Software Engineering
Course Project

ColorSense: Helping colorblind sense color

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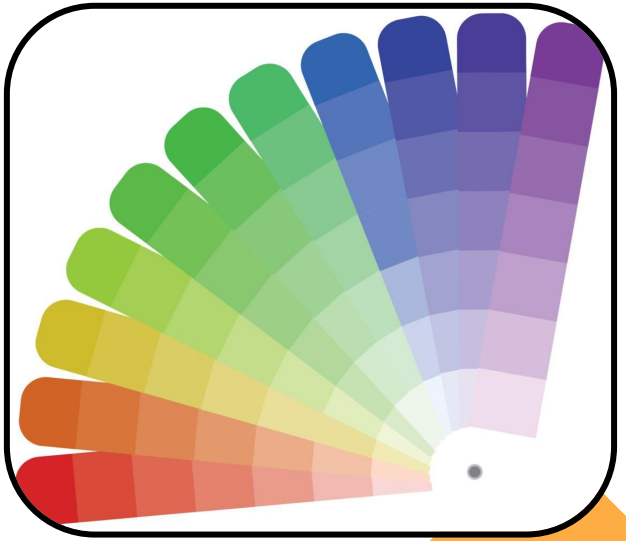
Product: “ColorSense”

A cross platform (android and ios) mobile application that aims to help color-blind people with their day-to-day struggles of unable to distinguish between certain colors via the following features:

- Live color labeling of objects with camera.
- Segmenting particular color.
- Color Blindness simulator
- Spreading awareness about the condition through a ‘Learn more’ tab.



Project Components

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01

Life-cycle & Requirements

Software Lifecycle

- For this software engineering project, we overall followed an evolutionary lifecycle approach.
- Evolutionary life cycle is characterized by a high level idea of the project, with the requirement specifications being finalized as we go through the process of development.
- In our project, we initially studied about color blindness, its consequences and effects on the color blind and how we can help them.
- The common types of color blindness were identified and the requirements were updated to design features these types.
- We came up with a basic set of features that we would implement. The features and type of service(for example web page, desktop application, mobile application) was finalized after discussion with our TA.
- Addition and updation of features as the project progressed.

Evolutionary Lifecycle

Brief Idea

Understood the project topic. Completed some basic research related to color blindness and its effects.

Discussing Aid

Discussed amongst ourselves about how we can help the color-blind sense/perceive color.

Functionality

Decided upon the functionalities to implemented after consulting TA.

Architecture selection

Based on the functionalities finalized, the architecture and tech-stack was finalized.

Development

Worked hard to learn a new programming language Dart and used Flutter with Android Studio to develop an app. Some functions were modified based on development constraints..

Testing

Tested with different image inputs, adjusted functions for better performance.

Stakeholders

The stakeholders for this project include:

- Primary stakeholders:
  - The developers: Us :)
  - Project guids: TAs and Professor.
  - Colorblind Individuals
  - End Users and General Public
- Secondary stakeholders:
  - Colorblind Advocacy Groups
  - Healthcare Professionals
  - App Developers
  - Accessibility Advocates
  - Educational Institutions

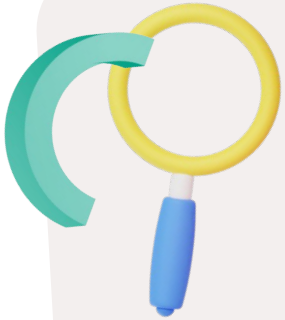
Requirements

- Among the primary stakeholders, we did not have direct contact with any colorblind individuals so our functionality ideas were based on online surveys and studies.
- Some requirements were identified after discussion among ourselves and the TA.
- Pre-existing color-blindness aid was referred to infer some requirements.
- Based on the collected information, a basic outline of the project was developed.
- The details of requirements are enlisted in the following SRS document: https://docs.google.com/document/d/1L26Fa8T1kCrRJu4Wvx0XAxaxKxP6ESwoGDyAeFaGimQ/edit#heading=h.sl9mtwa7mn2t

Some online survey results

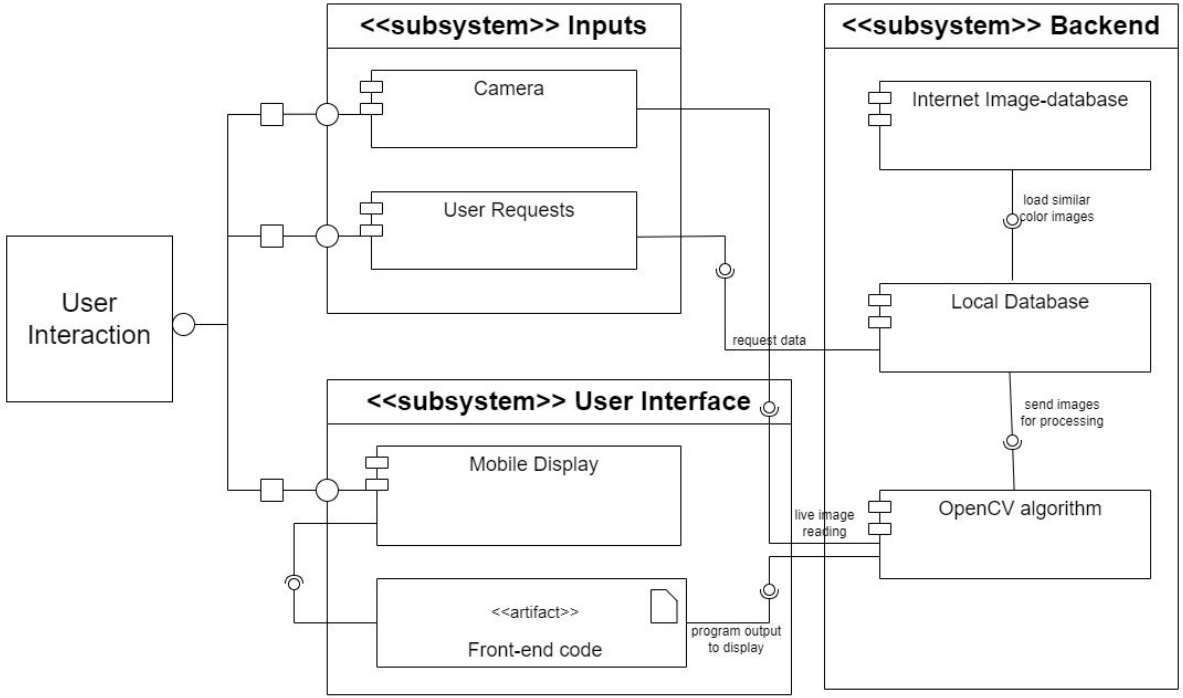
- There is general agreement that worldwide 8% of men and 0.5% of women have a red/green type of colour vision deficiency.
- The 8% of colour blind men with inherited colour blindness can be divided approximately into 1% deuteranopes, 1% protanopes, 1% protanomalous and 5% deuteranomalous. Approximately half of colour blind people will have a mild anomalous deficiency, the other 50% have moderate or severe anomalous conditions.
- 75% of colour blind people ask coworkers to verify colours on a weekly or daily basis (e.g., wires, medicine labels, chemicals, graphs, drawings or other items) with 31.28% replying ‘Almost Daily’ and 43.47% ‘A Few Times a Week.’
- More than three out of four colour blind workers report frustration or delays on the job due to colour blindness, with 35.59% replying ‘Almost Every Day,’ and 41.85% ‘Occasionally’ (about 1x per week).
- More than half worry colour blindness could cause them to make mistakes (51.51%) at work.

https://enchroma.com/pages/seventy-five-percent-of-color-blind-people-experience-challenges-at-work-enchroma-study-finds
https://www.colourblindawareness.org/colour-blindness/types-of-colour-blindness/

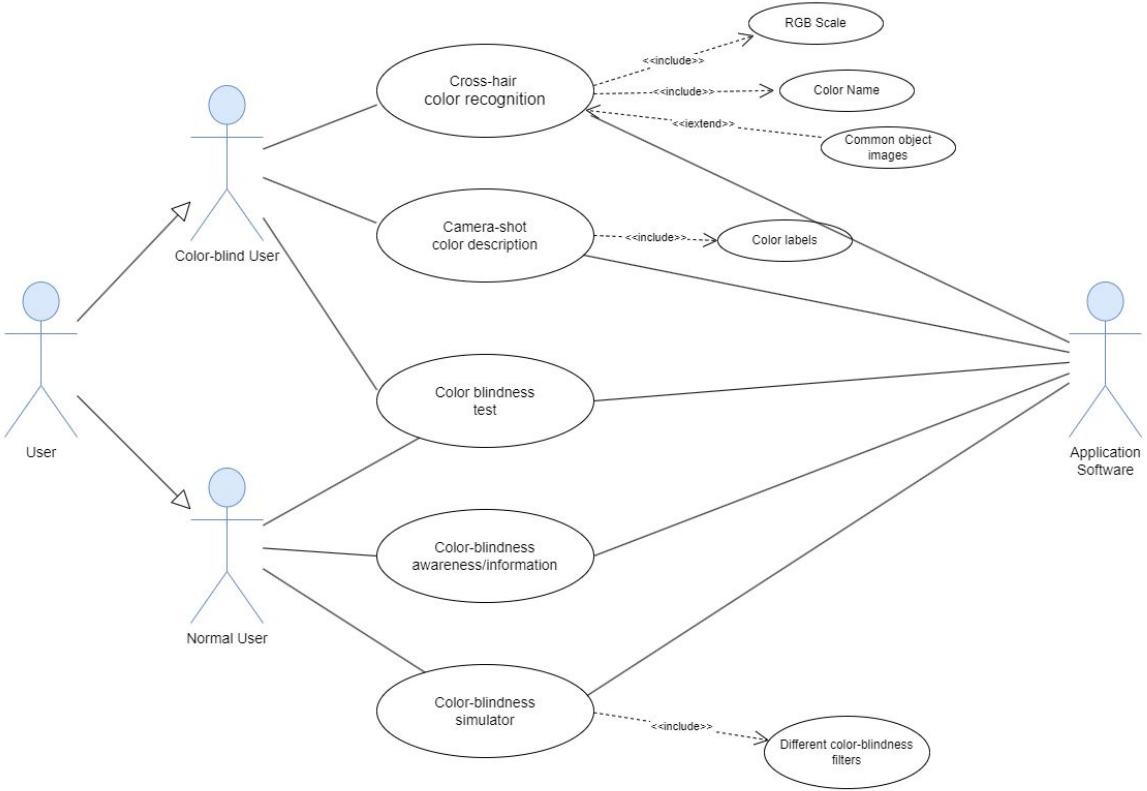


UML Diagrams

Component Diagram



Use Case Diagram



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Architecture and Technical Details

Architecture Implemented

Service-based Architecture:

Since our application is related to an aid software for people, there was no extensive need of maintaining a server and having complicated user interaction. Our main focus was on implementing the functionalities and hence we chose a service based architecture.

Microservices Architecture

The different functionalities were implemented as different dart modules, keeping them separate, easy to work on individually and easy to test. It was suitable since our services were largely independent.

Tech Stack

We used the following framework to develop the application:

- Flutter:Google's UI toolkit for building native cross-platform applications.
- Dart: Google's programming language for fast and efficient app development.
- Android Studio: Google's IDE for developing Android apps with ease.

We used GitHub for version control.

Draw.io for making UML diagrams.

Software Metrics

Line of Code

For different modules, we have following lines of code:
main.dart = 225, label.dart = 536, cam.dart = 212, sim.dart = 361, Test.dart = 89, learn.dart = 267.
Total - 1689

Time of Full display

Upon testing on Samsung M33 5G, the average initial loading time was around 2.38s and on Samsung S21FE it was 1.53s

Image processing time

For the identify a color function, it took an average time of 0.8-1s.
For simulator it took time corresponding to image size and quality,

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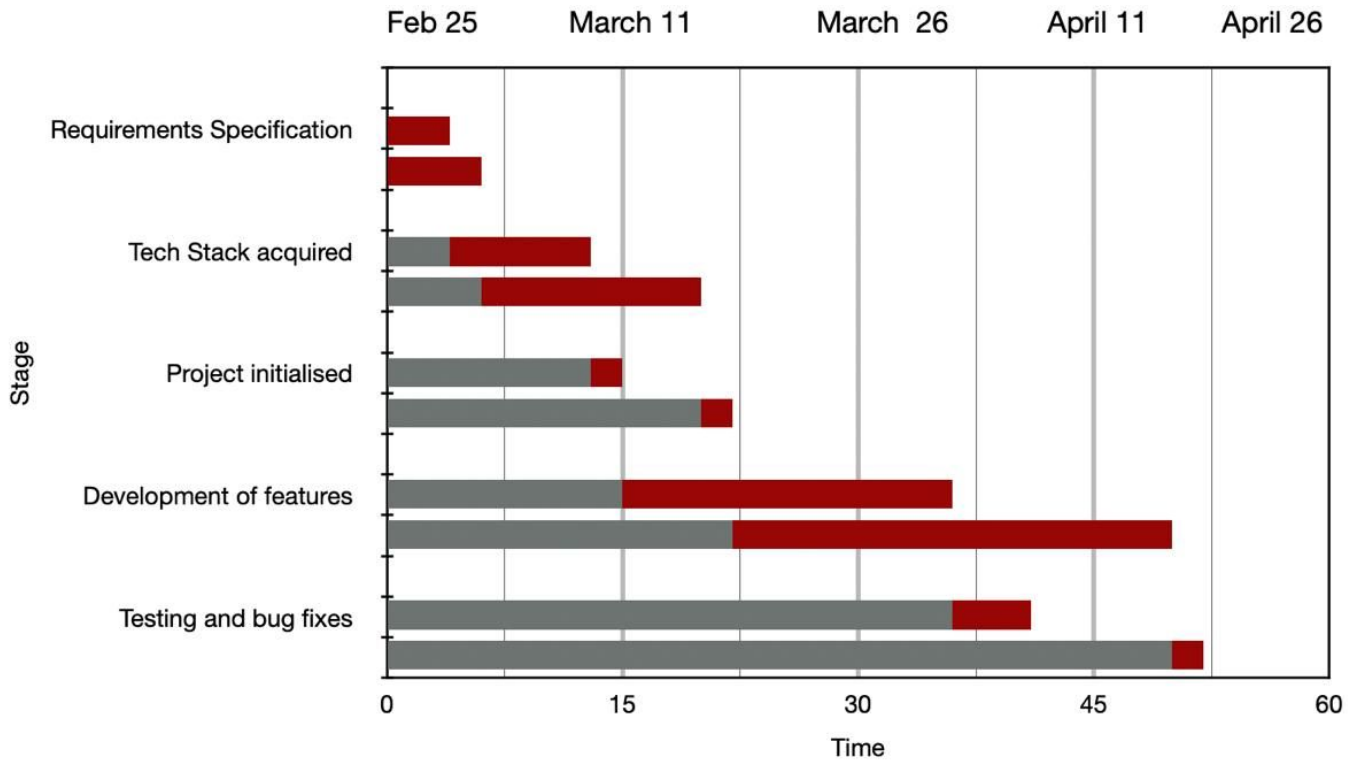
Project Management

Gantt Chart


Feb 25
March 11
March 26
April 11
April 26
Requirements Specification
Tech Stack acquired
Project initialised
Development of features
Testing and bug fixes
Stage
0
15
30
45
60
Time

04

Testing

Testing Performed

Functional Testing

Tried out different input images, input image using camera, etc to check if all functions are working properly.

Usability Testing

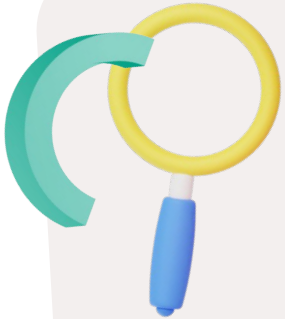
Tested the user interface and decided to keep it as clean and mono-chrome as possible in order not to confuse color-blind users.

Compatibility Testing

Tested the working of app features on both android and ios devices (in debug mode).

Integration Testing

Tested the application after integration of the functionality modules for any bugs after compilation.



Thank You