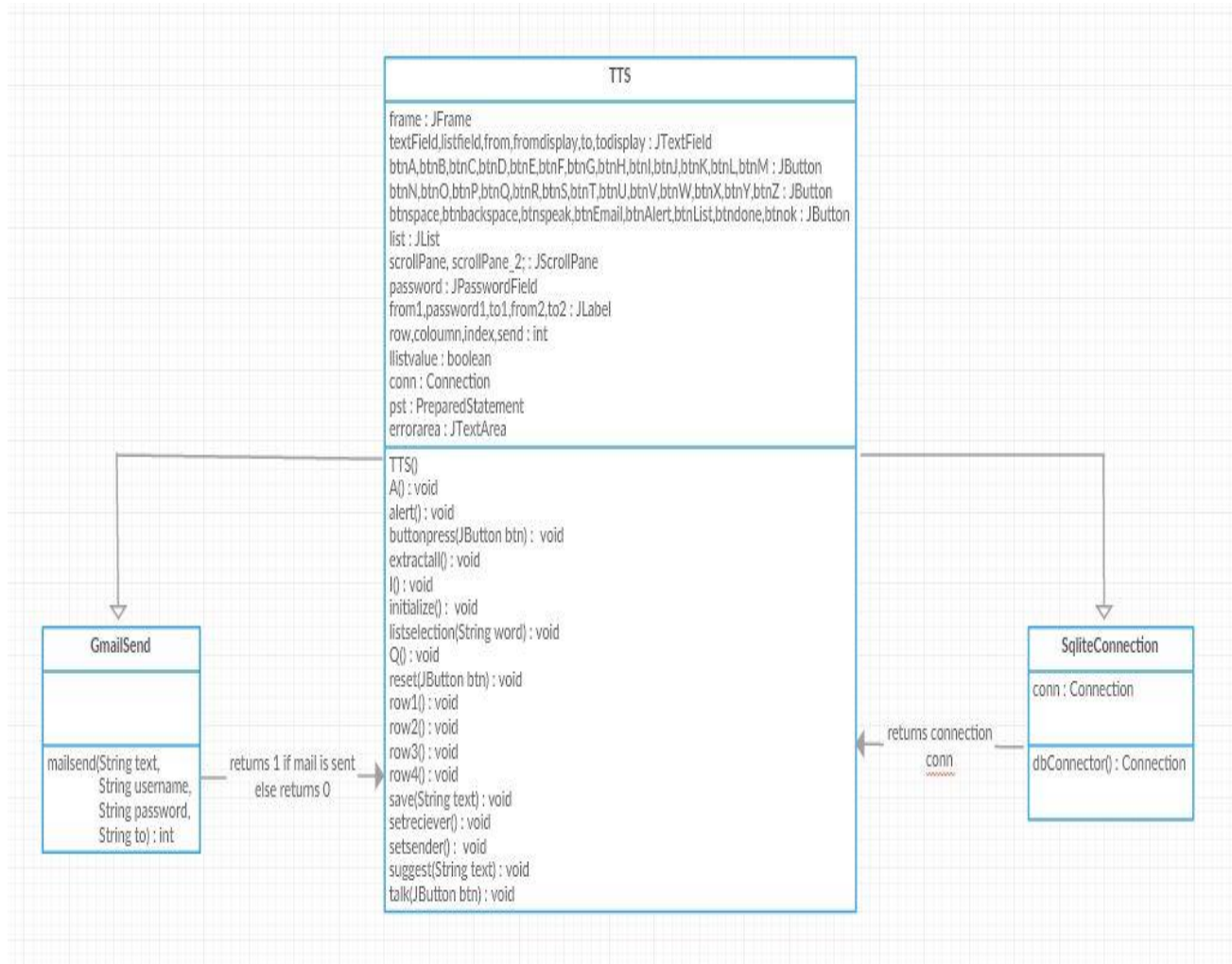


Fig 4.1: Class diagram

Here we have three classes.

The TTS class that consists of the layout and the major function like highlighting, suggestion, speaking alert etc. The second class is the Sqliteconnection class with the method `dbconnect()`. When the program runs and before the execution of the main program this class will be called by the constructor of the TTS class. The Sqliteconnection class will return an object `conn` that is used as a connection to the database. The third class is the GmailSend class. This class is used to send email from the users Gmail account. When the user wants to send mail the TTS

class will call the class GmailSend and invoke the method in it int mailsend(String text, String username, String password, String to). The parameter String text is the text written in the text field. The other parameters String username, String password, String to is taken from the database that is used to save the senders and receivers id. If the mail is successfully send 1 is returned back to the TTS class and a message is displayed saying “EMAIL SUCESSFULLY SEND.” Otherwise if the mail sending was a failure then 0 will be returned back to the TTS class and an error messaged will be printed.

## 4.2 State diagram

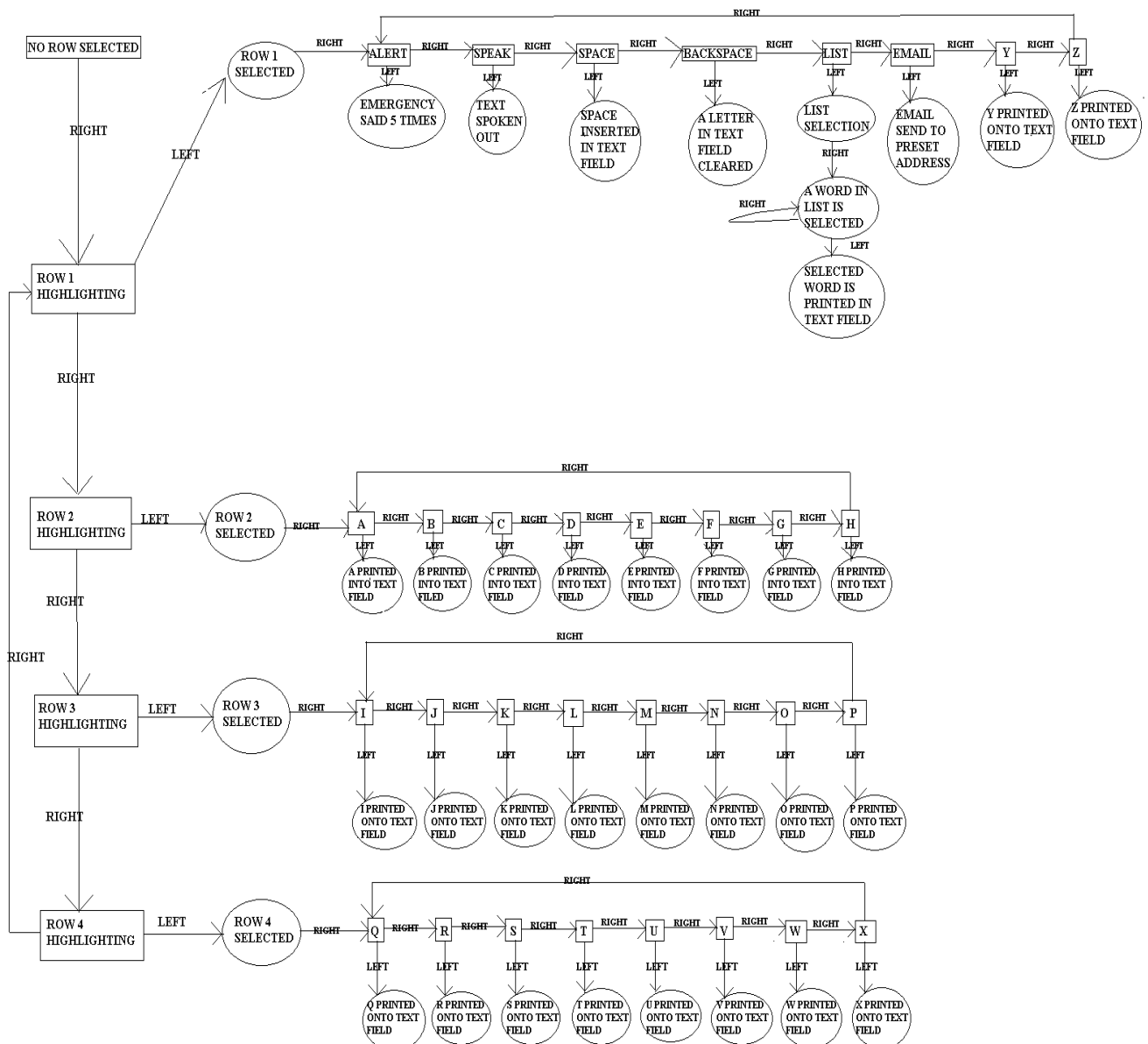


Fig 4.2: State diagram

Here initially no rows or columns will be highlighted. When the user presses the right mouse button the first row will be highlighted. If they press it again then the second row will be highlighted, again then the third row will be highlighted. Press it again and it will highlight the fourth row. If they press it again then the first row will be highlighted.

If the user wants to print A in the text field, which is on row two and column 1, the user will have to press the right mouse button two times so that the second row will be highlighted. Now the user must select this row when it is highlighted using the left mouse button. When the right mouse button is pressed the columns of the second row will be highlighted.

Now when the letter A is highlighted the user will have to press the left mouse button to select it. When it is selected it will perform its required action i.e. print A onto the text field. After the action of the button is performed then the system will go back to its initial state i.e. now row or column will be highlighted.

## Chapter 5

### Detailed Design

Our project is divided into three modules which in turn are divided into three sub modules each.

#### Module 1

##### Creation of spell card.

Here spell card is created. The spell card is a 4X8 matrix that consists of 26 letters in the alphabet, alert button, speak button, backspace, space, and list which is a button that is used to select word from the list of saved words.

##### Alert button

When the user presses the alert button “EMERGENCY” will be spoken out by the software five times. This button is provided in case the patient needs some assistance.

##### Speak operation

This button is provided to speak out the text written in the text field. For the speak operation we use a free tts.jar which has a set of library that will convert text to speech. The following code is executed when the speak button is pressed. After the code is executed the text in the text field will be spoken out.

```
public void talk(JButton btn)
{
    String VOICENAME="kevin16";

    Voice voice;

    VoiceManager vm=VoiceManager.getInstance();

    voice=vm.getVoice(VOICENAME);

    voice.allocate();

    if(btn==btnspeak)
    {
```

```

try
{
    String text=textField.getText();

    voice.speak(text);           // Speak operation performed

    save(text);//New words sent to database

    textField.setText(null);

}
catch(Exception e){}
}
}

```

## Module 2

### Creation of database

A database is created using SQLite 3 which consist of a set of predefined words and a count for each word. The count is used to indicate the number of times the word was spoken out by the user. This count variable is used for suggestion. The suggestion of words is shown based on the word having the largest value for count.

#### 1. Savedwords

FIELD	TYPE	CONSTRAINT	DESCRIPTION
Words	Varchar		Words used by user
count	integer		Number of occurrence of the word

Tab5.1: Table Savedwords

### Database connectivity

A standard code is used to connect the database to our software. In order to connect the database to the software we need SQLite JDBC driver. This driver (sqlite jdbc.jar) will establish a connection from the database to the software. When the program starts, this code

will get executed before the execution of the main program. It is done by calling this class and the method dbConnector() inside the constructor of the main class (TTS). This class will return an object, conn, to the main class which is connection to the database.

```
public class SqliteConnection {  
  
    Connection conn=null;  
  
    public static Connection dbConnector() {  
  
        try {  
  
            Class.forName("org.sqlite.JDBC");  
  
            Connection conn=DriverManager.getConnection("jdbc:sqlite:D:\\JAW.sqlite");  
  
            System.out.println("Connection sucessful");  
  
            return conn;  
  
        }  
        catch(Exception e) {    JOptionPane.showMessageDialog(null, e);  
            return null;  
  
        }  
  
    }  
  
}
```

## **Adding new words into the database**

Adding new words into the database or counting the number of times a word has occurred is done as follows.

Step 1: START

Step 2: When speak button or email button is pressed take the words in the text in the text field and store it in a string variable.

Step 3: Continue till the end of the string is reached.

3.1 Take a word in the string.

3.2 Search the database to see if the word is entered in it.

3.3 If the word is entered in the database increment its count by 1

3.4 Else add the word into the database

Step 4: END

## Module 3

### Email facility

Setting the sender's username and password: In order for the user to send email their username and password must be set in the column provided. When the username and password is written in the field provided the done button is to be pressed. When the done button is pressed the sender's username and password will be saved into the table sender. This is done so that the sender's username and password need not be written every time when the software is opened. The sender's username and password need cannot be set by the user. It needs to be set by their nurse or caretaker. There is a prerequisite for sending email i.e. the sender must enable access to less secure apps in their Gmail account. The only the software will be able to open the account to send mail

#### 2. Sender

FIELD	TYPE	CONSTRAINT	DESCRIPTION
sendername	varchar		Senders mail id
senderpsw	varchar		Senders password

Tab 5.2 Table Sender

Setting the receiver's email id: The receivers mail id must be written in the field provide. When it is written OK button is to be pressed. When it is pressed the receiver's mail id will be saved into the database. Only one receiver id can be saved into the database i.e. the patient can only send email to one person at a time. The receiver id can be changed according to the patients wish. The receiver id is also set be the patients caretaker or nurse. If the patient wants to send email to another person then the mail id needs to be changed by their nurse.

### 3. Reciever

FIELD	TYPE	CONSTRAINT	DESCRIPTION
name	Varchar		Receivers mail id

Tab 5.3 Table Receiver

Sending the mail: When the email button is pressed the following code will be executed.

When it is executed the mail will be sent from the defined sender id to the defined receiver id.

The sender id and receiver id is taken from the database. The text is taken from the text field.

```
public class Gmailsend
{
    public static int mailsend(String text,String username,String password,String to)
    {
        Properties props = new Properties();//Get the session object
        props.put("mail.smtp.auth", "true");
        props.put("mail.smtp.starttls.enable","true");
        props.put("mail.smtp.host", "smtp.gmail.com");
        props.put("mail.smtp.port", "587");
        Session session = Session.getDefaultInstance(props,
        new javax.mail.Authenticator() {
            protected PasswordAuthentication getPasswordAuthentication() {
                return new PasswordAuthentication(username, password);
            }
        });
        try {
            Message message = new MimeMessage(session);
```



```

message.setFrom(new InternetAddress(username));

message.addRecipient(Message.RecipientType.TO, new InternetAddress(to));

message.setSubject("");

message.setText(text);

Transport.send(message);

System.out.println("Message sent");

return 1;

}

catch (MessagingException e) {

    //JOptionPane.showMessageDialog(null,e);

    return 0;

}

}

}

```

## **Suggestion of frequently used words**

Suggestion of words works as follows. The steps shown below are executed every time a letter is entered into the text field.

Step 1: START

Step 2: Take the last word in the text field.

Step 3: Search the database for the words similar to the last word entered.

Step 4: If words like that exist then show the set of words.

## **Step scanning**

In step scanning the right mouse button is used for the highlighting of each row and column and the left mouse button is used for selection of the highlighted row or column. An integer variable row is used to denote which row is currently being highlighted and another integer variable column is used to indicate which column is being highlighted. When both row and column have non zero values and when the left mouse button is pressed the corresponding button in the  $i$ th row and  $j$ th column will be selected and its function is preformed.

## Chapter 6

### Implementation Details

#### User interface

User interfaces with spell card, alert button, speak button and list showing most frequently used words.

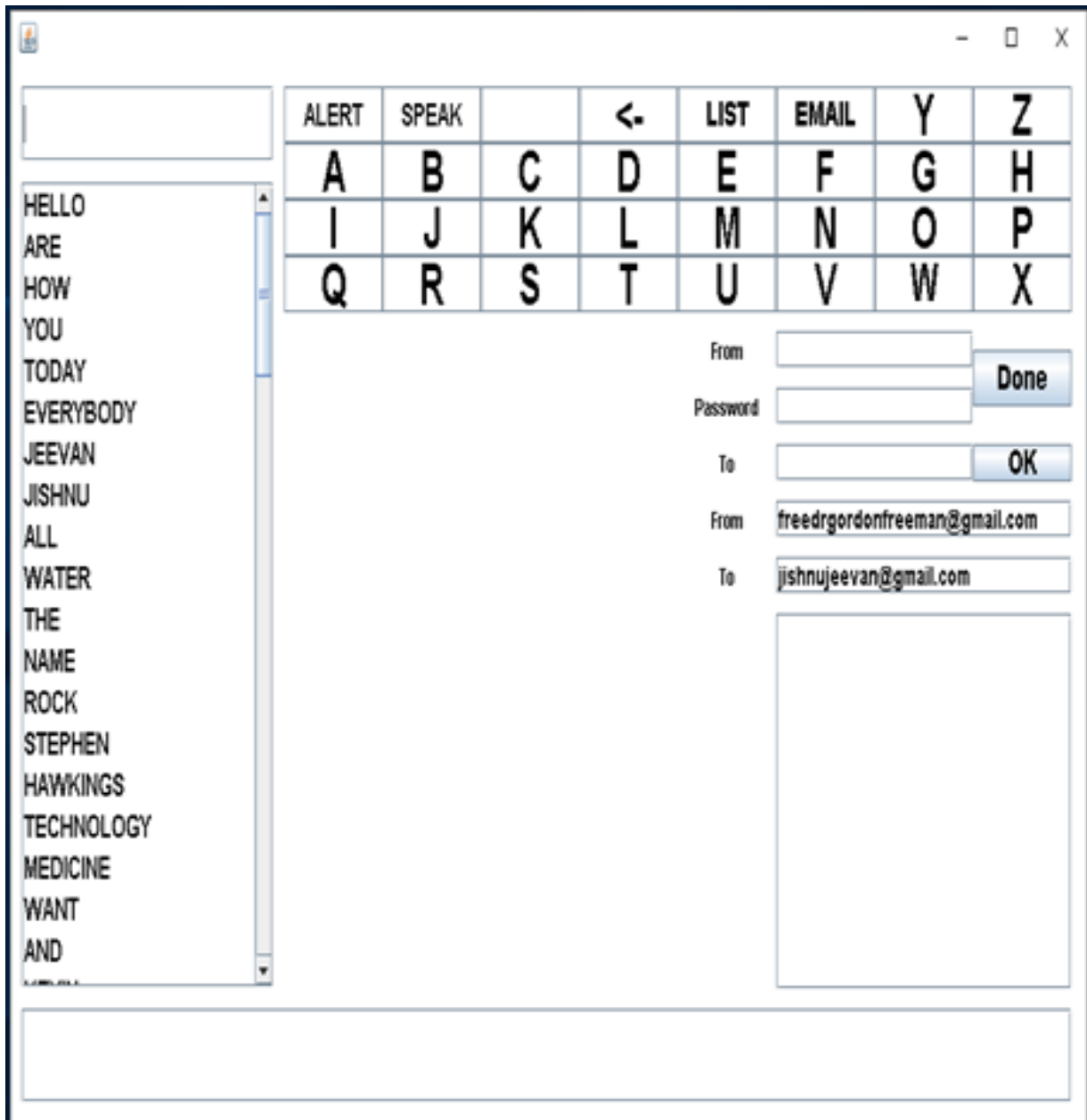
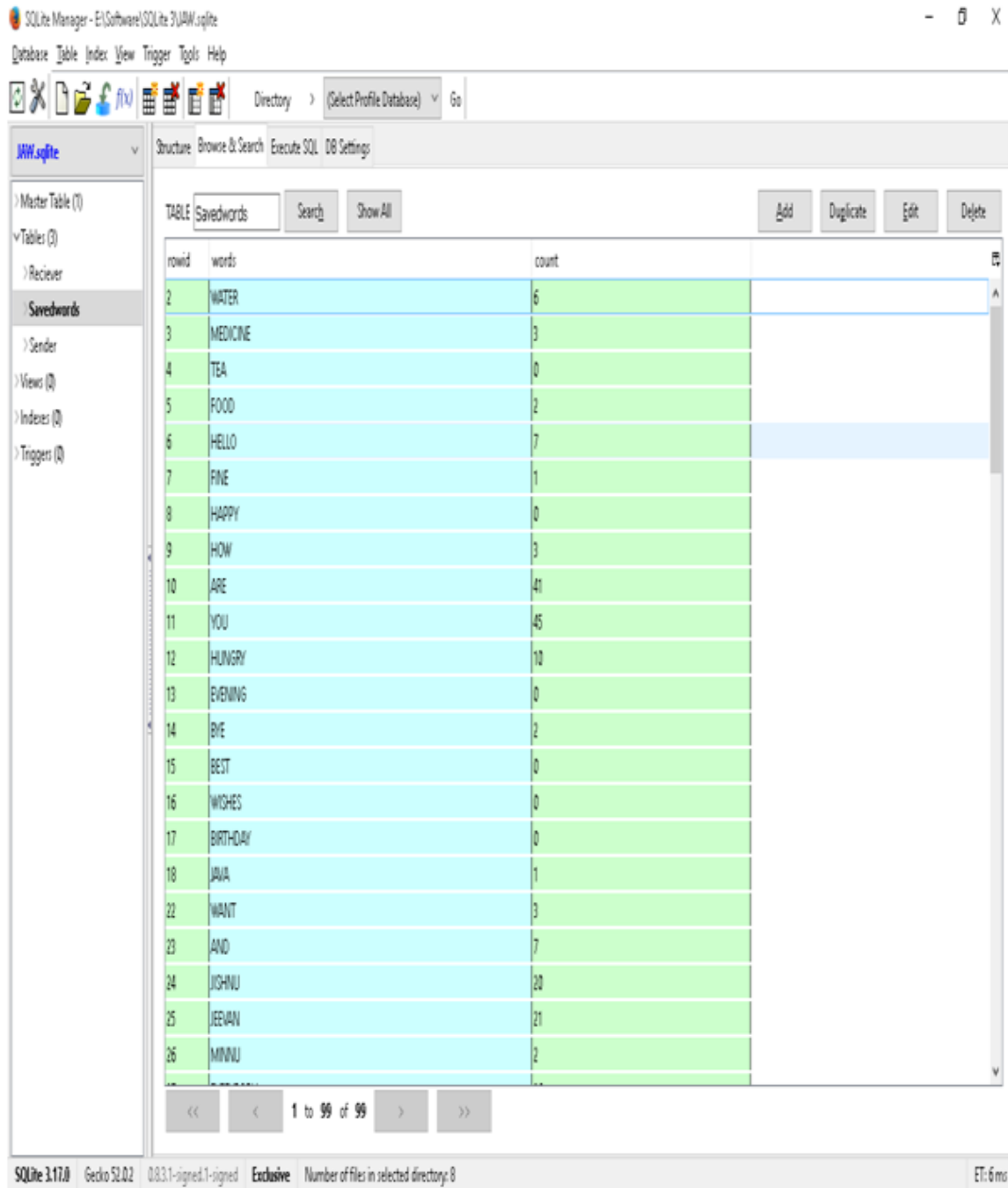


Fig 6.1: User interface

## Database that contains the three tables

Table Savedwords which contains the set of words and its number of occurrence



SQLite Manager - E:\Software\SQLite 3\JAW.sqlite

Database Table Index View Trigger Tools Help

Directory > (Select Profile Database) Go

Structure Browse & Search Execute SQL DB Settings

TABLE Savedwords Search Show All Add Duplicate Edit Delete

rowid	words	count
2	WATER	6
3	MEDICINE	3
4	TEA	0
5	FOOD	2
6	HELLO	7
7	FINE	1
8	HAPPY	0
9	HOW	3
10	ARE	41
11	YOU	45
12	HUNGRY	10
13	EVENING	0
14	BYE	2
15	BEST	0
16	WISHES	0
17	BIRTHDAY	0
18	JAVA	1
22	WANT	3
23	AND	7
24	JISHNU	20
25	JEEVAN	21
26	MINNU	2

<< < 1 to 99 of 99 > >>

SQLite 3.17.0 Gecko 52.0.2 0.8.3.1-signed.1-signed Exclusive Number of files in selected directory: 8 ET: 6 ms

Fig 6.2 Table saved words

Table Sender which contains the sender email id and password

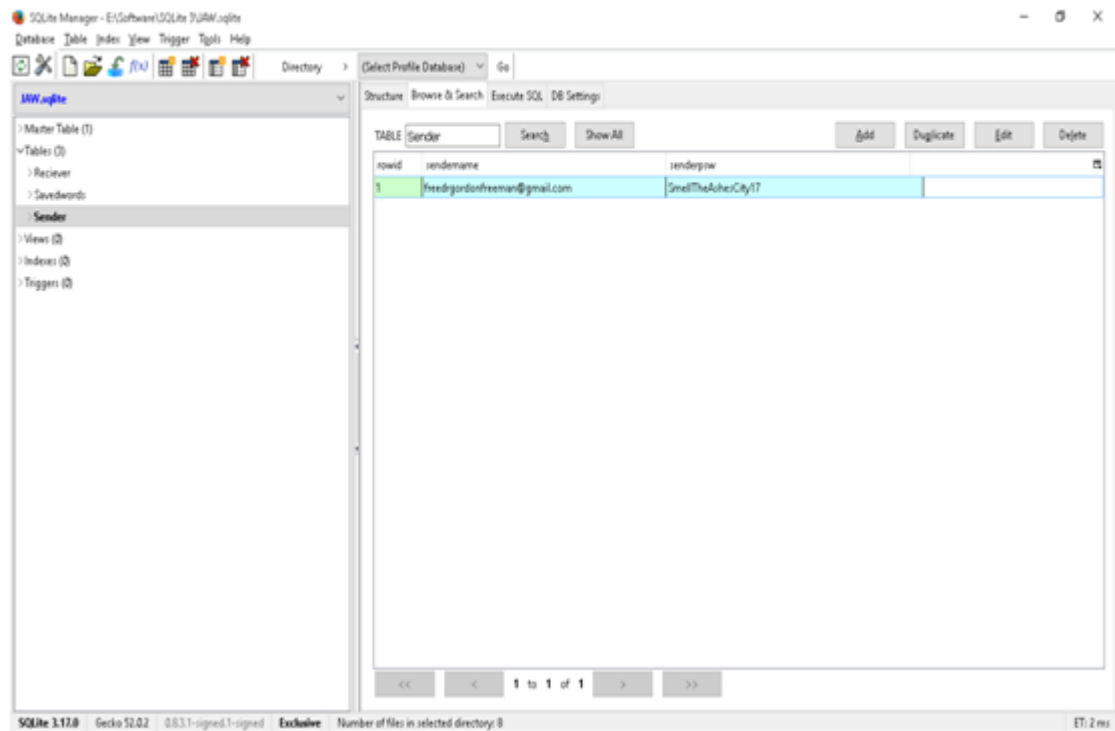


Fig 6.3: Table Sender

Table Receiver which contains receivers email id

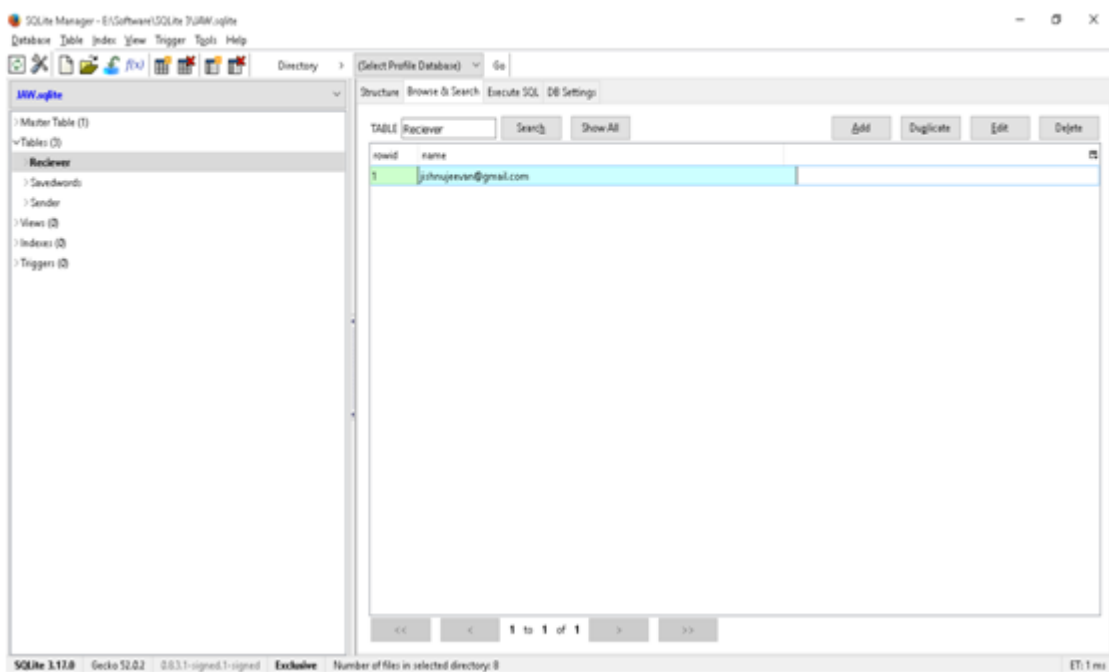


Fig 6.4: Table Receiver

## Sending email

1. Email button is pressed with text written in text field.



Fig 6.5: Email button pressed

2. Message saying email was successfully sent.



Fig 6.6: Message that says email was successfully sent

3. Receiver gets the mail.

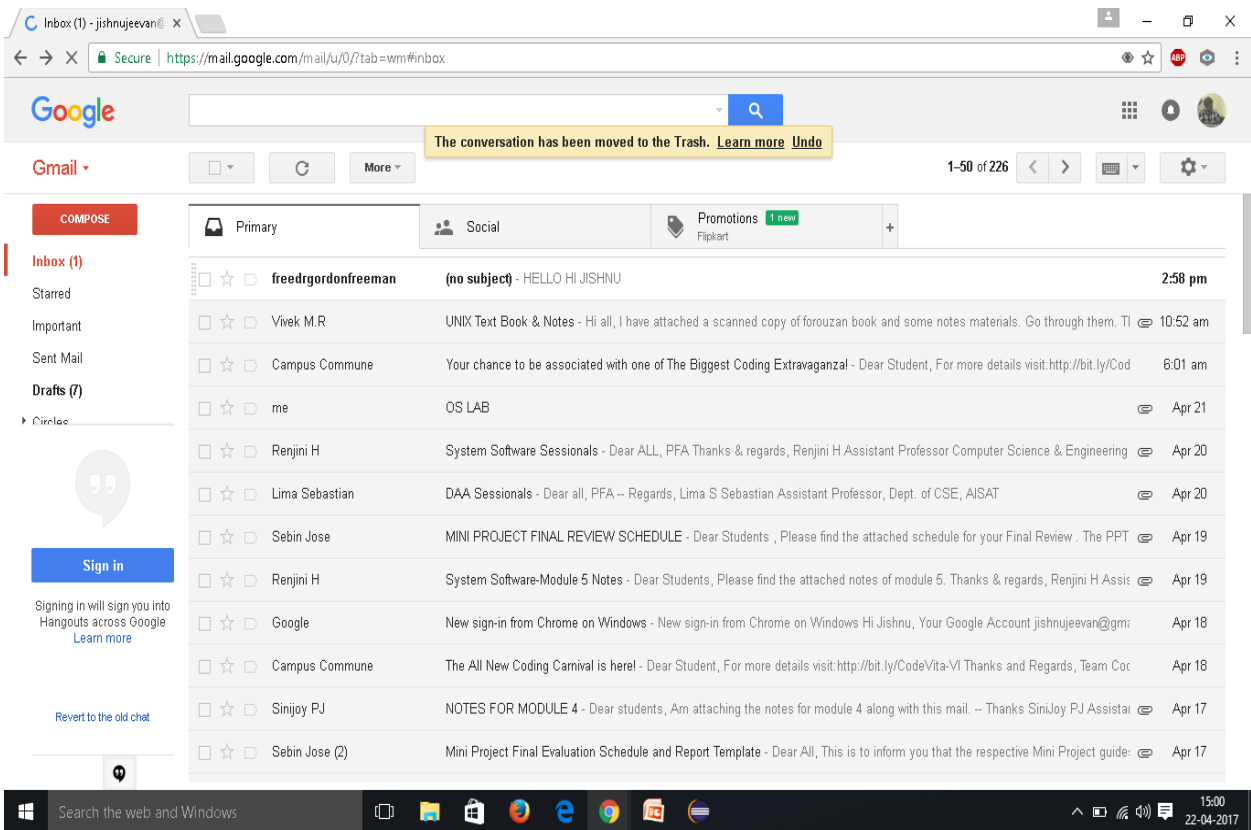


Fig 6.7: Receiver gets the email

Step scanning

1. Right mouse button to highlight a row

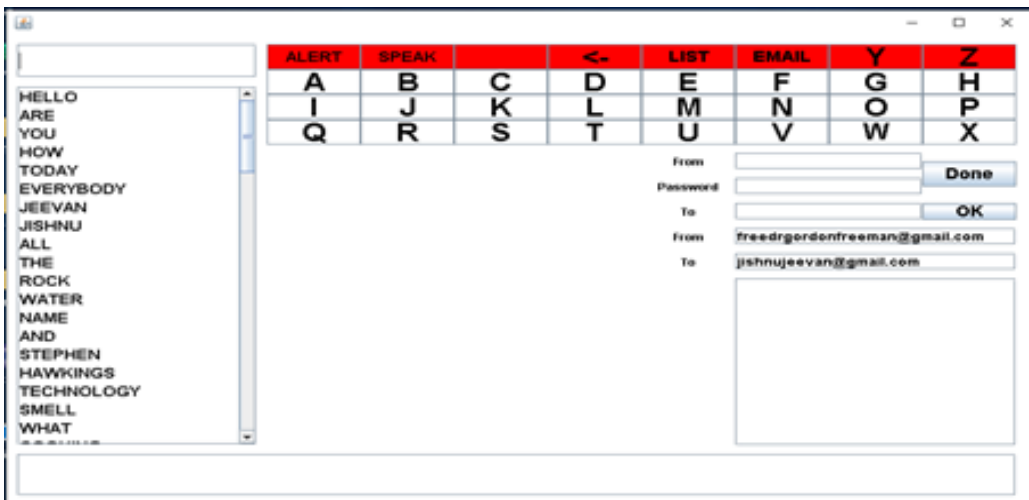


Fig 6.8: First row highlighted

2. Right mouse button to highlight another row



Fig 6.9: Second row highlighted

3. Left mouse button to select the row which is highlighted

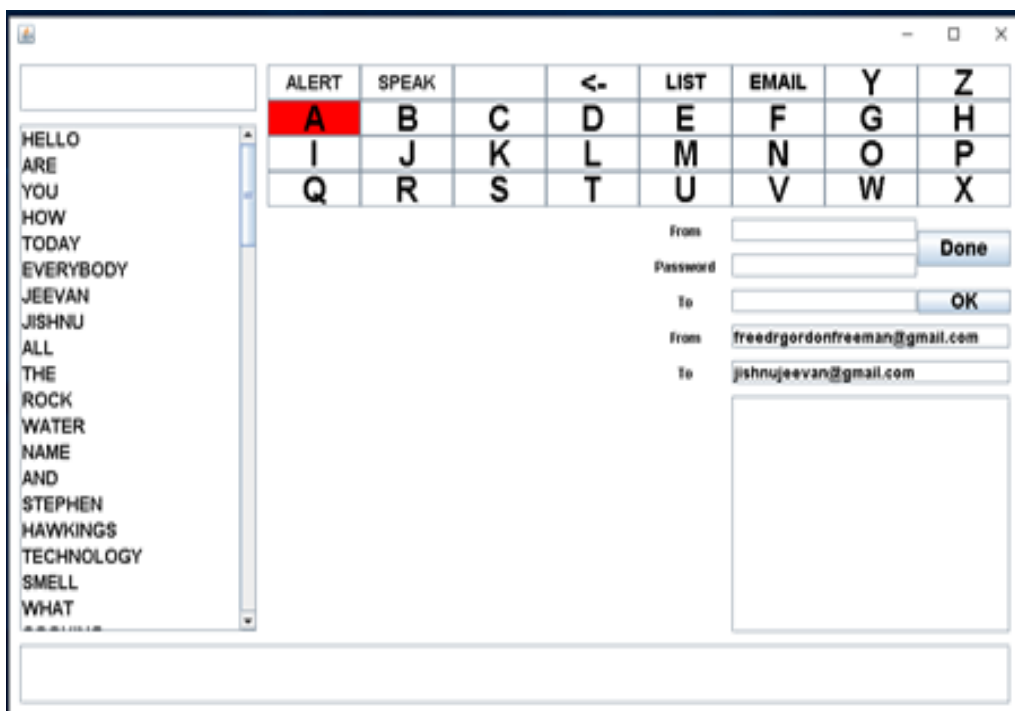


Fig 6.10: Second row selected and first column highlighted



4. Right mouse button to highlight columns of selected row

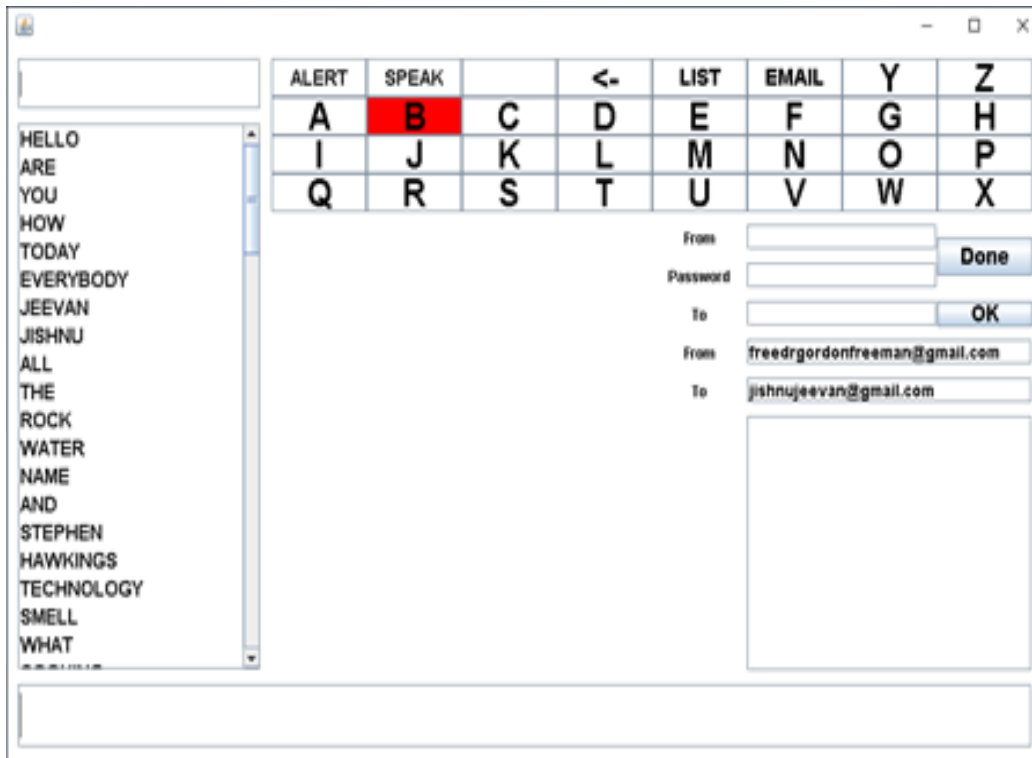


Fig 6.11: Second column highlighted

5. Left mouse button to select the highlighted key



Fig 6.12: Second column selected

**Testing:** Test case name: **Pressing the EMAIL button**

Precondition: Sender must enable “access to less secure apps” in their Gmail account

Test case number	Test case scenario	Input parameter	Expected output	Actual output	Comments
1	Senders user name, password and receivers username is valid	<u>freedrgordonfreeman@gmail.com</u> SmellTheAshesCity17 jishnujeevan@gmail.com	Email successfully send	Email Successfully send	Pass
2	Senders username invalid, password valid and receivers username valid	<u>raj@gmail.com</u> SmellTheAshesCity17	Email not successfully send.	Email not successfully send.	Pass
3	Senders username is valid, password is invalid and receivers username valid	<u>freedrgordonfreeman@gmail.com</u> hello jishnujeevan@gmail.com	Email not successfully send.	Email not successfully send.	Pass
4	Senders username, password is valid, receivers username is invalid	<u>freedrgordonfreeman@gmail.com</u> SmellTheAshesCity17 raj@gmail.com	Email not successfully send.	Email not successfully send.	Pass

## **Chapter7**

### **Conclusion**

Speech Assistant is software that can be used by paralyzed people to type text and speak out the typed text. With the help of the mouse users can type the text. Step scanning is used. Right mouse button is used for scanning the buttons and the left mouse button is used for the selection of the scanned button.

Text to speech converter (TTS) is used .The Voice is the central processing point for FreeTTS. The Voice takes as input a FreeTTSSpeakable, translates the text associated with the FreeTTSSpeakable into speech and generates audio output corresponding to that speech.

Database is used to show suggestion of frequently used words. And also used for saving new words. Email facility is provided so the user can send mail to a person that they rely on the most.

Other existing systems like the on screen keyboard have many unwanted keys that are not needed when writing text that in turn needs to be converted into speech.

We hope that our system will be helpful to some users for their communication purpose.

## **Chapter 8**

### **Future Scope**

- SMS facility can be implemented in this system.
- Regular or interrupted scanning (scanning each row after a regular interval of time). Here only a single button needs be used.
- Making use other input mechanism other than the mouse, like selection using eyes or cheek muscles or finger tips. So that patients with serious case of paralysis
- This software can be modified to give them full control of the computer system with just minute muscular movement. This will help the paralyzed person to use the computer just like any other normal person.
- With improvements like these the patient can use the computer to edit text, type documents, surf the web etc.
- Other hardware can be implemented along with this system like sensors to monitor the heart rate and breathing. If any fluctuations happen in their heart rate then a notification or a help message can be sent.

## Chapter 9

### References

- Text-to-speech (TTS) Overview: [www.voicerss.org/tts/](http://www.voicerss.org/tts/)
- Text-to-speech technology: [www.linguatec.net/products/tts/information/technology](http://www.linguatec.net/products/tts/information/technology)
- Switch access Scanning: [en.wikipedia.org/wiki/Switch\\_access\\_scanning](http://en.wikipedia.org/wiki/Switch_access_scanning)
- Step Scanning: [www.lindaburkhart.com/handouts/stepping\\_stones\\_chart\\_10\\_12.pdf](http://www.lindaburkhart.com/handouts/stepping_stones_chart_10_12.pdf)
- SQLite database: [www.tutorialspoint.com/sqlite/](http://www.tutorialspoint.com/sqlite/)