



THE LNMIIT

MINI PROJECT

**APPLICATIONS FOR
VIRTUALLY IMPAIRED
PEOPLE**

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Contents

1	ACKNOWLEDGEMENT	3
2	ABSTRACT	4
3	TECHNOLOGIES USED	5
3.1	Client Side	5
3.2	Server Side	5
3.3	Database	5
3.4	APIs	5
3.5	Algorithms	5
4	Description of Technologies Used	6
4.1	HTML, CSS, JavaScript, jQuery	6
4.2	JAVA	6
4.3	MySQL	6
4.4	JSWebkit API	6
4.5	JavaMail API	7
4.6	JSOUP API	7
4.7	Backtracking Algorithm	7
5	MODULES CREATED:	8
5.1	Log In	8

5.2	Virtual Assistant	8
5.3	EMAIL	9
5.4	MEMO	10
5.5	CONTACTS	11
5.6	ENTERTAINMENT(Sudoku)	12
5.7	TIMER	13
6	Research Conducted on partially blind people	15
7	INHERITENCE LAYOUT	17
8	ACTIVITY DIAGRAM	18
9	CONCLUSION	19
10	FUTURE SCOPE	20

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2 ABSTRACT

Technological advancements have led to platforms that are essential for the visually impaired people, so that they can keep in sync with the world. All the platforms including websites and android/iOS applications are not at all user friendly for people with low vision. Most of the existing websites and applications have a great User Interface but for those with a low vision these products are useless unless they can access them using voice commands. This project aims at building a platform for the visually impaired people which has all essential features and they are easily accessible with help of a virtual assistant. The Virtual Assistant basically converts Speech-to-Text and thus makes the web-app more accessible for people with low vision. According to a research, contrasting color combinations have a greater visibility for the visually impaired people and hence the User Interface is designed using contrasting color combinations.

We built a web-app which has various features for the Visually Impaired. The web-app has all essential features such as:

1. Virtual Assistant
2. Email
3. Memo
4. Contacts
5. Entertainment (Sudoku)
6. Timer

3 TECHNOLOGIES USED

3.1 Client Side

- HTML(mixed with ASP .NET)
- CSS
- JavaScript
- jQuery

3.2 Server Side

- ASP .NET
- JAVA

3.3 Database

- Microsoft SQL Server 2010

3.4 APIs

- JSWebkit API
- JavaMail API
- JSOUP API

3.5 Algorithms

- Backtracking algorithm

4 Description of Technologies Used

4.1 HTML, CSS, JavaScript, jQuery

Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS) and JavaScript it forms a triad of cornerstone technologies for the World Wide Web. Web browsers receive HTML documents from a web server or from local storage and render them into multimedia web pages. jQuery is a cross-platform JavaScript library designed to simplify the client-side scripting of HTML.

4.2 JAVA

It is a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. It is intended to let application developers "write once, run anywhere" (WORA), meaning that compiled Java code can run on all platforms that support Java without the need for recompilation.

4.3 MySQL

One of the fastest SQL (Structured Query Language) database servers currently on the market is the MySQL server, developed by T.c.X. DataKonsult AB. MySQL, available for download at www.mysql.com, offers the database programmer with an array of options and capabilities rarely seen in other database servers. MySQL is free of charge for those wishing to use it for private and commercial use.

4.4 JSWebkit API

This API's primary focus is content deployed on the World Wide Web, using standards-based technologies such as HTML, CSS, JavaScript and the DOM. However, we also want to make it possible to embed WebKit in other applications, and to use it as a general-purpose display and interaction engine.

4.5 JavaMail API

The JavaMail API provides a platform-independent and protocol-independent framework to build mail and messaging applications. The JavaMail API is available as an optional package for use with the Java SE platform and is also included in the Java EE platform.

4.6 JSOUP API

Jsoup is a Java library for working with real-world HTML. It provides a very convenient API for extracting and manipulating data, using the best of DOM, CSS, and jquery-like methods.

4.7 Backtracking Algorithm

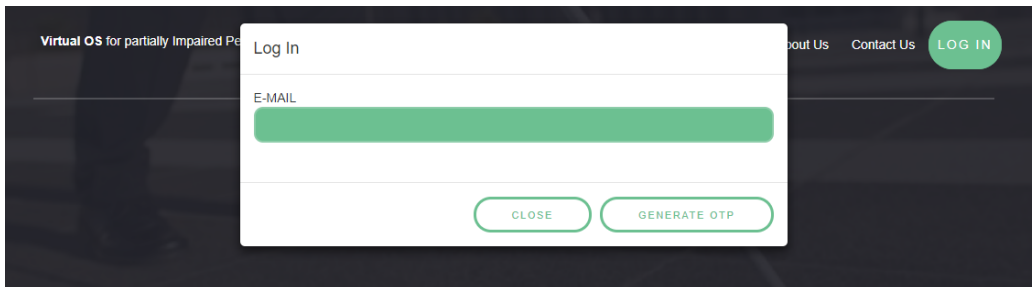
Backtracking is a general algorithm for finding all (or some) solutions to some computational problems. Backtracking is often much faster than brute force enumeration of all complete candidates, since it can eliminate many candidates with a single test. Backtracking is an important tool for solving constraint satisfaction problems, such as crosswords, verbal arithmetic, Sudoku, and many other puzzles.

5 MODULES CREATED:

5.1 Log In

The Login module is a very important part of this web-app. It helps the user to enter the email address and then an OTP is generated which is sent to the users Email-ID to authenticate the Email address entered. Also, the Login module helps the user in knowing his current location.

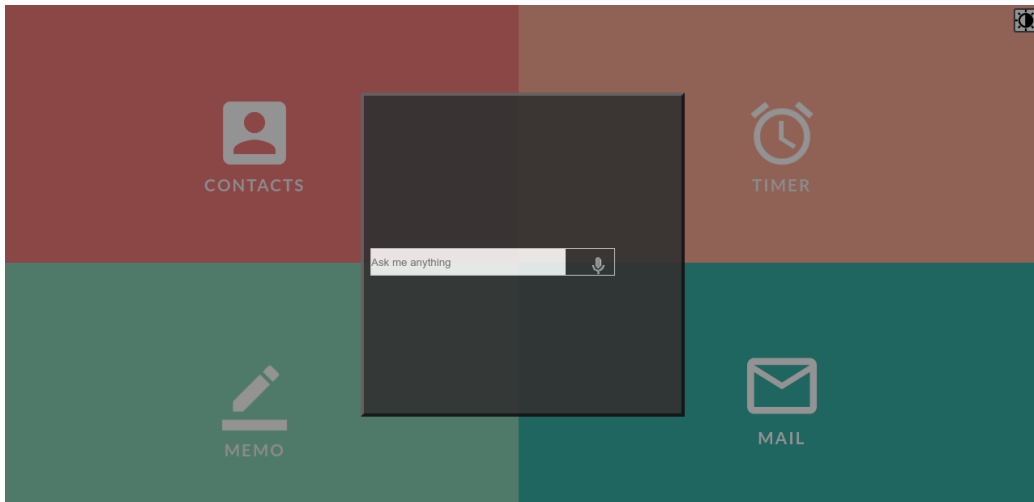
Implementation: LogIn module is implemented using bootstrap modals in css, google maps are embedded in login page using HTML iframe attribute. When login with email random number is generated using javascript Random function and sent to user's mail. Number entered is then checked with the number generated by random function which was stored in cookies using session is java servlet.



5.2 Virtual Assistant

As the name suggests the virtual assistant has been created to assist the user and make the web-app more accessible. People with low vision cannot see all the details on the screen and hence the virtual assistant makes it easy for them by taking input in the form of speech and later converting it into text. This feature can be used by the user for various purposes. The assistant is enabled to manage the following tasks:

- Answer Frequently Asked Questions(FAQs)

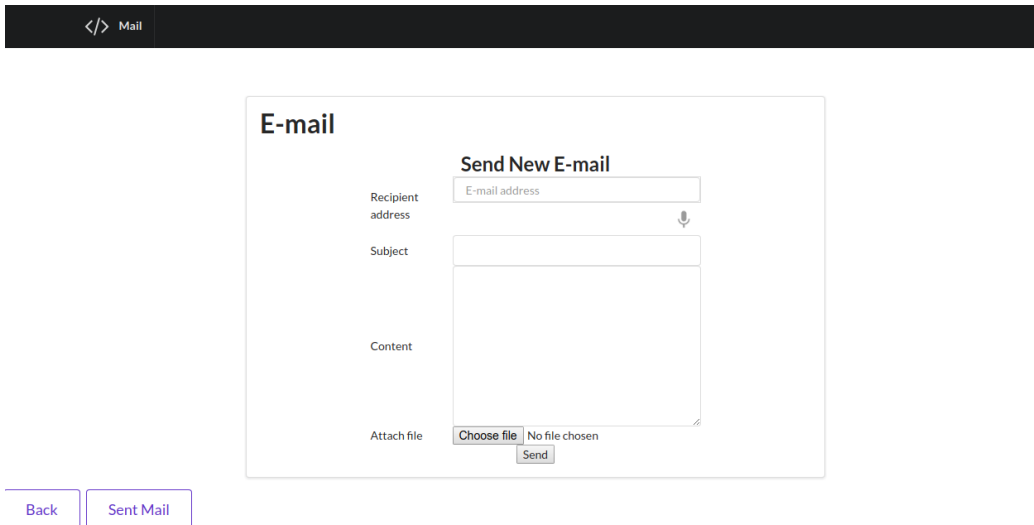


- Interact with User by identifying common phrases
- Notify the time to user when it receives keyword “time” as input
- Search meaning of the word followed by keyword “meaning of”
- Open URL of a website
- Enables user to listen summarized news articles
- Helps access all other modules

Implementation: This modules was used using iframe attribute in HTML. It involves implementation of JSWebkit API for activating microphone and detecting voice as text. Text are used as a command for virtual assistant which involves the concept of Knowledgenet for processing of commands. News and synonym java classes are created to post the data then Jsoup API are used for web scraping.

5.3 EMAIL

This module has been created to make the orthodox Email app more accessible for the people with low vision. The web-app can be used to add email of a

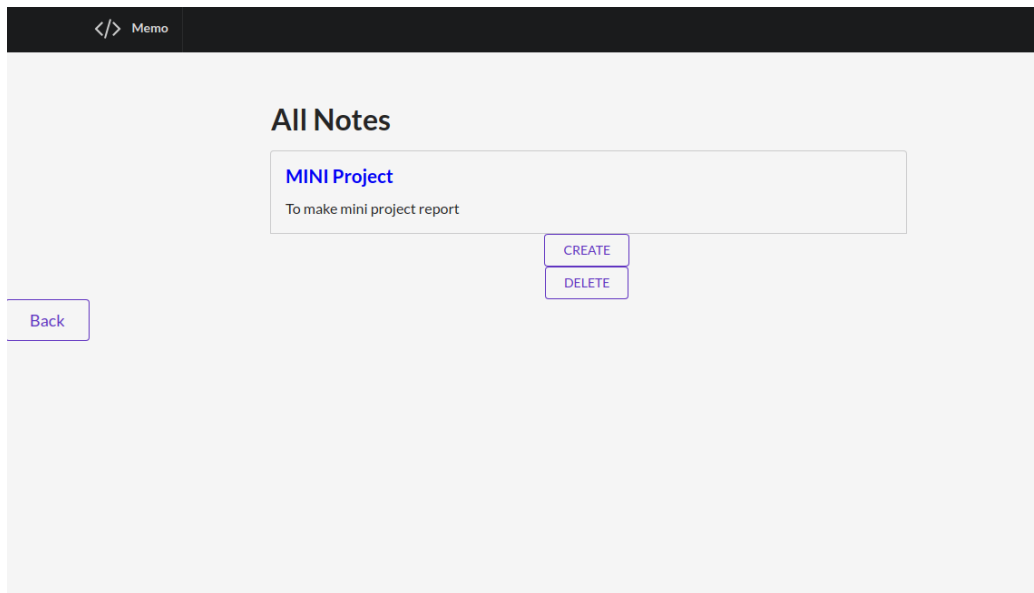


contact via voice command. And then Email can be sent to a contact by just specifying the contact name instead of mentioning the Email ID. This module can also be used to add content and subject of the Email. The assistant can also read out the content that is input by the user using voice command.

Implementation: Mailing is done using SMTP server which is an application layer protocol. The client who wants to send the mail opens a TCP connection and then mail is sent across connection . (The SMTP server is fixed on listening mode). After is get request from client via TCP connection, the SMTP process initiates a connection on that port . After successfully establishing the TCP connection the client process sends the mail instantly. For performing the above work we have created the SendMailUtility class which establish the connection than rest of the work is done by JavaMail API. Form is created using HTML and CSS for entering recipient, subject and content if mail sending is successful than subject and content of the mail is stored in Mail database using insert query using MYSQL.

5.4 MEMO

Memo are useful in keeping record of meetings, day to day expenditure and various other activities. The Memo module in this web-app helps the user



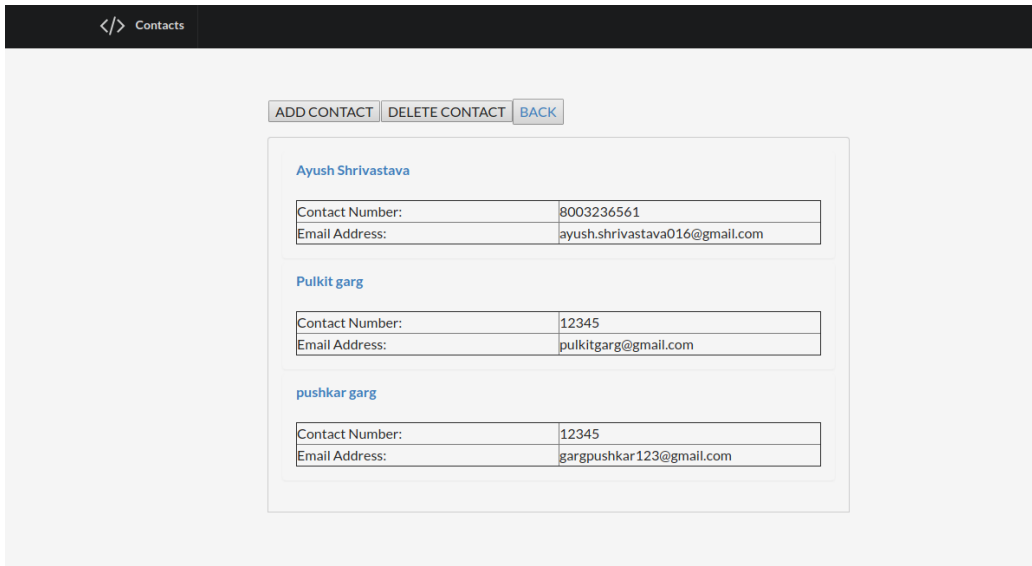
input and save a memo by simply entering it with the help of the virtual assistant. The user can input the subject and contents of the memo and the contents entered using voice command will be read out by the assistant so that user can check correct information is entered.

Implementation: We have created memo main ,Add memo and del memo java class which after getting data from JavaScript using doGet and doPost methods and after performing some operations insert or delete the data into or from memo database. HTML,CSS and JS are used to create memo form border and buttons.

5.5 CONTACTS

Contact cards are used to save information like email ID, contact numbers. The contact module in this web-app has been made more accessible using the virtual assistant. People with low vision may not be able to enter every small detail like email address hence, contacts can be saved using voice commands.

Implementation:We have created Contact main ,Add contact and del contact java class which after getting data from JavaScript using doGet and

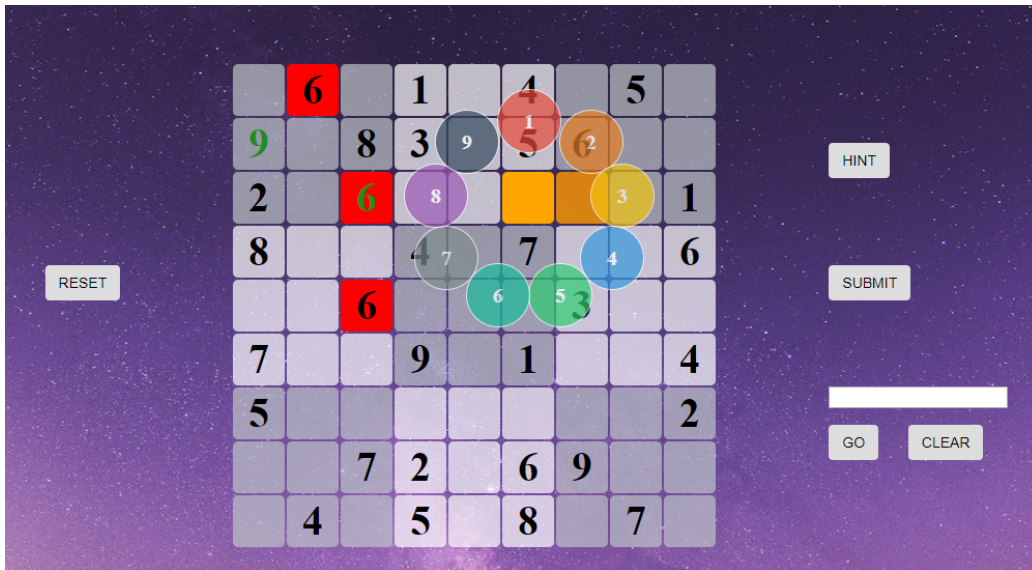


doPost methods and after performing some operations insert or delete the data into or from contact database. HTML,CSS and JS are used to create contact form border and buttons.

5.6 ENTERTAINMENT(Sudoku)

Sudoku is a popular puzzle game designed for players of all age groups. In this module, we have implemented the orthodox Sudoku which is assisted by the virtual assistant. The assistant tells the user exactly on which block they are by reading out the coordinates of the block. Moreover, users can enter the numbers using voice commands. And if the user enters a wrong input he will be notified by a beep. This makes the Sudoku more accessible for the people with low vision.

Implementation: HTML,CSS and Complex JavaScript is used for implementation of sudoku. For Hint feature in sudoku stack data structure is used which tells the correct answer of each block at the top of stack and pop that element. For checking correct answer at any given instant backtrack algorithm is used.

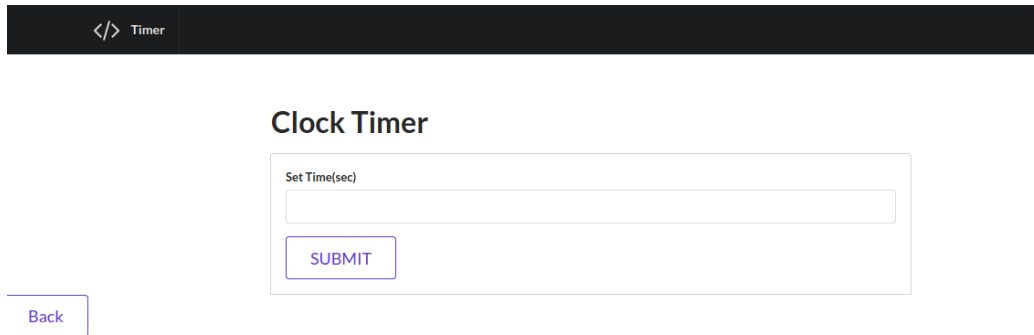


Working of backtrack algorithm in SUDOKU: Given a partially filled 9×9 2D array 'grid [9][9]', the goal is to assign digits (from 1 to 9) to the empty cells so that every row, column, and subgrid of size 3×3 contains exactly one instance of the digits from 1 to 9. Like all other Backtracking problems, we can solve Sudoku by one by one assigning numbers to empty cells. Before assigning a number, we check whether it is safe to assign. We basically check that the same number is not present in current row, current column and current 3×3 subgrid. After checking for safety, we assign the number, and recursively check whether this assignment leads to a solution or not. If the assignment doesn't lead to a solution, then we try next number for current empty cell. And if none of number (1 to 9) lead to solution, we return false.

5.7 TIMER

Timer is used to keep check of the time. For example: If the user sets a timer of 10 seconds a countdown will begin, and the user will be notified after 10 seconds. This is a very useful feature as the users with low vision are not able to properly use a watch, stopwatch and other devices.

Implementation: Timer frontend is created using HTML,CSS and JavaScript and count down is done by implementation of java thread in accordance with the time.



The screenshot shows a web application interface. At the top, there is a dark header bar with a code icon and the text 'Timer'. Below the header, the main content area is titled 'Clock Timer'. Under this title, there is a form with a label 'Set Time(sec)' above a text input field. Below the input field is a 'SUBMIT' button. To the left of the main form, there is a 'Back' button.

6 Research Conducted on partially blind people

People with visual disabilities are individuals who are blind, have low vision, or have colour blindness. People who are blind need text equivalents for the images used on the Web page, because they and their assistive screen reader technology cannot obtain the information from the image.

1. Understanding Screen Readers

- More and more visually impaired people are utilizing screen readers to access the Internet daily.
- If we create web-app that could write and read back to the user than we've taken a big step toward doing our jobs more effectively.

2. Text Labels

- All graphics should have text labels, i.e. alternative attributes in HTML (Hypertext Markup Language).

3. Avoid Text only Websites

- The creation of a text-only version should be seen only as a final option when all other alternatives for making the site accessible have been exhausted.
- Accessible pages needn't be bland! They can be well designed, attractive and interactive, while at the same time providing access for everyone.

4. Contrast is Key

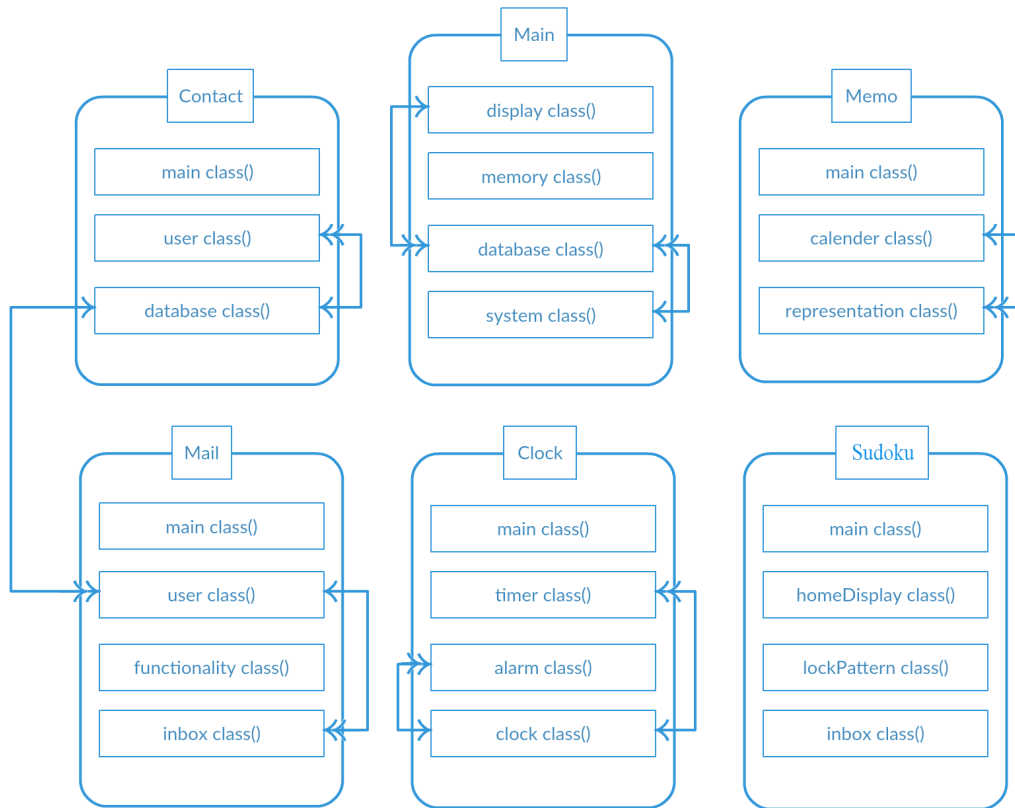
- Eye diseases like Retinitis Pigmentosa, Glaucoma, Retinopathy and cataracts (some of the most common eye disorders out there) all lead to a significant decrease in contrast sensitivity — that is, the eye's ability to differentiate between similar shades and levels of brightness.

- Today's layouts are detailed-oriented, often utilizing subtle gradients and slight shifts in value to create clean, modern, unobtrusive interfaces. For a user with normal eyesight, this makes for a very pleasing visual experience. To a user who struggles with contrast sensitivity, however, it can be a literal headache.

5. Fonts Size suitable for partially blind

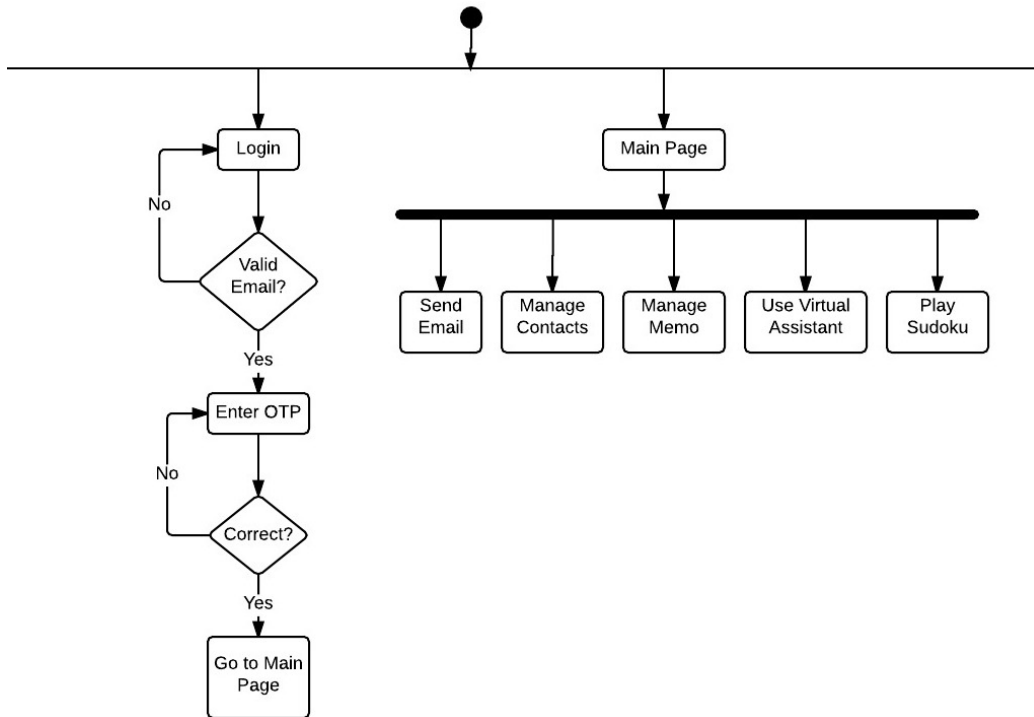
- Not to use absolute font sizes in style sheets. Code font sizes in relative terms, typically using percentages such as 120% for big text and 90% for small text.
- Making default font size reasonably big (at least 10 point) so that very few users have to resort to manual overrides.
- Try to avoid text that's embedded within a graphic, since style sheets and font size buttons don't have any effect on graphics. The font size is especially large (at least 12 point) and to use high-contrast colors.
- Adding a button that loads an alternate style sheet with really big font sizes if most of the site's visitors are senior citizens or low-vision users. Few users know how to find or use the built-in font size feature in current browsers, and adding such a button within your pages will help users easily increase text size.

7 INHERITENCE LAYOUT



HERE DOUBLE ARROW REPRESENTS PARENT CLASS AND SINGLE ARROW REPRESENTS CHILD CLASS.

8 ACTIVITY DIAGRAM



9 CONCLUSION

The web-app aimed at solving the problems for the visually impaired and various features in the app have increased its accessibility. The various problems that are successfully solved by the product are listed below:

- The introduction of the virtual assistant has caused the major difference in existing technologies and this product. The virtual assistant enables the users with low vision to access all the features using voice commands.
- Day to day necessities like Email, Contacts, Timer, Memo can be easily used by the visually impaired people and this keeps them in sync with the fast moving world. The careful use of contrasting colors helped develop an application with greater visibility.
- The introduction of screen readers also solved a major problem as it helps the user to refrain from reading the screen instead the virtual assistant reads the screen. This makes tasks such as news reading much easier.
- The careful use of appropriate Font-Size makes the website more readable for the people with low vision.
- Introduction of Text Labels contributed majorly in increasing the accessibility for the visually impaired people.

Addition of a few more features can make this web-app a product the visually impaired people have been waiting for. It solves a lot of their day to day problems with ease.

10 FUTURE SCOPE

- Application can be made compatible with different platform like desktop or android/IOS application.
- Currently we have created knowledgenet in virtual assistant which can be further improved via machine learning or procedural knowledge concept of artificial intelligence.
- Features like magnifying particular part of the screen or reading it can be added to make it more friendly for visually impaired.
- Features like sending mail with attachment using virtual assistant or searching the contacts can be improved by using latest frameworks.