

**BIRLA INSTITUTE OF TECHNOLOGY AND
SCIENCE, PILANI – Goa Campus
Second Semester 2021-2022**



Course Number: BITS F364
Course Title: **Human Computer Interactions**
Final Report - GROUP 7

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Problem Statement

“Bi-lingual, Voice-Guided Eyesight Assessment Application”

When we started out our project, we had a few goals in mind:

- Understand the scenario of eye-sight awareness in India
- Research what solutions pre-exist in the market
- On the basis of this understanding and research, come up with a Prototype App that is unique to the Indian landscape
- Incorporate accessibility features in the App that current Apps do not offer

Motivation

90% of all information that comes into our brain is visual. Despite this, awareness eye-check-ups remain low within our country.

(<https://pubmed.ncbi.nlm.nih.gov/11242828/>)

Conventional eyesight testing methods require a doctor for assistance and diagnosis. However, this is not possible for everyone – due to lack of medical facilities and lack of time.

Pre-existing apps in the market require the user to read and follow instructions on the screen. This can be difficult for people who have difficulty reading and for those who are already suffering from eyesight issues!

Our goal is to create an application that facilitates eye test through smartphone, and gives the person a preliminary diagnosis of his/her eye-condition, We further propose to improve the user interaction by using a voice-based guidance system that guides the user through each & every step of the test, so that even an illiterate person, who is unable to read, is able to administer a self-test. Sometimes reading can be a cumbersome process and voice-guided tests can speed up the process. We plan to implement the App in 2 languages – Hindi and English, since a majority of the Indian population have at least a functional understanding of either of these languages.

Related Literature & Research

Before starting our work, we examined the pre-existing research in the area of eye-care in India.

We also researched the Apps that were available in the Market on common platforms like Google Playstore and Apple Store.

Research Work

1. *Awareness and eye health-seeking practices for cataract among urban slum population of Delhi*
https://journals.lww.com/ijo/Fulltext/2017/65120/Awareness_and_eye_health_s_eeeking_practices_for.39.aspx
2. *Virtual Eye Doc: An Android based app in Bengali language for eye health & vision examination* – but this supports only one language
<https://ieeexplore.ieee.org/abstract/document/7913015/metrics#metrics>
3. *Mobile Visual Acuity Assessment Application: Acumob*
<https://dergipark.org.tr/en/download/article-file/288836>
4. *Awareness of eye diseases in an urban population in southern India* – Highlights that there is a need for health education in the Indian population to increase their level of awareness and knowledge of common eye diseases.
<https://pubmed.ncbi.nlm.nih.gov/11242828>
5. Existing Apps - Verana Vision Test, Peek Acuity, EyeXam, Eye Patient etc. available on Playstore
 - a. <https://apps.apple.com/us/app/verana-vision-test/id1507459848>
 - b. https://play.google.com/store/apps/details?id=andrei.brusentcov.eyecheck.free&hl=en_US&gl=US
 - c. https://play.google.com/store/apps/details?id=com.app.eyepatient&hl=en_US&gl=US
6. *Text-Free User Interfaces for Illiterate and Semi-Literate Users* - Describes various methods used for UI design so that illiterate people can use the application.
https://www.researchgate.net/publication/224281100_Text-Free_User_Interfaces_for_Illiterate_and_Semi-Literate_Users
7. *Android mobile applications in eye care* - This paper discusses the usefulness of such apps in real life. The paper finds such apps effective.

https://www.researchgate.net/publication/333634818_Android_mobile_applications_in_eye_care

8. *I. Rapid Assessment of Visual Impairment in Urban Population of Delhi, India*
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0124206>
9. *J. Prevalence and Causes of Blindness and Visual Impairment and Their Associated Risk Factors, in Three Tribal Areas of Andhra Pradesh, India*
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0100644>

Findings

Based on our research, we concluded the following:

1. There is a need for education in India to increase the level of awareness and knowledge of common eye diseases
 - a. Surprisingly, we found that awareness of eye diseases is low even in urban centers of South India & Delhi, despite these areas having reputed and well-equipped hospitals and medical facilities
2. None of the pre-existing apps had multilingual support - all supported only a single language
3. Existing apps have poor user interface, making it difficult for the non-tech savvy users to use effectively
4. As of now, we found no Apps that support a voice-guidance feature that guides the user through the App. We believe that this is absolutely necessary feature for eyesight testing Apps since most people using these Apps already might be having a poor eyesight to begin with

Methodology

I. User Study

Our target audience in this study was semi-literate people with potential vision problems.

Relevant groups on our college campus were identified. Their needs and problems were understood and analyzed to decide upon the relevant features to be included in the application.

The application was designed as an experimental apparatus as described below.

II. Experimental Apparatus

Our experimental apparatus included the Application we developed and the survey following the use of the Application.

We followed the following steps while developing the application:

1. Understanding the user-base and their unique needs and requirements.
2. Crystallize the goal of the application and what a user can achieve with it - our App aims to mainly spread education and awareness about eye-diseases in a way that is accessible to all people in India.
3. Developed a Low-Fidelity on paper design of the App to better understand the flow of the application and placement of UI elements.
4. We made 2 builds of the App.
 - a. **Build 1:** We used Adalo to design the App, since it provided us with pre-built material designs so that we could improve our UI without much effort. However we ran into issues while trying to integrate Google Text-to-Speech with Adalo.
 - b. **Build 2:** We then turned to MIT App Inventor, a tool developed by MIT. This tool is easy to use and provided us with an easy way to integrate Google Text-to-Speech within our App, however, we had to compromise on the UI aspect since MIT App Inventor didn't provide very good pre-built templates for App.
5. Then finally, build 2 was given to the survey participants to use and give their feedback.

Evaluation and results

We surveyed 23 Participants from campus which included:

- 7 mess workers
- 3 security guards
- 2 domestic helpers
- 11 of our batchmates (8 having spectacles, 3 who do not have spectacles)

We asked all of them to try out our App without assistance

Later, we asked them to submit a feedback form. People who were not able to understand the feedback form were assisted by us.

1. On a scale of 1-5 how intuitive do you think the App is ?

23
Responses

4.13
Average Number

Most people that used the App found it to be intuitive with an average rating of 4.13/5.

2. Do you feel the Text-to-Speech feature was useful in providing better guidance

Yes	17
No	2
Somewhat	4



74% users found the Voice-Based Guidance very useful and it improved the navigability of the App.

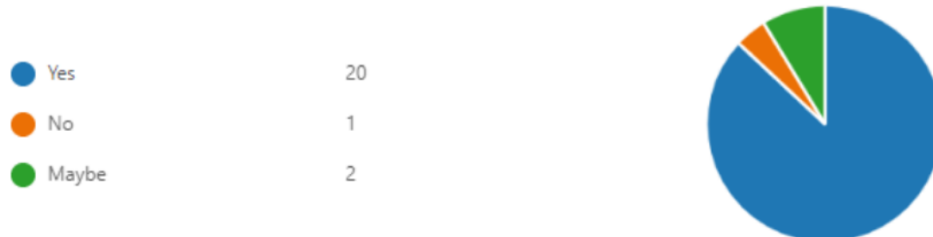
3. How would you rate the UI/UX of the App ?

23
Responses

3.48
Average Number

Users Rated UI a 3.48/5 and believed that there was scope for improvement and beautification.

4. Do you believe having 2 languages will boost the usability of the App, hence serving a wider audience ?



An overwhelming 87% users believed having 2 languages will significantly boost the user base of the App.

5. Did you face any issue while using the App?

23
Responses

Latest Responses
"No issues"
"No"
"The voice could be sweeter"

Most of the users didn't face any issues while using the App.

Some said that the voice could be sweeter. *We will surely work on this :)*

6. Can you suggest anything in App that needs improvement

23
Responses

Latest Responses

"Add test for reading test also."

"No"

"Make the tests more interactive"

We received some suggestions like adding tests for reading tests and making the tests more interactive.

7. Based on your test results, would you now be more inclined to visit an ophthalmologist for detailed checkup?

● Yes	13
● No	5
● Somewhat	5



60% of users were more likely to visit an ophthalmologist for a professional opinion after using our app. This is a positive sign and fulfills the goal that we had set out for our App.

Discussion

Awareness and availability of medical facilities and personnel for conventional eye checkup techniques remain low in our country.

There exist applications that facilitate eyesight testing of a person on a preliminary level.

We designed an application that provides an easy way to do so, with a novel approach. We facilitate audio instructions with bi-lingual support.

We also provide information about various common eye diseases in easy to understand layman language, with bi-lingual audio and reading support.

The application was used by about 25 people with varying backgrounds.

Our user-study sample space consisted majorly of semi-literate people such as the mess workers, security guards and housekeeping staff.

Their feedback was recorded as a short survey, integrated within the application.

As per the survey response, the key findings were in favor of our novel approach. Most users found the application to be easy to use, owing to voice-based guidance and bi-lingual support.

Voice instructions assisted those who had not learnt to read and also those with poor eyesight.

Bi-lingual support helped the section which can only read/understand Hindi, and not English.

It was practically observed that these key features improved navigability and usability of the application.

It was the users' belief that the application can be used by a significantly larger user base as compared to those apps that do not provide either of these features.

Finally, talking about the adequacy of the app, 60% of users were likely to seek professional diagnosis by an ophthalmologist after using our app.

Many of them realized the need to do so for the first time, due to unawareness of the eye problems.

Conclusion and Future Works

We surveyed 23 people, and based on their responses and conversations we had with them, we noted the following points

1. There is scope for beautifying the User-Interface further. Since we were short of time and experience in UI design, we could not spend much time on the UI/UX part.
2. Location based contacts of ophthalmologist - This would require location permissions from the user and integration with Google Maps. With this we could provide the user with details of doctors nearby.
3. Inclusion of even more regional languages - like Bengali, Tamil, Telugu, etc. - This could easily be done using Google Translate & it would make this a truly pan-Indian App.
4. Facilitate more scientific eye-tests like E-Test, C-Test, Chart-based test.
5. There is also scope to make it a complete eye-care app, by including information about more eye diseases and ailments prevalent in India.
6. Including video-based education within the App would make it more interactive and make it more likely that the user will seek further help from a doctor regarding his/her eye-related problems.

Individual Contribution

Shrishailya Anil Agashe (2019A7PS0004G)	<ul style="list-style-type: none">• Project Ideation and User Study• Literature Review• Build-2 of the App• Conducting survey with the App, and getting feedback from users
Aryan Gupta (2019A7PS0017G)	<ul style="list-style-type: none">• Project Ideation and User Study• Build-1 of the App• Conducting survey with the App, and getting feedback from users• Analysis of feedback from user survey
Nishant Vikas Sarangdhar (2019A7PS0043G)	<ul style="list-style-type: none">• Project Ideation and User Study• Literature Review• Build-1 of the App• Survey design for the application's users
Anmol Vivekkumar Redasani (2019A7PS0072G)	<ul style="list-style-type: none">• Project Ideation and User Study• Literature Review• Conducting survey with the App, and getting feedback from users• Analysis of feedback from user survey