

BE Project
CE Department
Project ID: BUKC-CE-2019-04
July, 2020



Bahria University
Discovering Knowledge

Color Classification and Detection System for Color Deficient People

Shizza Sohail
Zeeshan Amjad
Faisal Mumtaz

Department of Computer Engineering

Bahria University, Karachi Campus

Submission Performa

Name (1) Shizza Sohail
(2) Zeeshan Amjad
(3) Faisal Mumtaz

Address (1) 5 A – 3/14, Nazimabad No.5, Karachi
(2) House # 31, St-09, Sec IV Haroon Bahria HBCHS, Karachi
(3) House # D-189, St-19, Block 09, Gulistan-c-Jauhar, Airport (Karachi east)

Color Classification and Detection System for Color Deficient People
Engr. Usra Sami

This report is submitted as required for the Project in accordance with the rules laid down by the Bahria University as part of the requirements for the award of the degree of Bachelor of Engineering. We declare that the work presented in this report is our own except where due reference or acknowledgement is given to the work of others.

Signatures of students

Date

(1).....
(2).....
(3).....

20-07-2020
20-07-2020
20-07-2020

Signature of Supervisor

Date

.....

20-7-20

Acknowledgments

Firstly, all praise is to "ALLAH", the Almighty, the Greatest of all, on whom ultimately we depend for nourishment and guidance. We would like to thank Allah for giving us the opportunity, will power and strength to do our research work and to fulfill our commitments.

We would like to express our gratitude towards our Parents for their love and support throughout our lives, specially in the four years of our struggle. Thank you both for giving us motivation to reach for the stars and chase our dreams. Our family members deserve our wholehearted thanks as well.

We have taken a lot efforts in this project. However, it would not have been possible without the cooperation and kind support and help of many individuals and our university "Bahria University, Karachi Campus". We would like to extend our genuine gratitude to all of them.

We are highly indebted to our supervisor "Engr. Usra Sami" for her guidance, constant supervision as well as for providing necessary information regarding the project, for giving us such attention and time, her continuous support in meeting the deadlines and completing the project.

Thanks to the Head of Department (HOD), "Engr. Rizwan Iqbal" for his kind cheering which constantly motivated us in the completion of our project.

We are grateful to the PMO, " Engr. Huma Tabassum" for her responsiveness, cooperation, comprehension during the project. We respect her for understanding the problems faced by our team and her ability to solve them.

Thanks and appreciations to the team members for their ultimate collaborations and cooperation during the development of the project and people who have willingly helped us out with their abilities.

Abstract

In this project, we propose this study to help color deficient people to have equal chances with normal people in daily life as they have the physical defect in which they lose the ability to recognize colors either particular or the whole of them. This disability is problematic in daily life, moreover in some specific areas that require careful eyesight. This study designs an embedded system and mobile application for color deficient people. The system includes the hardware in which all the components such as Pi camera, SD card, USB and Device (Mouse, Keyboard) are connected with the Raspberry Pi and software in which when the Pi camera does live streaming so after that through python and using OpenCV library, Color detection and color model switching codes are implemented. The color in which the person is deficient is detected and then the color models are switched to another color model if the person face difficulty in seeing that color in current model. The user sees the switched models on the VNC Viewer on their preferable device.

Keywords: color deficiency, color detection, color model switching, raspberry pi, pi camera, OpenCV, VNC viewer, tkinter GUI

Table of Contents

1. INTRODUCTION.....	14
2. BACKGROUND AND LITERATURE REVIEW	19
2.1 EXISTING SYSTEM	19
2.2 PROBLEM IN THE EXISTING SYSTEM.....	21
3. SYSTEM ANALYSIS.....	22
3.1 WORK ANALYSIS	22
3.1.1 <i>Workflow Diagrams</i>	22
3.1.2 <i>Work breakdown structure</i>	23
3.2 DATA ANALYSIS	24
3.2.1 <i>Data Flow Diagram</i>	24
3.3 SYSTEM REQUIREMENTS	24
3.3.1 <i>Clients, Customers and Users</i>	24
3.4 RESOURCE REQUIREMENTS	25
3.5 DATA REQUIREMENTS.....	25
3.6 NON-FUNCTIONAL REQUIREMENTS	25
3.7 USABILITY REQUIREMENTS.....	25
3.8 RELIABILITY REQUIREMENTS.....	25
3.9 SECURITY REQUIREMENTS	25
3.10 PERFORMANCE REQUIREMENTS.....	25
3.11 MAINTAINABILITY REQUIREMENTS.....	25
4. SYSTEM DESIGN.....	26
4.1 DESIGN CONSTRAINTS	26
4.1.1 <i>Hardware and Software Environment</i>	26
4.1.2 <i>End-user Characteristics</i>	26
4.2 ALGORITHMS:	27
4.3 PROJECT MANAGEMENT STRATEGIES	28
4.3.1 <i>Distribution of Activities</i>	28
4.3.2 <i>Gantt Chart</i>	29
4.4 DEVELOPMENT METHOD.....	29
4.4.1 <i>Assumptions/ Constraints/ Standards</i>	30
4.5 ARCHITECTURE DESIGN	30
4.5.1 <i>Block Diagram</i>	30
4.5.2 <i>Logical View</i>	31
4.6 HARDWARE ARCHITECTURE	32
4.7 SOFTWARE ARCHITECTURE.....	33
4.8 SYSTEM DESIGN.....	34
4.8.1 <i>Use-case Diagram</i>	34
4.8.2 <i>Context Diagram</i>	35
4.8.3 <i>Sequence Diagram</i>	36
4.8.4 <i>Database Design</i>	36

4.8.5	<i>Data Conversions</i>	36
4.8.6	<i>SWOT Analysis</i>	37
4.9	USER INTERFACE DESIGN.....	37
4.10	PERFORMANCE	38
4.11	WORKING FLOW	39
5.	IMPLEMENTATION	40
5.1	DESIGNING PHASE.....	40
5.2	INTERCONNECTIONS B/W HARDWARE COMPONENTS	45
5.3	DESIGNING GUI USING TKINTER	46
5.4	VNC VIEWER:.....	46
6.	TESTING.....	50
6.1	FUNCTIONAL TESTING.....	50
6.1.1	<i>Test Risks/ issues</i>	50
6.1.2	<i>Items tested</i>	50
6.1.3	<i>Test Approach</i>	50
6.1.4	<i>Test Regulatory/ Mandate Criteria</i>	51
6.1.5	<i>Test Entry/ Exit Criteria</i>	52
6.1.6	<i>Test Suspension/ Resumption Criteria</i>	52
6.1.7	<i>Test Environmental/ Staffing/ Training needs</i>	52
6.2	PERFORMANCE TESTING	52
6.2.1	<i>Load testing</i>	52
6.2.2	<i>Test risks/ issues</i>	53
6.2.3	<i>Items tested</i>	53
6.2.4	<i>Test Approaches</i>	53
6.2.5	<i>Test Regulatory/ Mandate Criteria</i>	53
6.2.6	<i>Test Entry/ Exit Criteria</i>	54
6.2.7	<i>Test Deliverables</i>	54
6.2.8	<i>Test Suspension/ Resumption Criteria</i>	54
6.2.9	<i>Test Environmental/ Staffing/ Training needs</i>	54
6.3	STRESS TESTING.....	54
6.3.1	<i>Test risks/ issues</i>	54
6.3.2	<i>Items tested</i>	55
6.3.3	<i>Test Approach</i>	55
6.3.4	<i>Test Regulatory/ Mandate Criteria</i>	55
6.3.5	<i>Test Pass/ Fail Criteria</i>	55
6.3.6	<i>Test Entry/ Exit Criteria</i>	55
6.3.7	<i>Test Deliverables</i>	56
6.3.8	<i>Test Suspension/ Resumption Criteria</i>	56
6.3.9	<i>Test Environmental/ Staffing/ Training needs</i>	56
6.4	SYSTEM TESTING	56
6.4.1	<i>Test risks/ issues</i>	56
6.4.2	<i>Items to be tested</i>	56
6.4.3	<i>Test Approach</i>	56
6.4.4	<i>Test Regulatory/ Mandate Criteria</i>	58
6.4.5	<i>Test Pass/ Fail Criteria</i>	59

6.4.6 Test Entry/ Exit Criteria..... 59

6.4.7 Test Suspension/ Resumption Criteria..... 59

6.4.8 Test Environmental/ Staffing/ Training needs 59

7. RESULT AND DISCUSSION 60

7.1 INTRODUCTION..... 60

7.1.1 VNC Viewer Connection..... 60

7.1.2 Tkinter Output..... 60

8. CONCLUSION AND FUTURE WORK 61

8.1 CONCLUSION..... 61

8.2 FUTURE WORK 61

Figure 3.1: Project Overview 24

4. System Design 26

Figure 4.1: System Overview 29

Figure 4.2: Home Page of the project 30

Figure 4.3: Login page of the system 31

Figure 4.4: Software Architecture View of the System 32

Figure 4.5: Raspberry Pi 3 Model B1 33

Figure 4.6: Pi Camera 34

Figure 4.7: System Architecture 35

Figure 4.8: Live view captured by the web camera 36

Figure 4.9: Control diagram for the workflow of the system 37

Figure 4.10: Sequence diagram for the workflow of the system 38

Figure 4.11: SWOT ANALYSIS of the system 39

Figure 4.12: UML of an application 40

Figure 4.13: Working flow of the project 41

5. Implementation 42

Figure 5.1: Hardware to install the OS using Windows 43

Figure 5.2: Increasing the SWAP 44

Figure 5.3: Restoring the SWAP service command 45

Figure 5.4: Optimizing the OpenCV on Raspberry Pi 46

Figure 5.5: Using the work on Pip Command 47

Figure 5.6: configuring the build command 48

Figure 5.7: Inspecting the output of Cmake 49

Figure 5.8: Configuration of OpenCV 4 50

Figure 5.9: Installing OpenCV on Raspberry Pi 51

Figure 5.10: Installing OpenCV 52

Figure 5.11: Installing OpenCV library 53

Figure 5.12: Installing OpenCV on Raspberry Pi 54

Figure 5.13: Displays the new test option 55

Figure 5.14: Response for the web camera 56

Figure 5.15: Connected for the port of Raspberry Pi 57

Figure 5.16: Accessing raspberry pi using VNC 58

Figure 5.17: Command to close the terminal 59

Figure 5.18: Server connection Error 60

6. Testing 61