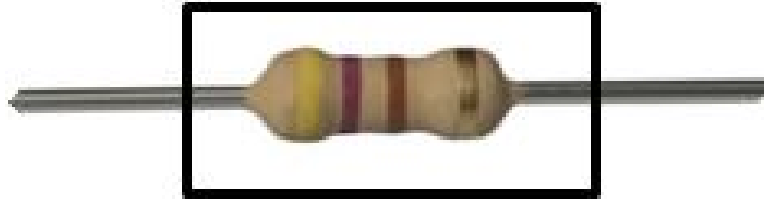


RESISTOR READER MOBILE APPLICATION



SOFTWARE REQUIREMENTS SPECIFICATION

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1 Introduction

1.1 Purpose

The purpose of this document is to describe the functionality, usage, and construction of the Resistor Reader application being created at the request of Dr. Timothy Usher, Department of Physics, CSUSB, and as part of the CSE 455 (Software Engineering) class. This document will include details of the project's requirements, interface, design, and potential issues.

1.2 Scope of the Project

“Resistor Reader” will be a mobile application used by students and faculty working in engineering fields. The primary goal of the application will be to provide a simple and effective means of determining the resistance of a single resistor to facilitate work by these individuals.

The application is also intended to assist colorblind individuals in identifying the resistance values of resistors they would otherwise be unable to read, in order to improve their ability to use these important circuit components properly.

1.3 Definitions, Acronyms, and Abbreviations

Apple Inc. Apple Inc.

Makers of the iOS mobile operating system.

Ampere Ampere (A)

The unit of measure for electric current.

Android Android

An operating system developed by Google and used for smartphones.

Google Google

Makers of the Android mobile operating system.

iOS iOS

An operating system developed by Apple Inc and used for smartphones.

Java Java

The programming language used for Android development.

Joule Joule (J)

The unit of measure for voltage.

Ohm's Law Ohm's Law

$V = IR$ where V is voltage in Joules, I is current in Amperes, and R is resistance in Ohms.

Ohms Ohms (Ω)

The unit of measure for resistance.

OpenCV OpenCV (Open Computer Vision)

A free and open source library for image processing handling.

Play Store Play Store

The application on standard Android devices through which users download applications.

Resistor Resistor

A circuit component that provides resistance as defined by Ohm's Law.

1.4 References

1. IEEE Std 830-1998 Software Requirements Specification
2. Ohm Sense iOS Application — itunes.apple.com/us/app/ohm-sense/id453570510
3. Student Advising SRS, CSE 455

1.5 Overview

The next section, “Overall Description”, will provide an overview of the mobile application functionality. It will describe the informal requirements and establish a context for the technical requirements specification in the next chapter. The third section, “Requirements Specification”, will describe the product's functionality in technical detail. Sections two and three will collectively describe the entirety of the application, but are intended for different audiences and will thus use different language appropriate to those audiences.

2 Overall Description

2.1 Product Perspectives

The application will provide the following features:

- A camera with guides to scan the resistor
- The total resistance value of the resistor
- The translation of each colored band on the resistor
- The resistor's tolerance value, if indicated by an optional band

2.1.1 System interfaces

The application will be done in entirely native code, and so will not need to interface with any external data sources. It will need to interface with Android-provided APIs according to the following diagram:

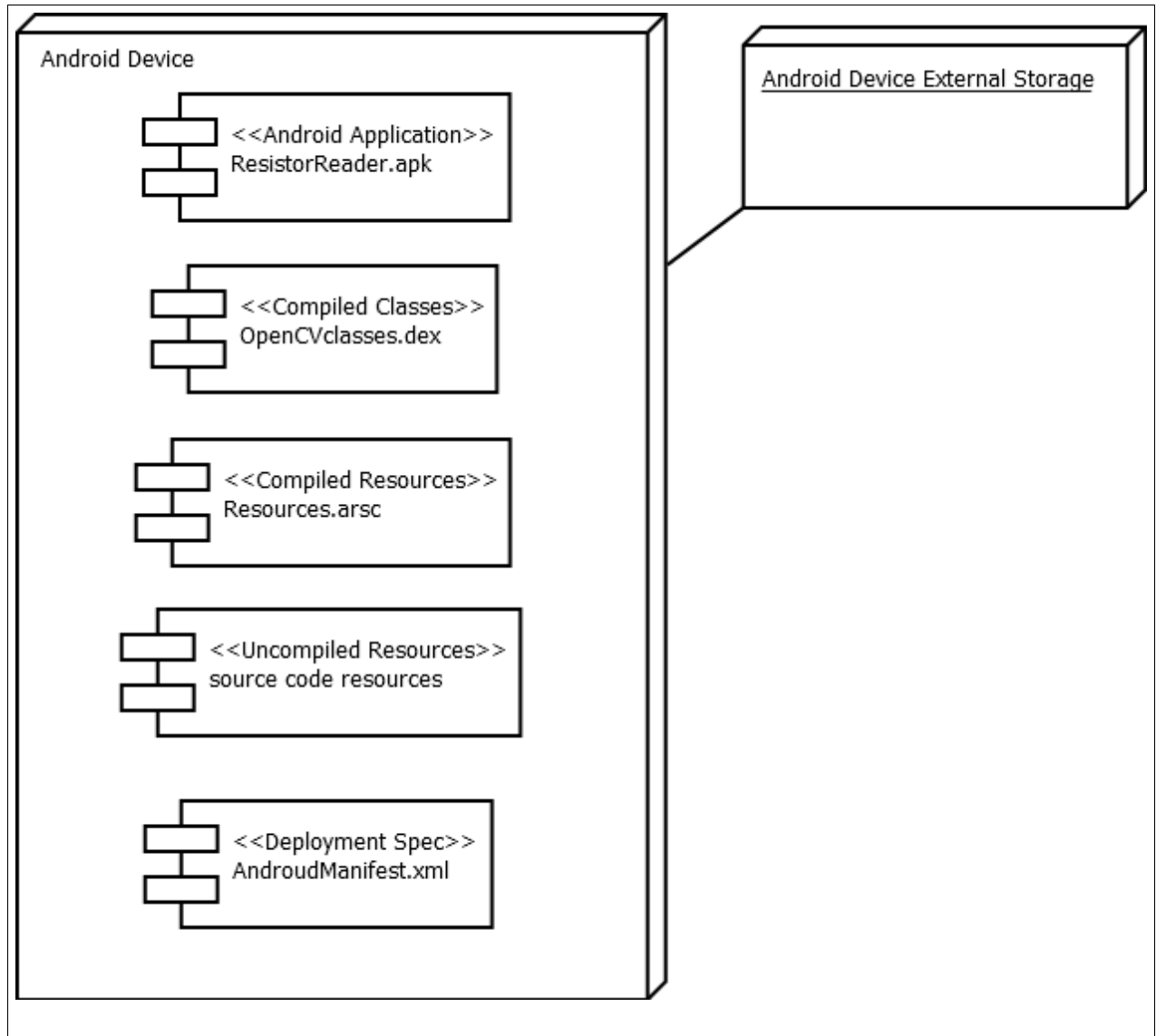


Figure 1: Resistor Reader App Deployment Diagram

2.1.2 User interfaces

There will be two distinct user interfaces presented in the application.

1. *Camera Interface:* This is the interface opened when the user starts the application. It presents the user with an outline of a box in the center of the screen. The user is

prompted to take a picture of a resistor while positioning the camera such that the resistor is contained entirely within the box.

2. *Results Interface*: This is the interface opened after a user has taken a picture of their resistor. It presents the user with the amount of resistance the given resistor has, as well as a breakdown of how that determination was made. It also provides the user with a back button to return them to the camera.

2.1.3 Software interfaces

The application will make use of the Java version of the Open Computer Vision (“OpenCV”) library. It will use this library to assist in image processing and handling. This will allow the application to identify and interpret a resistor’s colored bands, thus enabling the application to properly determine the resistor’s resistance value.

2.1.4 Communication interfaces

This application will not be calling on any outside library or data source. All calculations will be done natively to allow for fast response times and to avoid a requirement that the user’s Android device be connected to the Internet via Wi-Fi, 2G, 3G, 4G, 4G LTE.

2.1.5 Memory

The application will be designed to minimize RAM usage while maintaining quality and efficiency in image processing. The following restrictions will exist for RAM.

- The application will not exceed 100MB of RAM.
- The application will use no more than 5MB of disk space.

The actual values will vary depending on the operating system and phone.

2.1.6 Operation

The app will be available for download and use without downtime in perpetuity, assuming that it is never removed from the Google Play Store without the developer’s consent.

2.1.7 Site Adaptation Requirements

No adaptation is required.

2.2 Product Functions

The following diagram is a complete description of all application use cases:

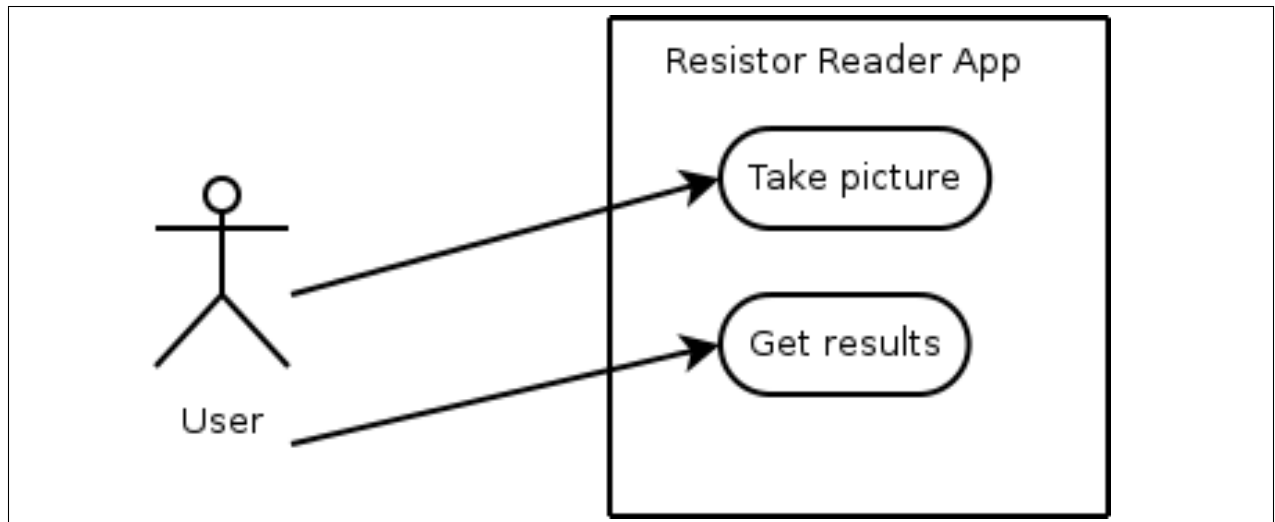


Figure 2: Resistor Reader App Use Case Diagram

2.3 User Characteristics

There are three general types of users, each of whom (due to the simplicity of the application's functionality) will engage with the application in the same way. These types are: students, faculty, and the colorblind. These categories may overlap (for example there may be a student who is also colorblind), but that has no bearing on the usage of the application. In all cases the application will be used to provide a quick and accurate readout of the resistance value and tolerance value of a single resistor.

2.4 Constraints

2.4.1 Operating Systems

The application will run only on version 4.0 and up of the Android mobile operating system to guarantee the availability of certain necessary device APIs.

2.4.2 Device Utilities

The application will only run on an Android device with a working camera so that the user is able to take a picture of the resistor they want measured. This is to make sure that the user is never unable to use the app due to a hardware limitation.

2.4.3 Accessibility

Given that the colorblind are one of the potential types of users of this application, care will be taken to ensure that the application is accessible to colorblind users.

The app will also be able to be used one-handed, and all application screens will be designed to facilitate this.

2.5 Assumptions and Dependencies

We will require a minimum of Android 4.0 on the user's device. See "Operating Systems" for further explanation.

3 Specific Requirements

3.1 External Interface Requirements

This application will not be connecting to any external interfaces, and so has no requirements for them.

3.2 User Interfaces

The following mock-ups represent the intended application interface:

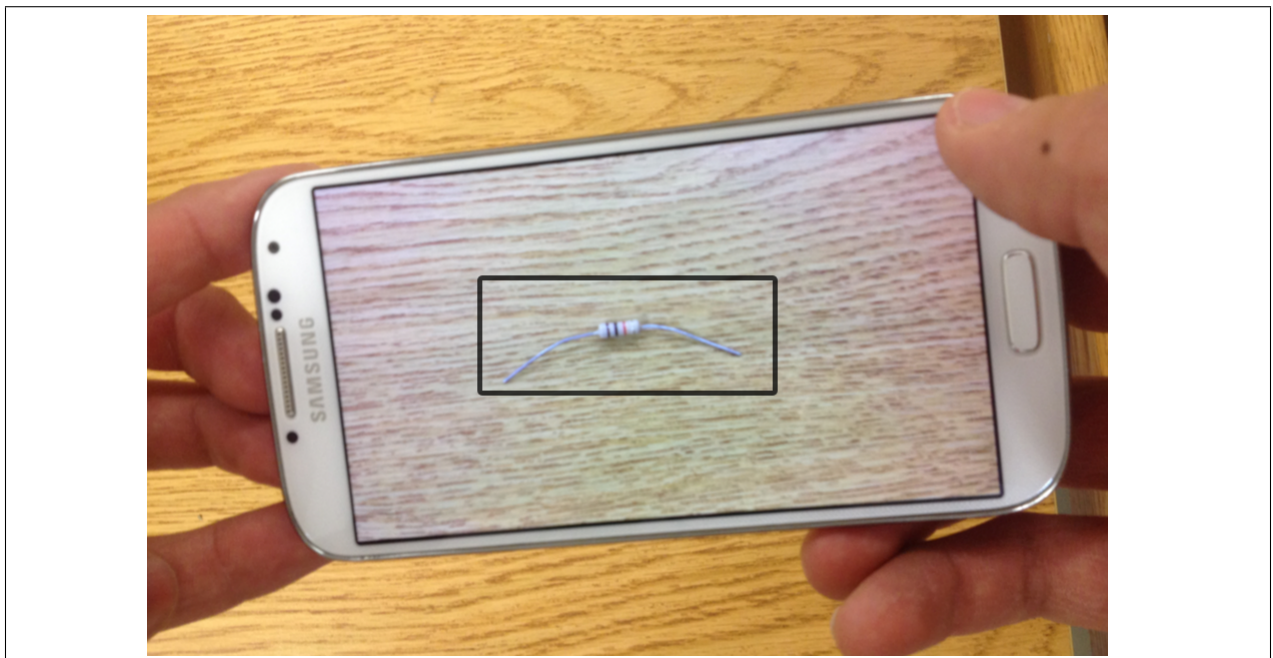


Figure 3: Mockup of the opening camera screen.

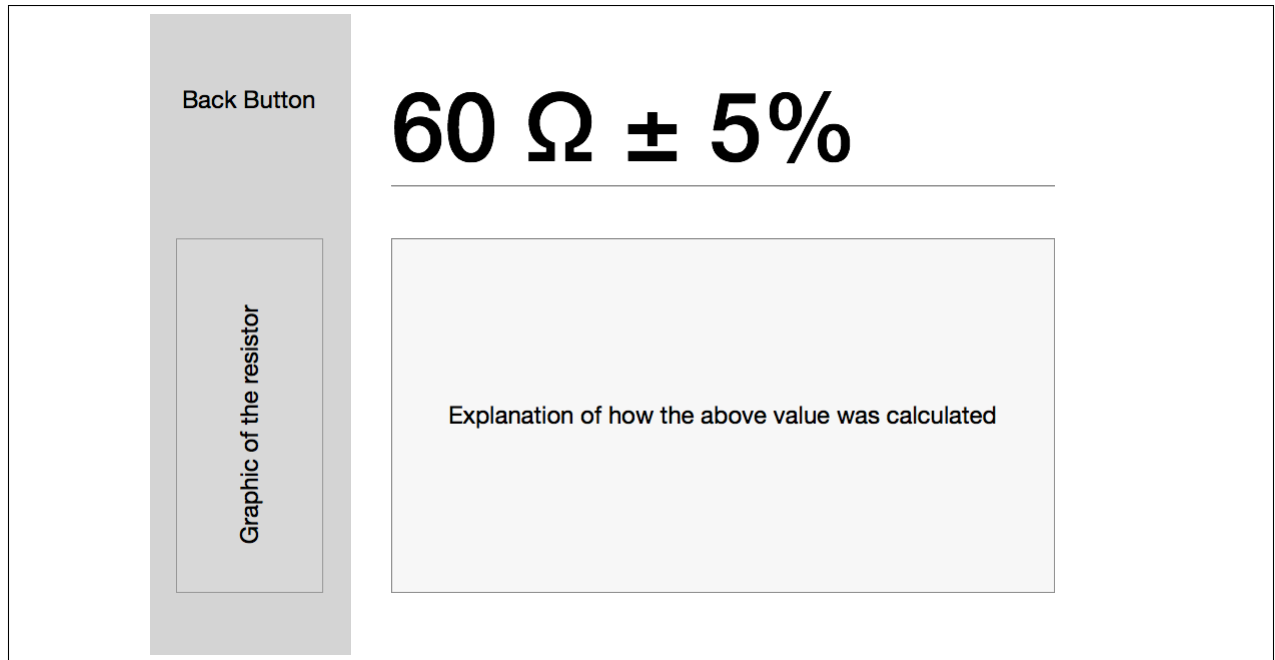


Figure 4: Mockup of the results screen.

3.3 Hardware Interfaces

The application shall be able to access and utilize a camera on the device through system-provided APIs.

3.4 Functional Requirements

The following functional requirements will be implemented:

1. Take a picture of a resistor. Display results describing the resistor's resistance and tolerance values.

3.5 Performance Requirements

We require the following performance measurements to be met:

1. The application will be up within 3 seconds across all devices.
2. After a picture is taken, results will be presented in under 3 seconds.

The application will take up to 3 seconds to start; the same amount of time it would take for an average Android device to load up your camera.

The application scanning function, after taking the picture of the resistor, will output the results in under 1 second. This value may be adjusted based on OpenCV testing benchmarks and hardware limitations.

Loading times will be constrained by color reading process complexity in the application.

3.6 Design Constraints

The design constraints for this iteration are as follows:

1. Any graphics will be designed to scale for both tablet and phone sized devices for an equal experience.
2. The application design shall be usable by colorblind individuals.

This application should feel as if you are taking a picture on Instagram or scanning a barcode in your barcode scanning application. Instead of waiting for the customized picture screen or the results of your barcode, it will load your resistor amount.

3.7 Software System Attributes

The software system must be running a version of Android greater than or equal to version 4.0, and must have the proper APIs available to access a working camera on the device.

Maintenance for the software shall include reviewing and improving the result-rate of the application, and the accuracy of the results themselves.

3.8 Other Requirements

The application will be used by students, faculty, and the colorblind. Although potential overlap exists between these categorizations, the usage of the application remains the same.

Given that the product will be used solely for resistor reading, it is unlikely that it will be a frequently-used product. The application shall have no utility outside of reading resistors.

The product will be made available through the Google Play Store, which shall be the only means of distribution to consumer Android devices.

The algorithm for color detection and results calculation shall remain consistent across all resistors tested against the application.

3.9 Document Approval

Document must be approved by:

- John Murad
(Project Manager)
- Dr. Arturo Concepcion
(CEO)
- Dr. Timothy Usher
(Client)