

User and Product Manual Instructions

This document is a template of a user and product manual. The client may wish to make improvements on the prototype or need to fix it if something goes wrong or another group of students may work to make a more rugged prototype. The document needs to be clear for someone else who is not an engineer **to use, maintain or reproduce the project**. Include as many images and diagrams as possible for a better understanding. Keep it plain, simple, visual and logical.

In general, if you are not sure exactly what to include, imagine that this document was the only thing that you had. Imagine also that your job was to add a new feature or recreate the project that is described in your document. What would you need to know?

Only include details relating to your final prototype.

Template conventions:

- Remove all **red text**, it is only there to guide you
- Remove this page (instructions)
- Replace all instances of <xxx> with the appropriate information for your group, for example you could replace <System Name (Acronym)> by The Amazing Product (TAP)
- Save this document as 'User and Product Manual_group number' instead of Deliverable X so that others know what it represents when they see it in MakeRepo

GNG2101

Design Project User and Product Manual

“Clarity”

Submitted by:

Accurate color detection team 1.5

Catherine Satoh, 300351169

Sunanda Datta, 300371606

Shiven Joshi

Aditya Vashishth, 300391746

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University of Ottawa

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List of Acronyms and Glossary

Provide a list of acronyms and associated literal translations used within the document. List the acronyms in alphabetical order using a tabular format as depicted below.

Table 1. Acronyms

Acronym	Definition

Provide clear and concise definitions for terms used in this document that may be unfamiliar to readers of the document. Terms are to be listed in alphabetical order.

Table 2. Glossary

Term	Acronym	Definition

1 Introduction

The color detection website project aims to develop an intuitive and reliable web application that accurately detects and identifies the dominant color in video frames captured by a user's camera. Utilizing advanced color detection algorithms, the website will analyze video inputs in real-time, delivering precise color identification results. Additionally, the project will provide information on the lightness or darkness of shades and include a text-to-speech option. This technology has diverse applications in digital design, fashion, and quality control in manufacturing, with its primary purpose being to assist Kate, a colorblind client, in pursuing her hobbies.

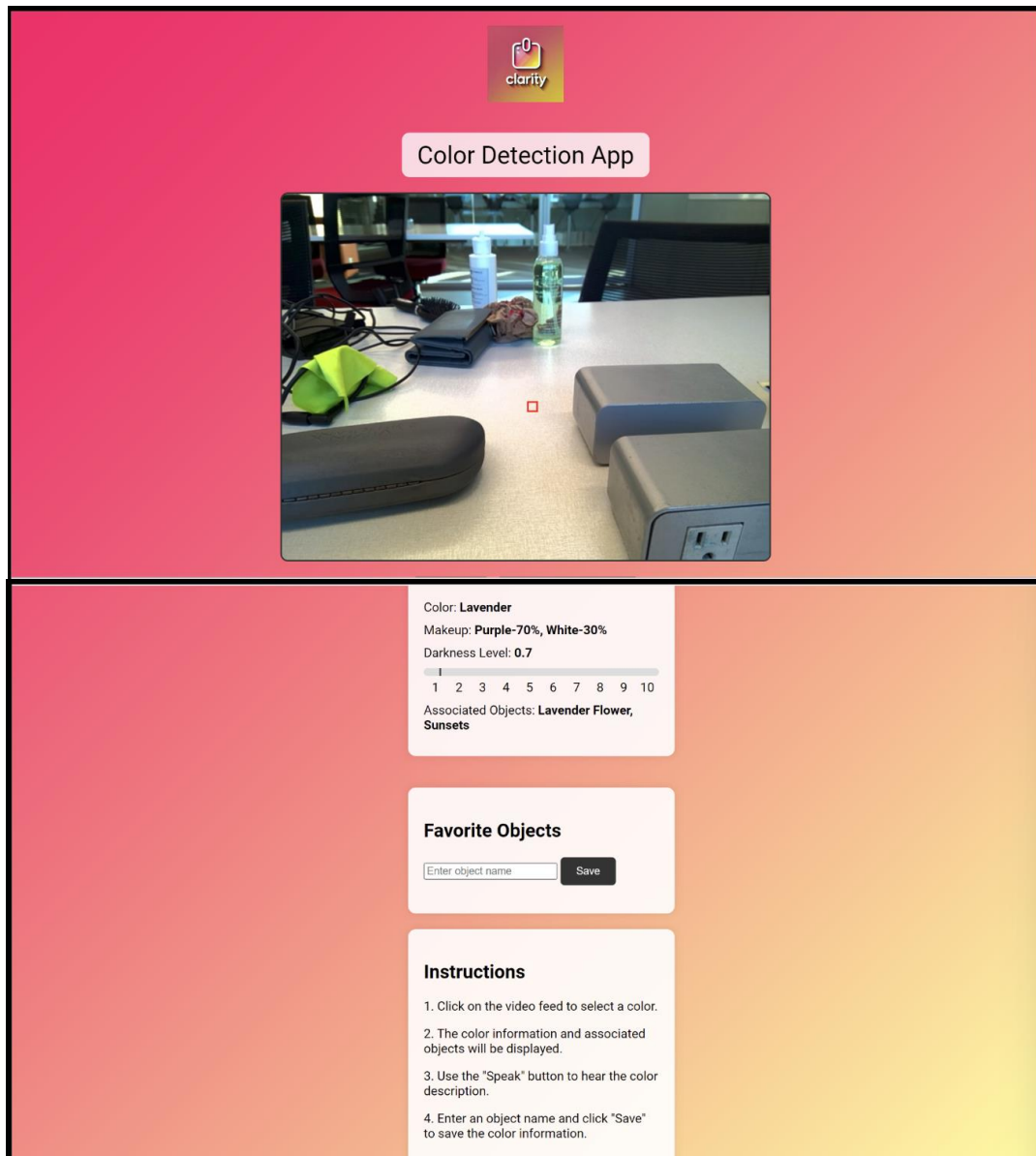
The intended audience for this document includes:

- Users who require accurate color detection for digital design, fashion, and quality control in manufacturing.
- Specifically, colorblind individuals like the client Kate, who wish to use the website for their hobbies.

The purpose of this document is to provide comprehensive guidance on the use and functionalities of the color detection website. It aims to help users understand how to effectively utilize the website for accurately detecting and identifying the dominant color in video frames, as well as obtaining information on the lightness or darkness of shades. Additionally, it includes instructions on using the text-to-speech feature and provides insights into the website's various applications.

This document includes all there is to know to use the Clarity website. This includes cautions, setting up the system, full use of the website, any troubleshooting and support, list of equipment and bill of materials, and any additional notes for future work.

2 Overview



Our client Kate has **monochromatic colorblindness**, reduced resolution vision, and extreme sensitivity to light. This leads her to have difficulty distinguishing between colors, but also between the lightness and darkness of a shade. This is important to understand to then be able to find ways to help our client. Our user needs large font, a voice over function reading out the color name, clear color names, a scale showing lightness or darkness level, and must be able to be used with ease in dark mode. A feature Kate wished for was to be able to add objects to certain colors to be able to associate them. Our web-based solution provides our client with the tools to access color with ease, toggling through the settings with different buttons.

What differentiates us from other products is the simplicity of use and color names. Other color applications on the market include complicated color names or worse, no color names but just RGB color values.

2.1 Conventions

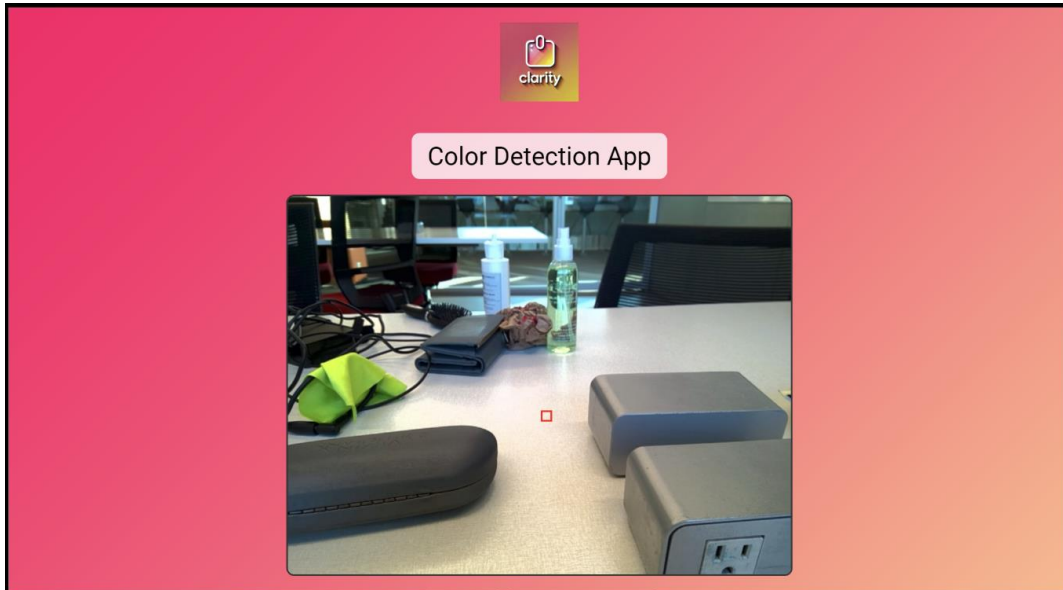
Not applicable to the Clarity website.

2.2 Cautions & Warnings

No such cautions or warnings are required for the user. There are certain attributions that must be given because of the intellectual property used for the code, such as OpenCV and NumPy. However, this is not applicable to the user but rather the Clarity team.

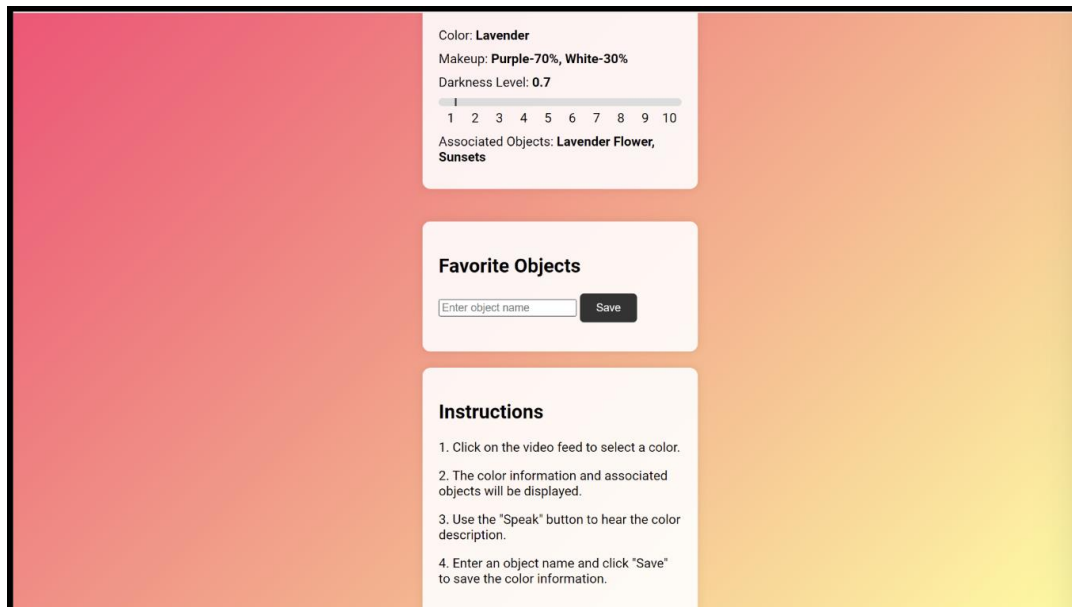
3 Getting started

1. The website: Clarity can be accessed using the provided link. Once accessed, a colorful screen will appear with a camera in the middle, surrounded by several other features. To use the camera, bring your device close to the wanted object to detect its color. Clarity will detect the objects color simply by tapping on the camera screen.



(Figure 3: Clarity main page)

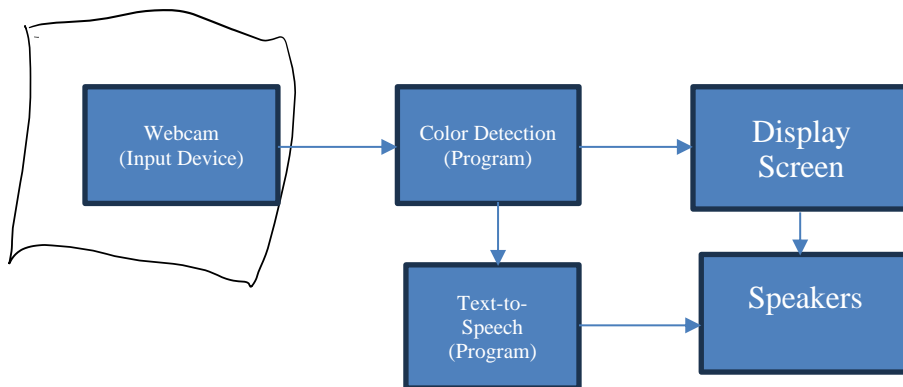
2. The results will then be displayed underneath; a color name, percent composition of colors and a list of objects with similar colors will all be provided. If you wish, underneath these descriptions, in the "favorite objects" box provided, you can insert other objects you've seen before with the same color. The website also comes with a text-to-speech feature that reads allowed the detection by clicking on the text-to-speech button. Furthermore, the colorblind mode button can be pressed to make the website monochrome. For more detail, an information section can be found at the very bottom of the website's page, outlining all of what has just been said. (4 images ish need to be added)



(Figure 4: Clarity detection results and additional features)

3.1 Configuration Considerations

The software prototype is a Color Detection and Analysis System that captures live video from a webcam, processes the video feed to identify colors, and provides detailed information about the detected colors. The system is designed to be user-friendly, even for non-technical users.



3.2 User Access Considerations

The users can be classified into 2 groups. For one, users that have colorblindness like our Client, Kate. This group would benefit from being able to more easily identify daily object's colors

when needed. This can help them perform daily, vital tasks such as picking an outfit or recognizing colored buttons on kitchenwear, to name a few.

3.3 The other group would be people without colorblindness, that would simply want to use it to see how the app works, and to potentially relate to how colorblind people may feel when using it themselves. Otherwise, they may use it for hobbies such as DIY crafts.

Clarity's set up is quite easy as it only requires one step. To access Clarity, the user will need to enter the URL of the app into their web browser of choice. Besides that, there are no further steps to access Clarity as no sign in or passwords are required.

3.4 System Organization & Navigation

There is one page to the website which completes all the functions requested by the client.

Main page:

Opening the website the camera opens automatically, giving the user a chance to point and tap to identify a particular color.

Subsections:

Scrolling down, the other features are available. This includes turning toggling to the black and white feature and saving objects with the same color. There are also instructions to be able to properly use Clarity.

3.5 Exiting the System

Because the website can be used as an app by saving the website on the home-screen, it can be closed by simply pressing the home button on the phone.

4 Using the System

When opening the website for the first time, export the website as an app to the home-screen. To do this press the export icon, scroll down until you see “Add to Home Screen,” and select that option.

When that is done, exit the app to see if the website is indeed on the Home Screen.

Open the website and direct the camera to a desired object and click the screen to get its color detected.

Make sure to hold the camera close to the object for accurate detection of the colors.

If you wish to hear the name of the colors, select the Text-to-speech option.

If you wish to switch the screen to grey-scale, select the “Color-blind mode”

To add an object to the color name, scroll down and type the object.

4.1 <Given Function/Feature>

Not applicable to Clarity (all the features were listed in 4.0)

4.1.1 <Given Sub-Function/Sub-Feature>

Not applicable to Clarity (all the features were listed in 4.0)

5 Troubleshooting & Support

If the website stops responding, re-fresh the website.

5.1 Error Messages or Behaviors

If the detected color is not accurate or keeps detecting a different color, try placing the camera closer to the object.

5.2 Special Considerations

If applicable, describe any special circumstances, actions, caveats, exceptions, etc., that should be considered for troubleshooting

If the app starts malfunctioning as in, it glitches or fully freezes, try reloading the page until it is back to normal.

5.3 Maintenance

Describe regular maintenance that should be performed on the prototype to avoid failure.

No maintenance is required for the website in particular. As long as your device and your web browser of choice is kept in working condition, the website should keep working.

5.4 Support

If anything abnormal were to happen with Clarity, first follow the procedures provided in section 5.2, or contact any of the emails

6 Product Documentation

Explain in detail how the final prototype was built including design considerations and calculations. Separate it into categories that make sense for your prototype (mechanical, electrical, software, etc.) and explain the importance of each. If there are options for material/items that you considered or analyzed, explain which ones might be feasible and which ones that your analysis shows are not feasible (with some results to back up your statements, as required). This section should be tailored to your particular prototype.

For example, if stainless steel was an arbitrary choice for a particular part, you could indicate that other materials (e.g. plastic or wood) might also be an option but were not tested. However, if metal that resists corrosion is the basic requirement and you tested several materials before choosing stainless steel (i.e., the choice is not arbitrary) then you can indicate this here, along with supporting data. Sometimes, material needs to be swapped, if no longer obtainable or if no longer cost-effective, present any work that you did that might help another designer make material substitutions or even note the basic requirements (e.g., must resist corrosion in a humid room environment for 30 years).

The same is true for critical portions of software or expensive/sensitive electronic functionality. Basically, if you were worried about a portion of the design and “settled” on a particular solution or method, then it needs to be documented. This includes the testing or analysis that you did to arrive at that specific solution.

Support this explanation with relevant design files you have made (circuit diagram or mechanical diagrams, code, flowchart, 3D models, laser cutting files, etc.). Add pictures to help your explanation. This section should be presented like an [instructables manual](#) with many pictures and clear steps to create the prototype.

6.1 <Subsystem 1 of prototype>

6.1.1 BOM (Bill of Materials)

	Cost	Cost type (expense, labor, material)	Direct/indirect	Variability (fixed, semi- variable, variable)
Electricity	Around 0\$	Expense	Direct: Since Clarity is not affiliated with a larger corporation, this is a direct cost	Fixed: Fixed tuition costs covers university maintenance, including electricity.
Production Materials	Around 0\$	Material: Software	Direct: same reason as previously mentioned	Fixed: One time purchase for each material.
Rent	Around 0\$	Expense	Direct	Fixed: Must pay this amount

Phone plans	60\$ each (over 2 months)	Expense	Direct	Fixed: Must pay this amount regardless of other factors
Transportation	7.8\$ every other day (over 2 months)	Expense	Direct	Fixed: Must pay this amount regardless of other factors
Food	\$30 weekly per student		Direct	Variable: Sometimes some members did not eat during the session
Intellectual Property	Description		License	Source
Open Source Software: OpenCV	An open-source computer vision and machine learning software library with extensive tools for image and video analysis, including color detection.		3-clause BSD	Repository OpenCV on Github: https://github.com/opencv/opencv/blob/4.4.0/LICENSE
Numerical Python: NumPy	A fundamental library for scientific computing in Python, which provides support for large multi-dimensional arrays and matrices. It also allows for a collection of mathematical functions to operate on these arrays.		3-clause BSD	Repository NumPy on Github: https://github.com/numpy/numpy

Importance and Legal Constraints on developing our product:

Intellectual Property	Benefits	Legal Constraints	Impact On Product
OpenCV	<p>Cost effective: It is free.</p> <p>Reliable: Widely used in the industry, ensuring it is well-tested</p> <p>Flexible: Compatible with multiple programming languages</p>	<p>BSD licence:</p> <p>Permissive: allows for both open-source and proprietary use.</p> <p>Can be redistributed, only requiring proper attribution to the original authors of OpenCV.</p> <p>Must include copyright notice and a copy of the BSD license and if modified must include that you have changed files. It is not required to open-source the modifications</p>	<p>Advantage:</p> <p>We can freely use OpenCV in commercial products, which is a significant advantage for business development.</p> <p>As long as the product's documentation and distribution packages include the necessary attributions to comply with the BSD license, OpenCV is very beneficial</p>
NumPy	<p>Efficiency: Provides highly optimized, fast operations for numerical computation. This much more efficient than regular Python lists and loops</p> <p>Integration: Seamlessly with other scientific libraries (ex. Scipy)</p> <p>Ease of Use: Provides an easy-to-use interface for performing complex numerical computations</p>	<p>Same as OpenCV constraints, since they are under the same licence.</p>	<p>Leveraging a powerful, free library like NumPy can give a product a competitive edge in terms of development speed and cost-efficiency.</p> <p>Once again, with the correct attributions NumPy is very beneficial.</p>

6.1.2 Equipment list

All other the equipment that was needed to build this website:

- Computer
- Camera
- IDE (PyCharm)
- Speaker (for color read out loud)

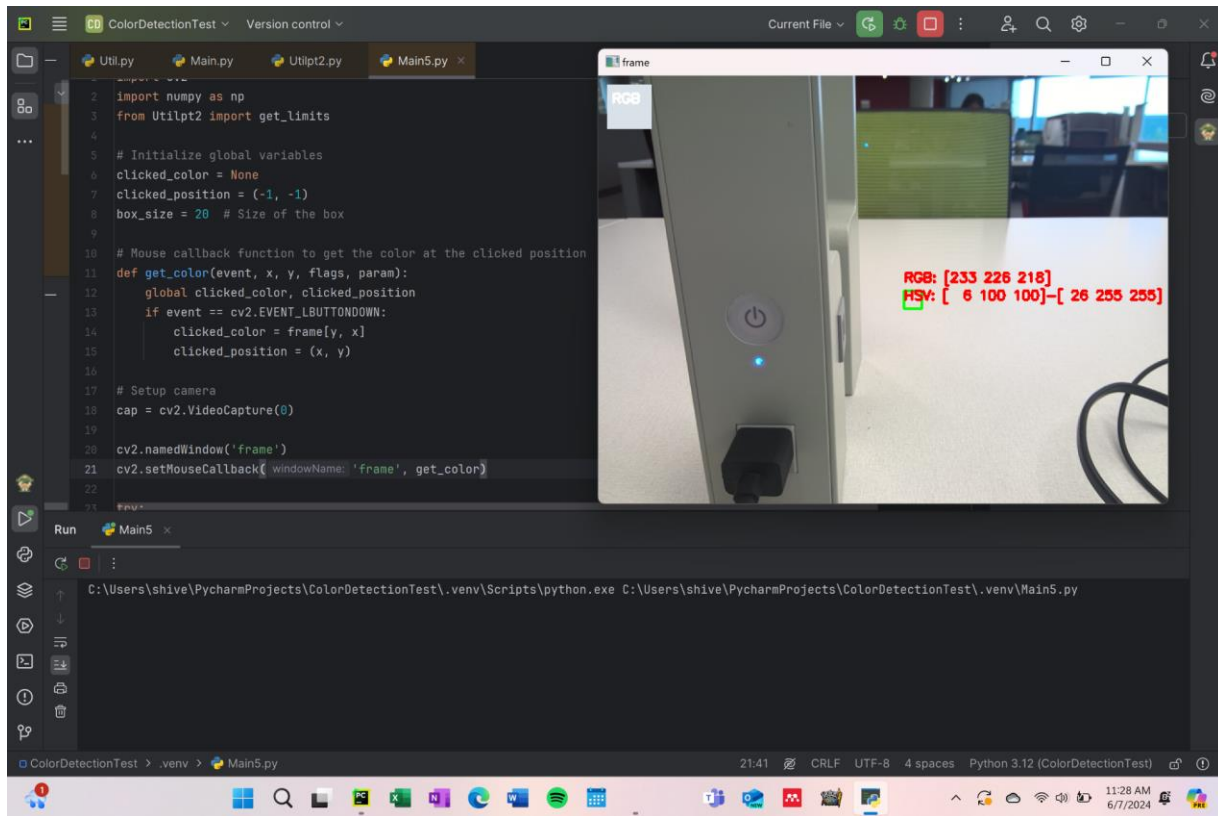
6.1.3 Instructions

Explain step by step instructions on how to build this specific subsystem. Include as many pictures as possible and diagrams for clear understanding of the process. Make sure to attach all files you are referencing.

6.2 Testing & Validation

First Prototype:

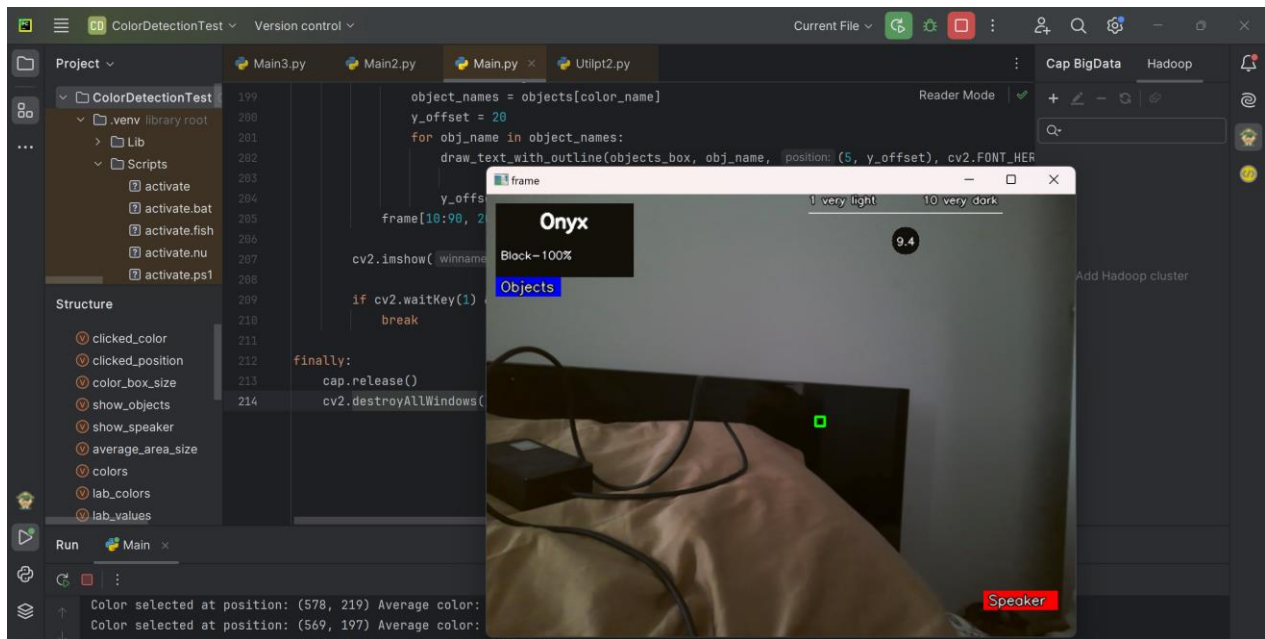
Category	Ideal Value	Marginally Acceptable Value	Actual Tested Values
Accuracy of Color Identification	98%	92%	Testing showed 10/10 detection, therefore 100% accurate color identification
Independent Usability	Completion of one task within 10 seconds	Completion of one task within 15 seconds	Tasks completed successfully within 10 seconds
Battery Consumption	Less than 5% battery usage per hour	Less than 10% battery usage per hour	Not used enough to determine
Error rate	Fewer than 1 error per 100 uses	Fewer than 5 errors per 100 uses	Testing showed 10/10 detection, therefore 100% accurate color identification



Second Prototype:

Product Assumption Not Yet Tested	Related DFX Factor	Tested Outcomes
Lightness/darkness of shade, that this will be shown as a percentage	Usability: Our client requested for the shade percentage as one of its functions, therefore providing this information will ensure that the website is usable for the customer.	Displays consistent 100% of a shade. The color is accurate but the intensity of the shade is not.
The addition of 2 colors when detecting color	Quality	Only displays one color
Testing code on website	Usability: Kate has requested a website or app	Attempted multiple times with no success yet
Menu expansion	Quality: This function is not necessary, however would increase the quality of the website	Not completed for prototype 2

Website can be accessed on phone	Reliability	The website is not running, therefore it cannot be accessed on a phone yet
Speed of website capture	Reliability	The website is not running, therefore speed cannot be tested yet



7 Conclusions and Recommendations for Future Work

Summarize your lessons learned and your work related to your prototype and suggest the most productive avenues for future work so that other groups can continue and improve upon your work.

What would you do if you had a few more months to work on this project? What are the things that your abandoned because of lack of time but would be important to add?

The primary lesson that our team learned from making this app is that a website functioning just like an app is far easier to make than an actual app. Our team was specifically tasked to make an IOS app for our client which tends to be harder as Apple is notoriously complicated to work with for app development. Nevertheless, the process of creating an app, especially with our limited knowledge in this field was very difficult to do. A much easier, and equally as effective of a solution turned out to be making a website. Knowing this sooner would have helped our team complete our task more easily.

For anybody looking to enhance our app, we suggest to keep testing the accuracy of the detector to eliminate any redundant color names and or inaccurate shade percentages. Making the app as consistent and accurate as possible will make it much more effective. Otherwise, adding

accessible features such as text size and brightness adjustability may make it more pleasant for any user.

The improvements we suggested above were some of the things we ran out of time to do and are hoping to someday fix/add if we are given more time.

8 Bibliography

Insert your list of references here.

APPENDICES

9 APPENDIX I: Design Files

Summarize the relationship of this document to other relevant documents. Provide identifying information for all documents used to arrive at and/or referenced within this document (e.g., related and/or companion documents, prerequisite documents, relevant technical documentation, etc.).

Include all design files in MakerRepo.

Also provide the MakerRepo link to your project.

Table 3. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date

10 APPENDIX II: Other Appendices

You can include other critical and important work here. Maybe they are not important in the structure of this document but need to be included.