



E L E O S

Eleos Smart Mirror

Capstone Project

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Problem Statement

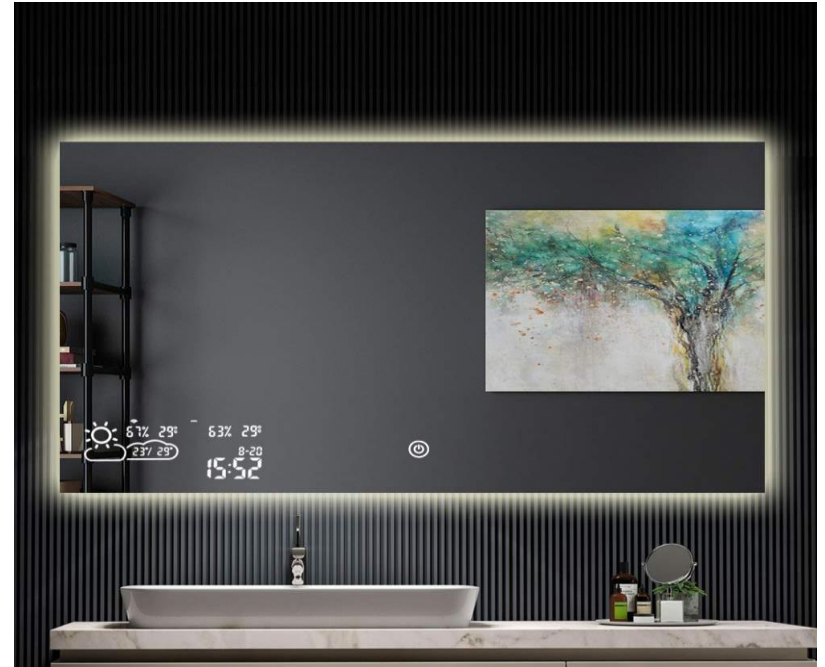
Mirrors are part of our everyday lives

- ❖ Untapped in technological innovation
- ❖ Sufficient but not meaningful



Existing Solutions

- ❖ Majority of products are DIY
- ❖ Pre-made are expensive
- ❖ Lackluster functionality
- ❖ Poor customization



Achieved Objectives

- ❖ Converted traditional furniture to increase productivity.
- ❖ Mirror provides innovative solutions with user friendly application.
- ❖ Added modifiable widgets:
 - Clock
 - Face Statistics
 - Weather forecast
 - Calendar with Events
 - Voice Commands



Engineering Design

Utilized University Courses

- Capstone I, Capstone II, Software Project Mgmt, Ethics
- Android Studio, Computer Security, Data Management
- Embedded Systems, Systems Programming, Software Quality
- Microprocessors, Architecture, IoT, UI,
- OOP, Data Structures, Algorithms, AI, ML, Data Mgmt
- Cloud Computing

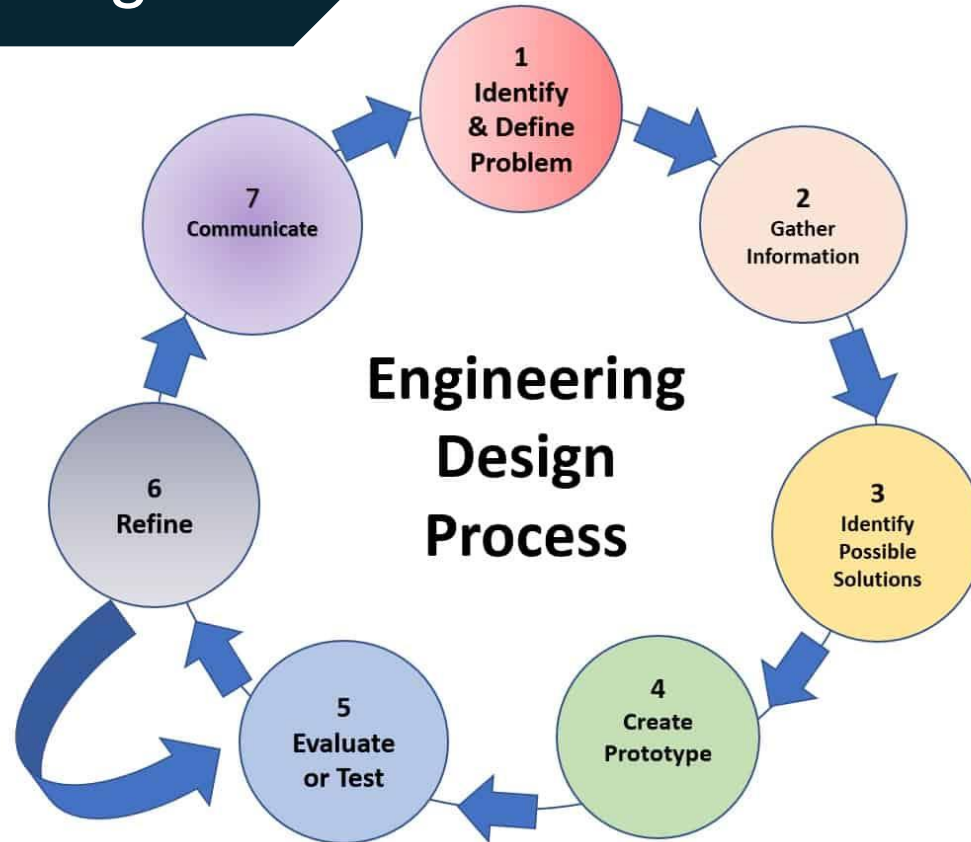
Software Engineering Program Map 2015-2016						
Year	Course	Course	Course	Course	Course	Course
1-1	COMM 1050U Technical Communications	ENGR 1015U Introduction to Engineering	MATH 1010U Calculus I	MATH 1850U Linear Algebra for Engineers (Coreq: MATH 1010U)	PHY 1010U Physics I	
1-2	CHEM 1800U Chemistry for Engineers	SSCI 1470U Impact of Science and Technology on Society	ENGR 1200U Introduction to Programming for Engineers	MATH 1020U Calculus II (Prereq: MATH 1010U)	PHY 1020U Physics II (PHY 1010U)	ENGR 1025U Engineering Design (ENGR 1015)
2-1	ELEE 2110U Discrete Mathematics for Engineers (MATH 1020U, MATH 1850U)	ELEE 2790U Electric Circuits (MATH 1020U, PHY1020U, MATH 1850U)	SOFE 2710U Object Oriented Programming and Design (ENGR 1200U)	SOFE 2800U Web Programming (ENGR 1200U)	Liberal Studies Elective	
2-2	SOFE 2715U Data Structures (SOFE 2710U)	ELEE 2450U Digital Systems (ELEE 2110U)	Science Elective	SOFE 2720U Principles of Software and Requirements Engineering (SOFE 2710U, SOFE 2800U)	STAT 2800U Statistics and Probability for Engineers (MATH 1020U)	
3-1	ELEE 3450U Microprocessors and Computer Architecture (ELEE 2450U)	SOFE 3650U Software Design and Architecture (SOFE 2720U)	SOFE 3770U Design and Analysis of Algorithms (ELEE 2110U, SOFE 2715U, MATH 1850U)	SOFE 3200U Systems Programming (SOFE 2720U)	SOFE 3700U Data Management Systems (SOFE 2715U, SOFE 2720U)	Liberal Studies Elective
3-2	ENGR 3360U Engineering Economics	SOFE 3490U Software Project Management (54 credit hours)	SOFE 3720U Introduction to Artificial Intelligence (SOFE 3650U, SOFE 3770U)	SOFE 3950U Operating Systems (SOFE 3200U, ELEE 3450U)	SOFE 3850U Software Quality (SOFE 3200U, SOFE 3650U, SOFE 3700U, SOFE 3770U)	SOFE 3850U Computer Networks (54 credit hours)
4-1	ENGR 4840U Capstone Systems Design for Electrical, Computer and Software Engineering I (Successful completion of all non-elective courses in year three)	SOFE 4790U Distributed Systems (SOFE 3770U, SOFE 3850U, SOFE 3950U)	SOFE 4350U User Interfaces (SOFE 3650U)	SOFE 4590U Embedded Systems (ELEE 3450U, SOFE 3950U)	Engineering Elective	
4-2	ENGR 4841U Capstone Systems Design for Electrical, Computer and Software Engineering II (ENGR 4840U)	ENGR 4760U Ethics, Law and Professionalism for Engineers	SOFE 4840U Software and Computer Security (SOFE 3850U, SOFE 4790U)	Engineering Elective	Engineering Elective	



Engineering Design

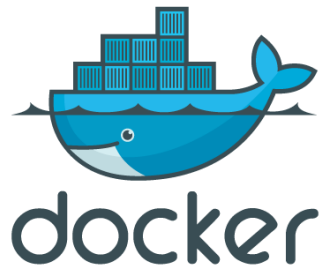
Focal Points

1. Reliability
2. Functionality
3. Simplicity
4. Security
5. Scalability



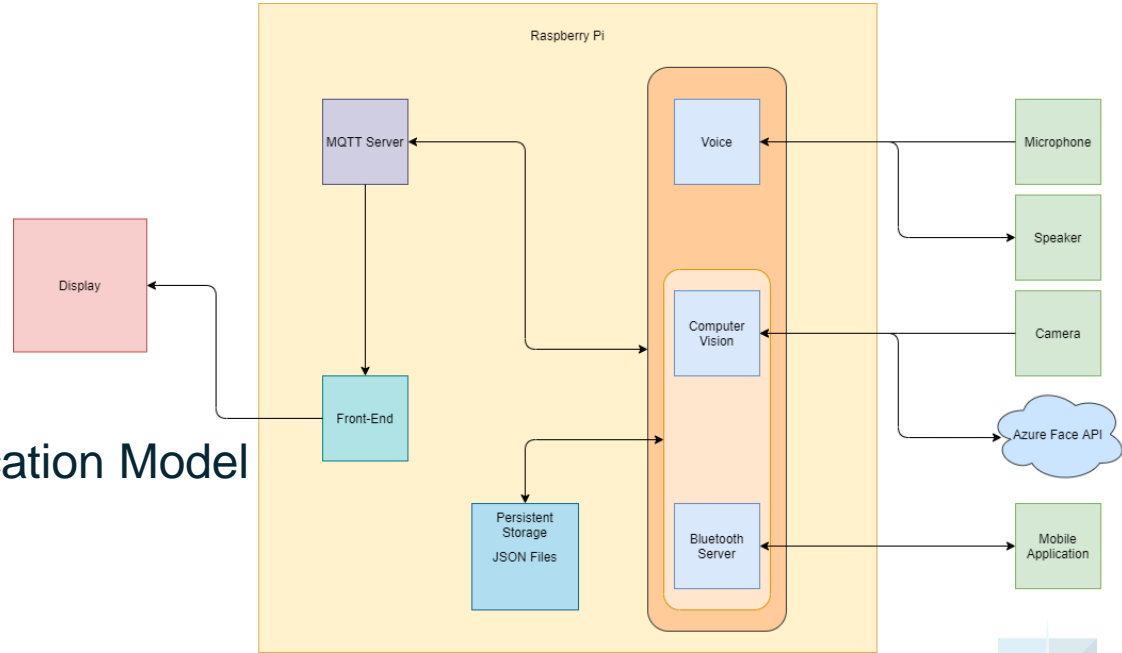
Engineering Design

- ❖ Magic Mirror²
- ❖ Google Assistant
 - Dialogflow
 - Firebase
- ❖ OpenCV
- ❖ MQTT
- ❖ Docker



Architecture

- ❖ Local Architecture
- ❖ Individual Software Modules
- ❖ Machine Learning
 - Facial Recognition
 - Emotional Analysis
- ❖ Voice Recognition
- ❖ Mobile Application
- ❖ Publish/Subscribe Communication Model
- ❖ Bluetooth
- ❖ WiFi Connectivity



Design Breakdown

❖ Hardware & Components

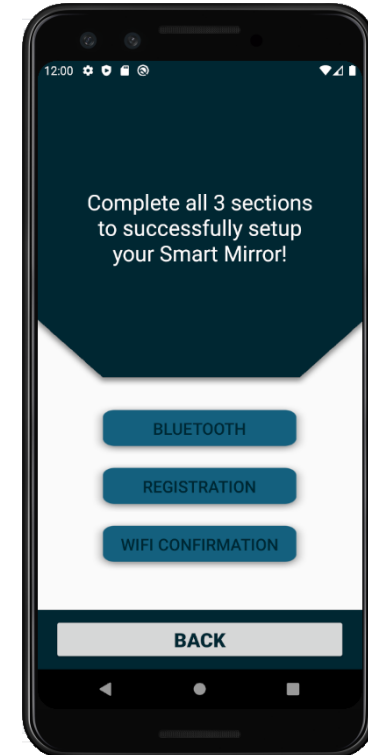
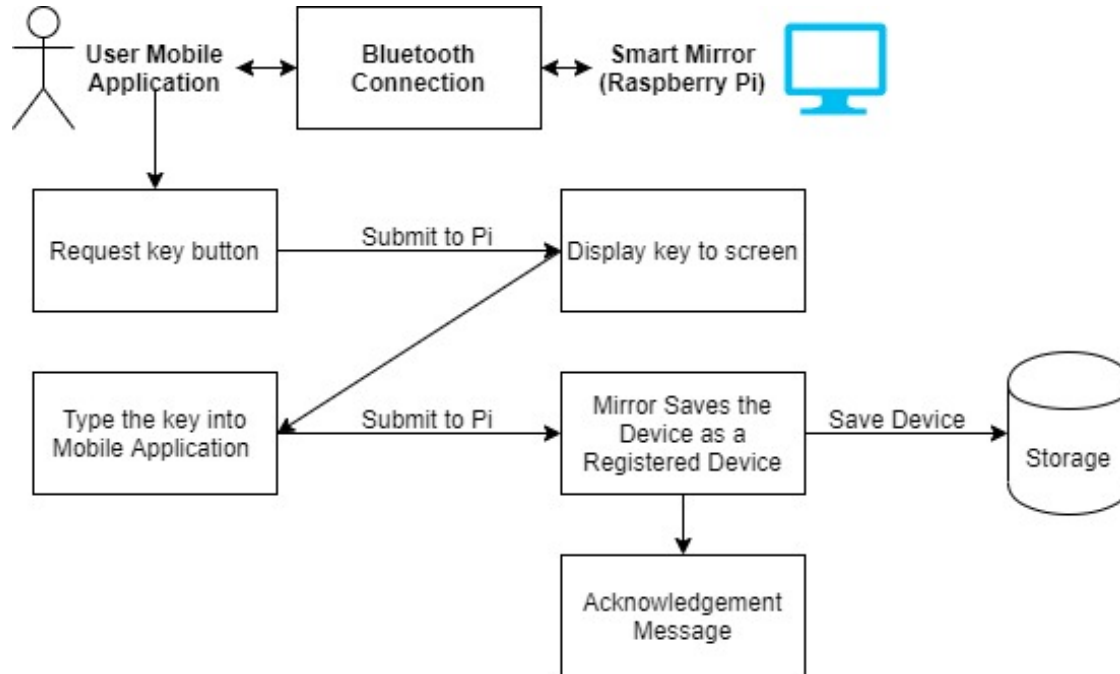
- Acrylic Two Way Mirror
- Monitor
- Microphone
- Camera
- Speaker
- Raspberry Pi



The Build

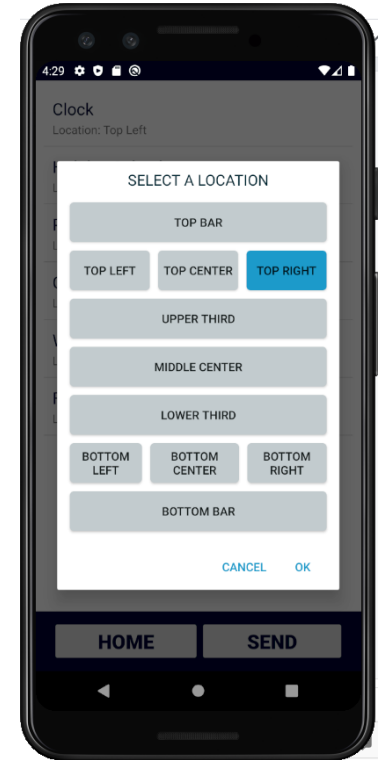


Communication Flow



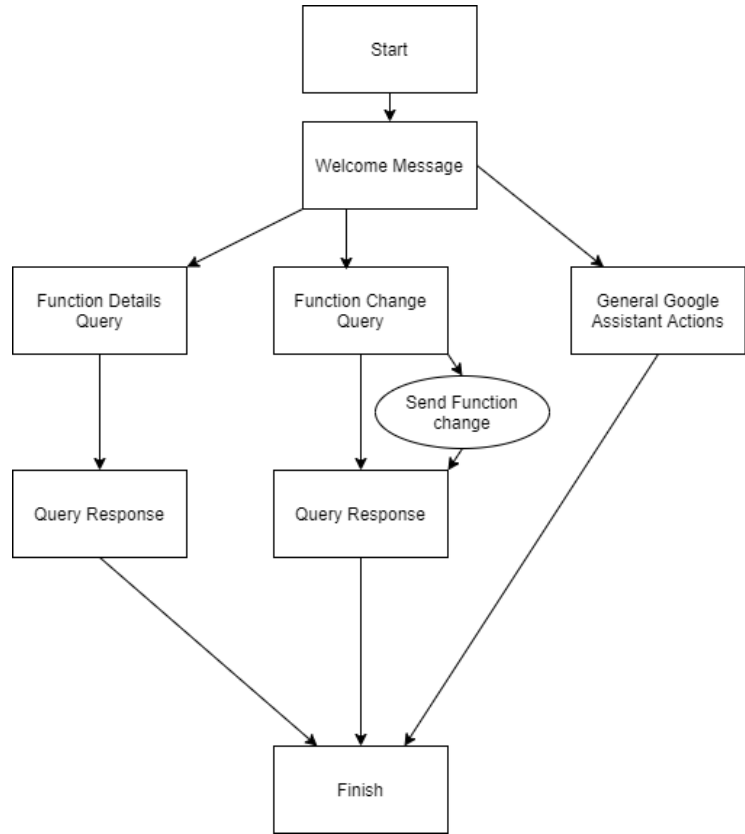
Communication Flow

- ❖ Mobile app used to customize
- ❖ Customization enables dynamic information display
- ❖ Selected widgets can be placed in any of the sections shown.
- ❖ Increased ease of use

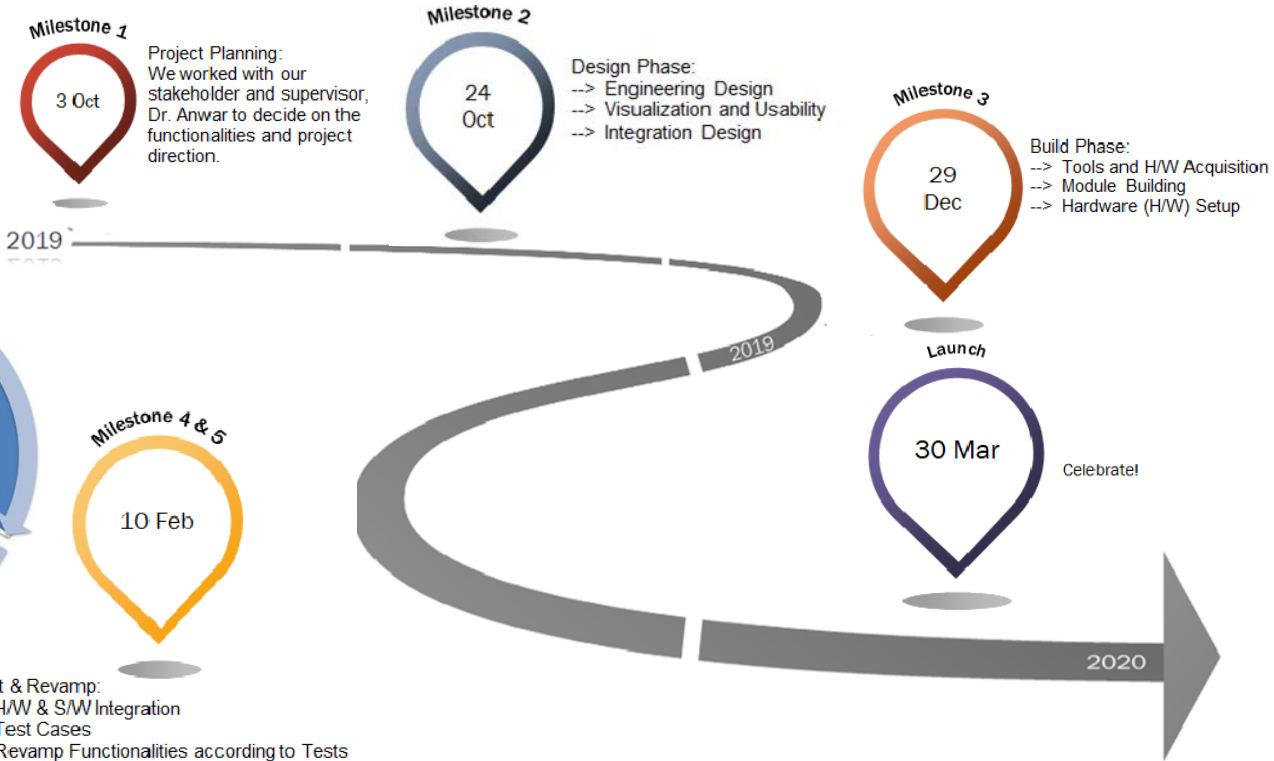


Communication Flow

- ❖ Voice recognition conversation flow
- ❖ Changes were made from original design



Analysis Process

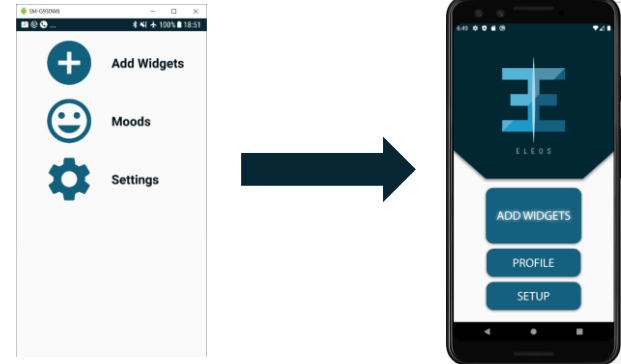


Design Revisions

Implemented changes under consultation from Dr. Anwar:

- Modified Features
- Added more functionalities
- Removed foreseen hazards
- Improved Machine Learning

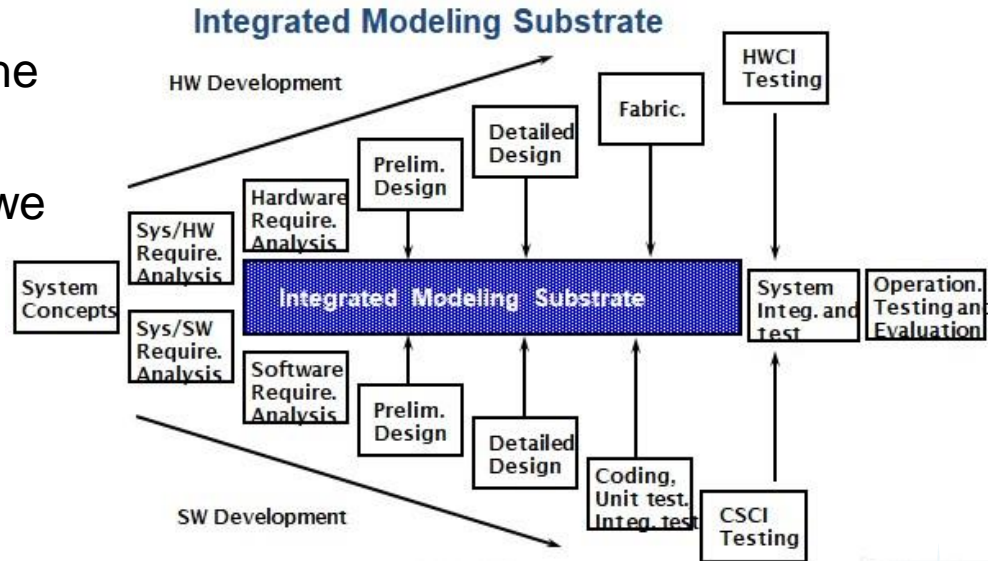
- Moved recording of facial recognition from app and moved it to the mirror
- Removed moods page in mobile application since we chose not to have LED strips as they are foreseen hazards
- Added Profile page to setup up user profile
- Added Setup page
 - Bluetooth, Registration, Wifi
- Improved UI



Product Testing Approach

How we approached the testing

- Incremental review throughout the design process
- Utilized this methodology since we have H/W & S/W

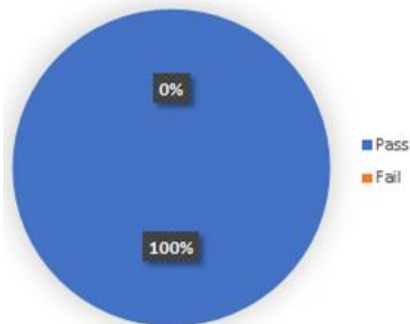


→ Utilized Automated Testing Python using unittest Framework

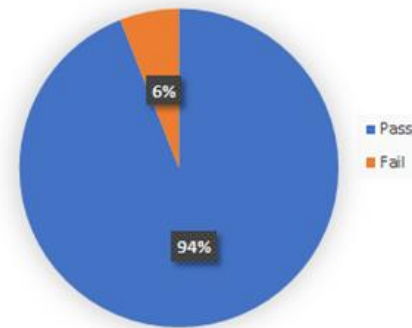


Simulation Results

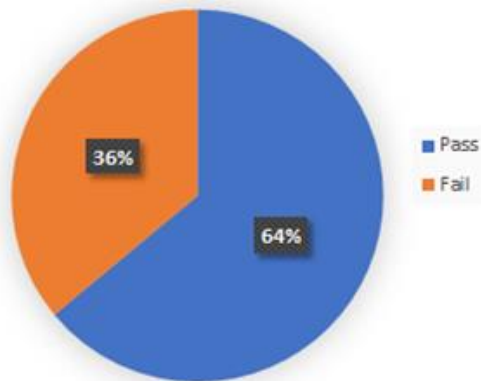
Facial Detection



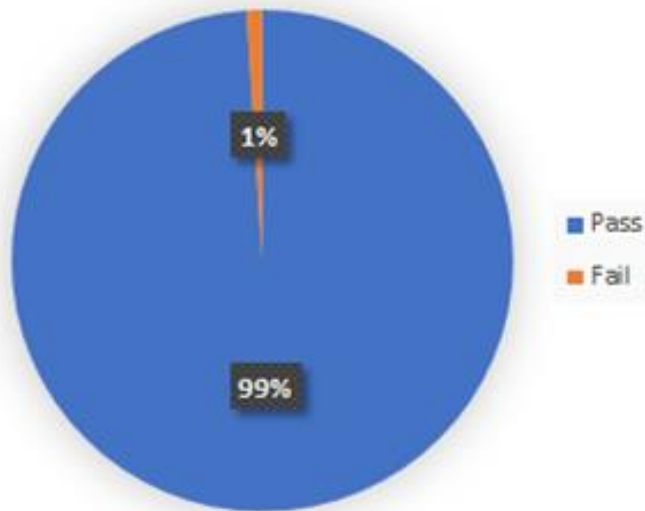
Facial Recognition



Emotional Detection



Revised Emotional Detection



Azure Face API



Takeaway Note

The best products that come out in the market are the things that most people don't know that they need.

Demonstration

