**LIVE VIEW CONTACT LENS SYSTEMS FOR COSPLAY**

By

Tan Ai Tee

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfilment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEMS (HONS)

INFORMATION SYSTEMS ENGINEERING

Faculty of Information and Communication Technology
(Perak Campus)

JAN 2018

**UNIVERSITI TUNKU ABDUL RAHMAN**

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# ACKNOWLEDGEMENTS

# ABSTRACT

This project is to develop a mobile application related to the product visualization and virtual try on solution for contact lens users, retail and mobile commerce by experiencing the Augmented Reality technology. This project focus on contact lens virtual try on called live view contact lens system which is used for business purpose that helps to improve the e-commerce business in becoming more efficient and effectively. There are hundreds to thousands of patterns, design or colour of contact lens, it is easy to purchase a wrong design due to the reason that customers are unable to try on the contact lens before purchasing.

Due the problem stated, this project used Augmented Reality technology and also facial recognition technology to allows seller to import their contact lens picture or photo with different design, pattern and colour into this application and allow seller to integrate with this application to let customers especially cosplayers to test different designs of contact lens by using their own face before they purchase.

The basic components for this project are camera and MEMS sensor such as accelerometer. Most of the smartphone devices in the general population of smartphone holders contains these sensors. This project is specially developed for the contact lens seller or contact lens user especially cosplayer. It is intended to increase the effectiveness and efficiency of e-commerce business and meets the needs of customer. In addition, it provides customer or cosplayer more convenient and less error prone when they purchase contact lens.

With the help of advanced AR and Facial Recognition technology, this project will greatly help and contribution to the e-market.

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| | |
|---|---|
| *AR* | Augmented Reality |
| *CPU* | Central Processing Unit |
| *MEMS* | Microelectromechanical systems |
| *OS* | Operating System |
| *PNG* | Portable Network Graphics |

**CHAPTER 1: INTRODUCTION**

**1.1 Problem Statement and Motivation**

To shop online while at home has started to become the new trend because no one wants to take an hour to bathe, travel and walk around in a shopping complex just to find out that the shop has been closed or the product was sold. Therefore, shopping at home brings a new level of convenience to the customers while saving time and costs for both seller and buyer. However, there are some issues that have been discovered recently as the variety of the product has been increasing, while the product previews are not as promising as displayed.

**1.1.1 No preview of contact lens before purchase**

E-commerce business means the whole transaction will be carried out though online communication, nor see the items physically. Therefore, customer can only purchase products based on the photo provided by the seller or E-commerce website. Contact lens have a wide variety of designs up to hundreds or thousands of different patterns, designs and colours. Customer will often face difficulties to ensure the product purchased would meet their needs. If a customer is dissatisfied on the product, it is only natural that the customer will not purchase from the same store again. It is important to retain customers by providing a better online shopping environment and fulfil the needs of the customers. If the company do not invest in customer loyalty, the company will end up losing more customers than it can gain.

**1.1.2 Current market applications perform generally poor**

It can be seen obviously in the market, they are a lot of virtual try on eyeglasses, cloth, watch and jewellery but it is lack of virtual try on for the contact lens. Besides, some of the seller just provide this feature by using model photo or allow customer to upload their own photo. There are not many applications that allow users to use live camera by using facial recognition and Augmented Reality technology. It is one of the innovative idea and the first step to spread this technology. If the seller provides this feature in their business, it will help reduce the return rate. Since the possibility of purchasing the wrong contact lens will drop. Hence, it is important to reduce return rates to increase the reputation of the business and confidence in customer loyalty.

## 1.2 Project Scope

A mobile application will be delivered at the end of this project. The application enables seller to use this application on their E-commerce website or mobile commerce to sell contact lens with the ability to display try on previews. Therefore, sellers need to inject PNG files with transparent background into the application to enable the try on preview.

The application can be categorised as a module that can be embedded into pre-existing Android applications or E-commerce websites. The final project should provide a high quality live preview where it can greatly enhance user's contact lens shopping experience. Some minor features will include recording a video or capturing a photo while previewing the contact lens, which can then be shared to social medias based on user's preference. Besides, this application also allow user to try on different designs or colours of contact lens by using still image for some user that may not have the convenience of using live view mode.

## 1.3 Project Objective

One of the main objectives of this project is to increase the brands image. As the application will add an edgy touch to the existing application, making it look futuristic, helping the company's image. Next, the objective is to help improve seller's business. By using the application, customers would be more satisfied and confidence in their chosen product as they are able to get a preview of what to expect when they receive their purchased products.

Besides, it will also help reduce the return rate as customers would be less likely to purchase incorrect product, helping the company solve issues regarding product returns. Then, the objective is to help the seller to manage their business easier. The application allows the seller to add in contact lens photos easily and the application will attempt to crop and transparent the background by itself. Hence, it will be bringing much convenient on managing the product image storage as they do not need to change their existing photos.

Lastly, the objective is to improve the seller's online business by using advanced AR technology. As there are only a limited number of companies are using AR technology to promote and market their products, it will provide the company some competitive advantage if they use the application.

## 1.4 Impact, Significance and Contribution

This project is aimed primarily on those retailers or contact lens sellers through E-commerce or mobile commerce. They would normally carry out their business through online communication by using modern gadgets. Along with the system, it can further enhance their business and become more advanced by integrating AR into their contact lens application. The secondary target will be the online consumer especially cosplayers. This is due to the wide varieties of contact lens design in order to mimic multiple characters from all kinds of animations. Thus, cosplayers would have a higher demand on buying different types of contact lens to let them cosplay different animated characters. Hence, when a new favourite animation is released, they might have to purchase once again, consistently throughout the year as cosplay fiesta or even competitions may be held multiple times at different locations around the world.

## 1.5 Background Information

In the twenty-first century, a lot of technology are fast-paced changing, evolving and taking their place in this century. Nowadays, technology is virtually in all sector, Augmented Reality (AR) is one of the technology in the latest trend that is an integration of digital information with user environment in real time. AR overlays reality with additional information, usually computer graphics and geolocation. As we can see the launching of Pokémon Go is a huge success for Augmented Reality. Due to the huge success of the Pokémon Go, it offers a useful direction for other areas such as marketing, fashion, tourism and retail. According to the Juniper research estimates by 2017, more than 2.5 billion AR applications will be downloaded to devices annually (Underwood, 2013).

Due to the fast and dramatic changes of technology has given new concept of marketing in which buyer and seller do not need meet each other face to face nor see the items sold by the seller physically. These products may include household groceries, furniture, electronic devices and even cosmetics. Among these categories, selling of cosmetic products has been rising sharply over these few years, especially contact lens due to the trend of cosplaying. Cosplay refer to one of the hobby where cosplayer would wear a costume and make up to represent a specific animated character. In order to look similar to the character, cosplayer will buy the coloured lens with different design and patterns to match their characters, making contact lens popular in the market.

There are hundreds to thousands of designs and patterns of colour lens. In order for the customer to test the variety design before purchase, this project which is AR contact lens application allows seller to integrate their e-commerce with this virtual try on contact lens module. This feature allow seller to import their contact lens picture or photo with different design, pattern and colour into this application and allow seller to integrate with this application to allow consumer especially cosplayer can be testing different design of contact lens with their own real face by using live camera. It uses eye tracking technology as an AR input system to monitor the small movements of the eyes to determine the direction the user is facing. It allows to capture the photo and save it, so the customer can compare which design is most suitable. It can enhance customer's online shopping experience as it improves purchase confidence, which results in lower return rate and higher customer loyalty.

Some of the e-commerce website provide this feature that enables consumer to upload or choose a photo and then select the lens they want to try on. More than often, these websites will only create a new layer for the lens virtually which does not include the latest AR technology. Now the mobile devices are powerful enough to handle AR software. Therefore, this project will use AR technology to apply this feature. Besides, the application will also provide one function which is to keep track the purchase date of different contact lens. The reason behind this is that most customers are unaware that their contact lens are near expiry date, and continue wearing them will cause eye irritation or in worse cases, permanent damage to their eyes. If the contact lens is expiring, the application will remind the customer to buy new contact lens from the seller.

**CHAPTER 2: LITERATURE REVIEW**

In this project, the research on current practice toward the problem faced is conducted by reviewing four similar applications. These three applications are Acep TryLive, AIR OPTIX® COLORS and NiceEyes: Live Video Mode respectively.

**2.1 Literature Review- Similar application**

**2.1.1 Acep TryLive: Virtual Try on Solution**

TryLive is the brand of Acep TryLive, TryLive is first created by Total Immersion but on 25th of November, 2015, Total Immersion announced that TryLive has been acquired by Acep, the optical measurement solutions specialist (*TryLive Acquired by* 2015). TryLive is a multifaceted virtual try on solution by using augmented reality technology. It is an Augmented Reality solution created for the retailers and E-commerce sectors to offer their products to "try-on" virtually by taking advantage of digitally integrated software. This breakthrough consists of multiple aspects to virtually show how a product would appear and moves on with the absence of the physical product. By simply presenting on camera-equipped computer, tablet, digital screen, or even a smart phone, the screen will display an image of the user "wearing" the product in real time. The TryLive application has been tailored to virtually eyewear, apparel, shoes, watches and jewellery, furniture, headphones, and all types of clothes. TryLive enhances social shopping experience at home or anywhere around the world.

 **Strengths**

- **Immersive Interaction**

  TryLive provide immensely engaging experience for the buyers and is an impressive selling tool. TryLive have the visual and kinaesthetic sense where buyers can try the product virtually with live preview (*Virtual Try on Solutions Overview* 2015). Buyers can take snapshots of their product interactions and immediately share to social networks such as Facebook or Twitter.

- **Improved conversions and Reduced returns**

  TryLive is able to form a strong relationship with customers which can encourage customers to revisit, higher shopping confidence and boost sales. By giving customers a clearer image of how your product would look like, TryLive will

enhance the confidence in customers when purchasing and reduce product return rates, restocking and shipping fees.

- **Designed for multi-channel retail**

TryLive is a perfect fit for e-commerce, for the in-store retail experience, and for cross-channel commerce.

**Weaknesses**

- **Does not support native mobile application**

Acep TryLive is a company that sells its AR solution by software as a service. It can be easily integrated into most websites with no effort, however, native mobile applications are currently not supported. Smartphones can only access the service by using a web browser.

- **Have less customisable options**

The product is presented in software as a service, hence, it will take more time or even money in order to get some customisation. Moreover, sellers will need to provide 3D models for every product required before they can start to promote the selected products.

### 2.1.2 AIR OPTIX® COLORS - Colour Studio

AIR OPTIX® COLORS is an online website selling coloured contact lens. There is a feature at the e-commerce website called colour studio. This feature is available on the website and also mobile application. The mobile application can only be found at apple store. **Figure 2.1** below shows the screenshot of colour studio from mobile application. This application allows user to try the different coloured contact lens sold by AIR OPTIX® COLORS by selecting a model's picture or they can choose to upload their own picture or take a new photo by using a webcam or smartphone's camera. After choosing the photo, user can choose which contact lens they want to try and apply it on the picture. The picture will change and show the effect of the lens. With the help of this feature, user can more decide which colour is more suitable for them. **Figure 2.2** below shows the same feature performed at the E-commerce website.

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**Figure 2.1**: AIR OPTIX® COLORS - Colour Studio Mobile application
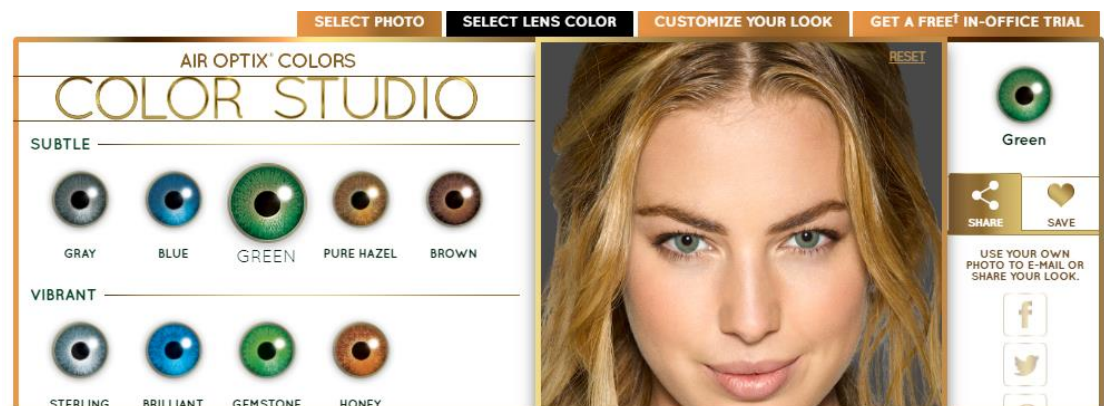


**Figure 2.2**: AIR OPTIX® COLORS - Colour Studio Web-based

**Strengths**

- **Quick and easy to use**

  The application is fast and easy to use because it has default models you can choose instead of uploading your own photo. If the user is reluctant of providing their personal face image, they can use the readily available models to imagine how the product would look like accordingly.

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- **Supports iOS mobile devices**

  The application can be used in iOS devices instead of only being capable of using it online in a website. Providing this function in a mobile device natively would provide a better effect and convenience to the users.

**Weaknesses**

- **Not enough pattern details**

  The application does not provide enough contact lens details. While the default models fit perfectly on every contact lens available, customers' own photos are lacking details which are essential to a cosplayer.

- **Does not support Android devices natively**

  The reviewed application is currently available through online website and iOS devices, but not Android devices. Hence, it has left out a huge market for the Android users.

### 2.1.3 NiceEyes: Live Video Mode Mobile Application

NiceEyes in Live Video Mode is a mobile application that lets user easily and swiftly change their eye colour in real time as shown in **Figure 2.3**. By rendering the view in real time, it creates a more realistic feel as users can move around with the contact lens in place. In this application, there are many realistic and natural eye colour to choose from and it also provides this feature where user can change their eyes to make them bigger and more beautiful. Furthermore, another great feature of NiceEyes is that user can change the opacity of eye colour, to help user to look more natural. NiceEyes also allow user to save their captured photo or recorded video to gallery and can share the photo via social media such as Facebook and Instagram.
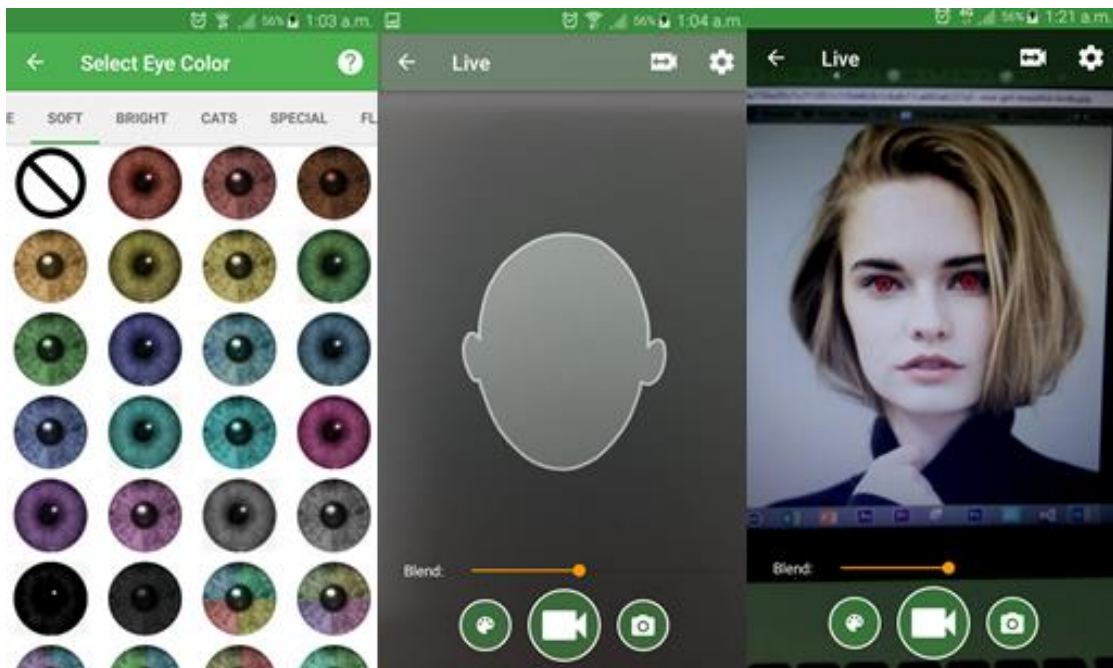
**Figure 2.3**: NiceEyes Mobile application

 **Strengths**

- **Wide variety of contact lens designs**

  The application categorise its contact lens designs into Soft, Bright, Cats, Special, Flags, Green, Blue, Brown and etc. It has more than 150 designs where user can test them easily.

- **Supports Android devices**

  This application works in Android devices, creating a better user experience as users with slower network performance are also capable of using it in real time without relying on their Internet speed.

- **Supports Live View Mode**

  The application is able to render real time contact lens as a preview for the users. This will amplify the effect of Augmented Reality as users will not look at a static photo, but instead a mirror-like application.

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**Weaknesses**

- **Live Mode provided is in Beta**

  The live mode view is still currently in Beta mode; thus it can be seen clearly that the contact lens may flicker around users' eyes during quicker movements. It is yet unknown the release date of the complete version, hence, the experience of the feature provided is quite limited.

- **Does not support iOS devices**

  The application although supports Android devices, but has yet to make its move into iOS devices.

## 2.2 Comparison with similar application

Below Table 2.1 shows the comparison between Acep TryLive, AIR OPTIX®
COLORS and Nice Eyes among their strengths and weaknesses.

**Table 2.1**: Comparison between similar applications.

| Application | Acep TryLive | AIR OPTIX® COLORS | Nice Eyes |
|---|---|---|---|
| **Android Platform** | No | No | Yes |
| **iOS Platform** | No | Yes | No |
| **Website Platform** | Yes | No | No |
| **Lens Design Detail** | Low | Medium | High |
| **Live Preview** | Yes | No | Yes |
| **Live Preview Quality** | High | N/A | Medium |
| **Lens Colour Correction** | Yes | No | Yes |
| **User Interface Design** | Poor | Good | Normal |

The table attributes are explained in detail as follows:

- **Android Platform** – Determines whether the application can be executed on Android devices.

- **iOS Platform** – Determines whether the application can be executed on iOS devices.

- **Website Platform** - Determines whether the application can be integrated on a website.

- **Lens Design Detail** – Indicates the amount and quality of contact lens designs and patterns available.

- **Live Preview** – Determines whether the application provides live preview instead of static view.

- **Live Preview Quality** – Shows the live preview quality by considering the accuracy, speed and correctness of the virtual contact lens displayed.

- **Lens Colour Correction** – Indicates whether the application provides colour correction to the contact lens.

- **User Interface Design** – Indicates the user friendliness and interface design quality.

## 2.3 Resolved solution

By analysing Table 2.1 shown above, it can be seen that none of the reviewed application support both Android and iOS platforms. The application would aim to achieve on at least one platform, which is Android, and provides high lens design detail with high preview quality, also good user interface design.

Therefore, the application will contain the following attributes:

- **Supports Android Devices and Websites**

- **High Quality Contact Lens Design**

- **Supports Live Preview at High Quality**

- **Provides Lens Colour Correction**

- **Good User Interface Design**

**CHAPTER 3: SYSTEM DESIGN**

**3.1 Design Specification**

**3.1.1 Methodology**

      The agile approach has been selected for this project. This project focus on client collaboration. The client has opportunity to provide their feedback about this project to ensure this project has meet the needs of the client. By using agile methodology, it can detect any issue at the very early stages and minimize the risk of developing a software. The reason why agile approach is selected is because agile method allows for rapid changes that might occur during testing or feedback phase.
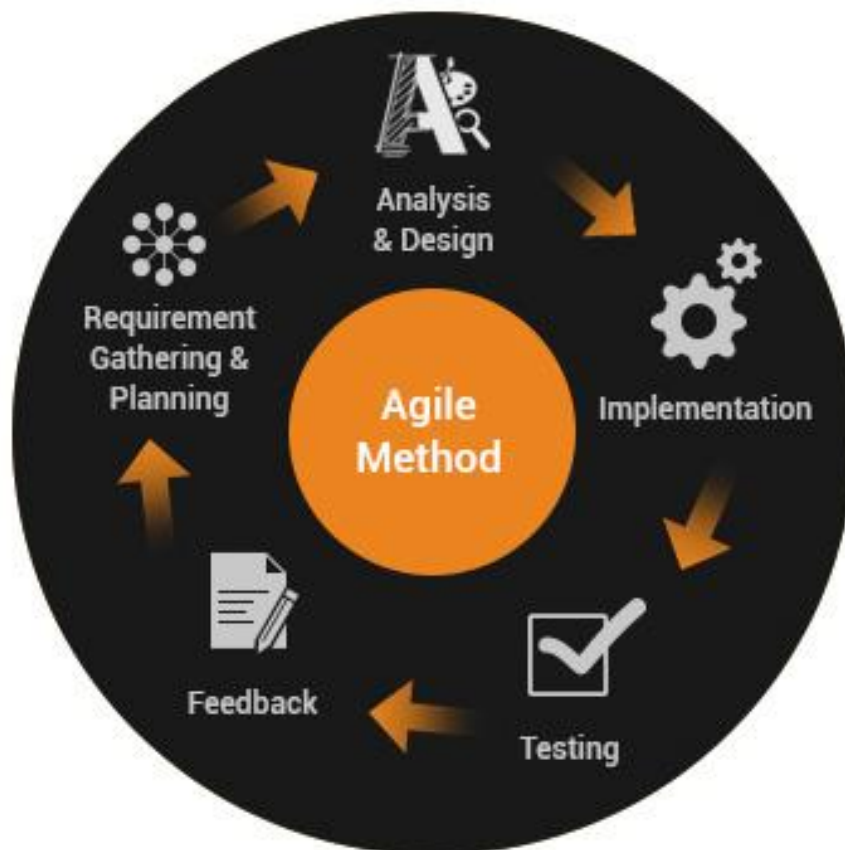


**Figure 3.1**: Agile Method Process Cycle.

    **1.   Requirement Gathering and Planning**

      In the first process of agile method is to gather the user requirements. This will include user stories and documentation reviews. During this phase, it is important to plan the project in a shorter term because Agile approach offers more flexibility on requirement changes. Hence, future changes and improvements can be easily implemented during the next process cycle.

## 2. Analysis and Design

In the analysis and design phase, the focus lies on what are the important modules required and how are they supposed to be created. By defining the important modules, such as the ability to import 2D contact lens and convert them into 3D models, would help the application to have a smoother design flow. This is because the main function, that is making a preview of the user wearing a contact lens, would require a set of 3D contact lens model to function. Thus, with a proper analysis and design flow, it can greatly help in creating the actual application.

## 3. Implementation

Next, this application would need to be implemented on an existing mobile shopping application or website or standalone application. By implementing the application on a pre-existing platform would provide a better testing and feedback processes. While standalone application would be easier to perform but may take more time to test.

## 4. Testing

Then, testing involves users to test the application using real data. Testing include finding out whether the feature works as there may be a variety of human faces, or whether the application contains any errors or bugs.

## 5. Feedback

Finally, after testing the application, it is important to collect and document the feedback provided by all users. Users may also provide their own opinion or their experience of the overall application's performance. By analysing the results and reviews collected from all the users, it will help on the repeated process of gathering requirements and planning.

### 3.1.2 Technology Requirements

For the application to perform well, it is very important for the device running the application to have some minimum requirements. The hardware requirements for mobile devices are as follows:

1. Basic Central Processing Unit (CPU)

2. Screen Display

3. Microelectromechanical systems sensors

4. Front or rear camera of decent quality

5. Motion sensors (For a better live preview quality)

On the other hand, if the application is running on website, it only needs to have basic CPU, a screen for display and a webcam. However, certain features may not be available on a website as there will be no motion detectors.

As for the software requirements of the application for a smartphone would only be Android Platform Operating System, due to the application may only support Android users.

### 3.1.3 System Performance Definition

A defined set of performance goal and definition should be identified beforehand for determining the system's performance. By doing so, these definitions will serve as a clear standard performance that is supposed to be achieved by the application.

First, the application's live contact lens preview must not flicker if no sudden movements have been made by the user. Therefore, the quality of the live preview is an important criterion in measuring the system's performance.

Next, the application's database must be synchronized on both online and local database to ensure that all contact lens models are present and usable by the application. Updated or new contact lens designs should be identified and downloaded accordingly.

### 3.1.4 Verification Plan

It is crucial to have a reliable verification plan as it could help address issues that will be faced during future development (Vishwanath, n.d.). Therefore, the verification plan must consist of test cases that are capable of discovering loopholes that are concealed within the application. Hence, a few test plans are designed to be performed on the application during testing phase to discover abnormalities.

First and foremost, the project's documentation should be reviewed to reassure the application's features are able to meet the objectives and scopes. Thus, a checkmark can be ticked on a list of objectives and scopes to ensure that the application works as intended and as expected.

Then, it is very important to test for application deliverables, verifying that the application is capable of producing the correct output and the accuracy or chances of failure. In this phase, defective modules or ineffective logical statements in the application can be discovered, and a new patch should be made to remove or reduce the module's defective parts.

## 3.2 System Design/Overview

Majority of application previously reviewed does not include AR technology or virtual try on for contact lens. In order to solved the problem stated, this project will integrate AR technology with face recognition to track the user's eyes movement. In addition, the application will also track the user's facial shape to determine if the user is looking at a different direction, so that the contact lens can be scaled and skewered accordingly.

By implementing these technologies, it will help the application to get a better grasp on the user's facial shape for a higher live preview quality. Also, the application can auto-calibrate the environment's ambient colour to correct the contact lens' colour. Manual calibration should also be a choice for users who understands basic colour corrections. Thus, creating a more realistic contact lens preview that blends into the surrounding.

However, in order to perform the features mentioned as above, the application would need to have both facial recognition and eye recognition. Facial recognition will help to ensure that the application is indeed "looking" at a person's face, then eye recognition will be performed to identify the size and location of the eyes. The contact lens models should be downloaded from an online database server and store into the smartphone's local storage to allow shorter switching time between different lens designs.

### 3.2.1 Flowcharts

It is important to have a clear outline and process flow of the application to avoid creating loopholes or bugs during development. Therefore, a flowchart has been created for the application from start to end as shown below in **Figure 3.2**.

The flowchart starts with App Launch, and then the main page is shown where users are able to choose whether they want to login. After that, the user is able to choose different modes available, especially photo mode and live view mode. Thereafter, if

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photo mode is selected, user will have to decide whether they want to snap a new picture or choose from the gallery. Next, the photo will be processed and subsequently, the selected lens will be put on to the user's eyes. On the other hand, users can also choose live view mode which will ultimately redirect users to choose their desired lens product to try on the contact lens. Users will also be able to take photo or record a short video during live mode or change the lens product; users can also exit the application.
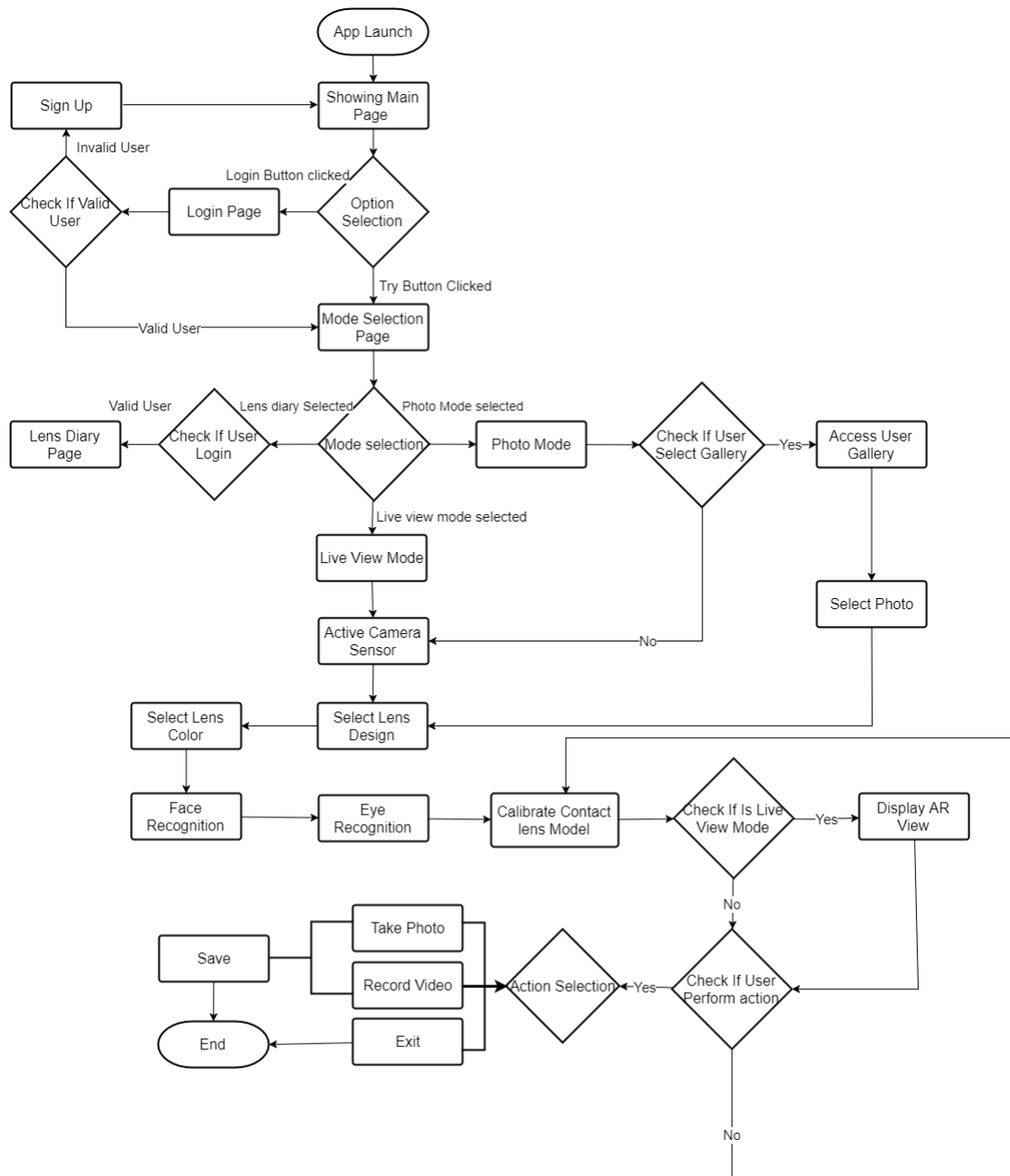


**Figure 3.2**: The flowchart for the application from program execution to termination.

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### 3.2.2 Block Diagram

A block diagram has been created below in Figure 3.3, where two actors are present, being the customer and seller respectively. The block diagram also displays how the customer can get a live preview by aiding the application with a video or image after the application retrieves the lens data which can be uploaded by the seller. Last but not least, the seller is able to push updates to the application to patch bugs or introduce new features.
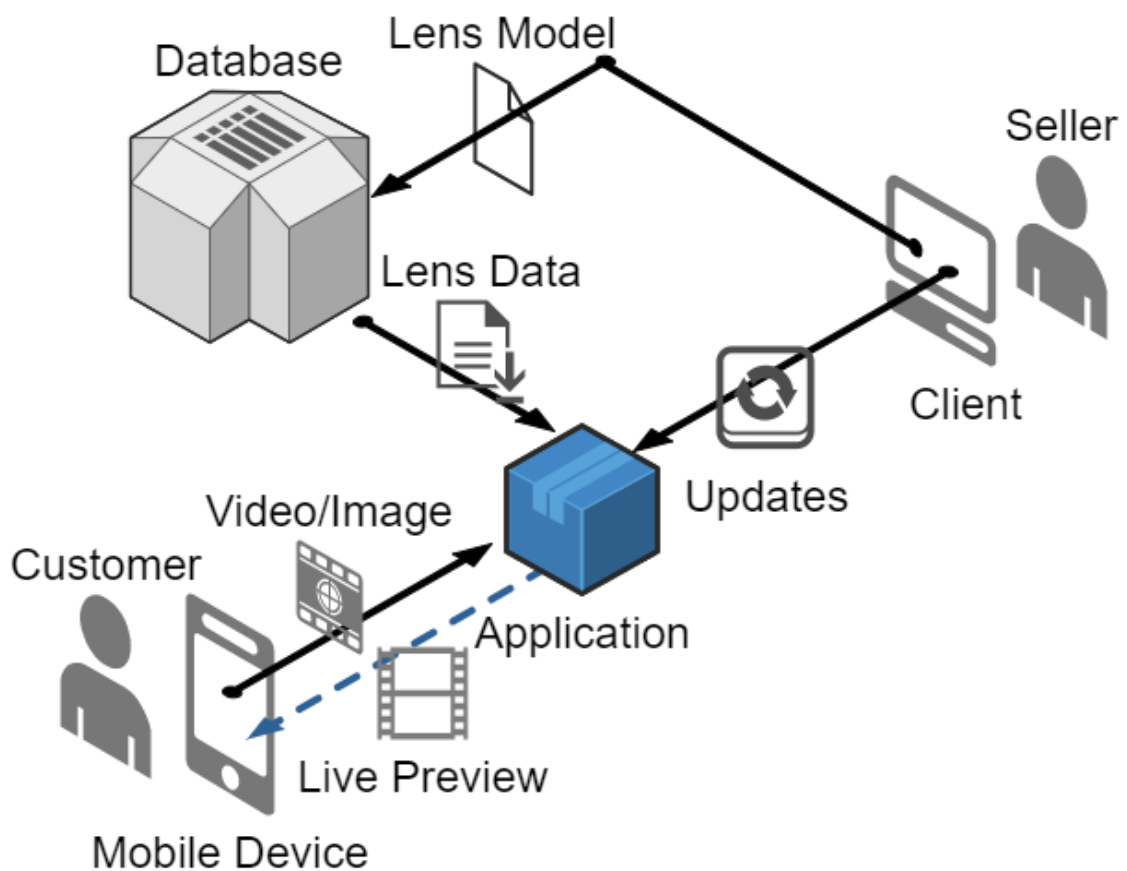


**Figure 3.3**: The block diagram shows an overall view for the interaction between a customer and seller with the application.

### 3.3 Implementation Issues and Challenges

It is expected that there are a few issues and challenges that will be faced when trying to build the application. Firstly, eye recognition algorithm is not as widely used or popular when compared to face recognition. Although face recognition can determine the location of the eyes, but it is unable to accurately decide the size and

shape of the eyes. Therefore, it is important to have a good eye recognition algorithm to ensure that the application is able to adjust according to user's eye features.

On the other hand, creating a new mobile application will be considered as a tough challenge to be encountered as it belongs to a new field. Even though the programming language that will be used to build mobile application is Java, the environment is totally new and foreign. Besides, Android based application has many versions available on the market, making it harder to identify bugs on different versions.

## 3.4 Timeline – Gantt Chart

Two Gantt charts are shown below to provide a clear outline of the tasks to be performed during the current semester and the next semester.

| | Task Mode | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|---|
| 0 | | ▲ FYP 1 Oct Session 2017-Live View Contact Lens System for Cosplay | 34 days | 10/16/17 | 11/30/17 | |
| 1 | | ▲ Initiating | 1 day | 10/16/17 | 10/16/17 | |
| 2 | | Brainstoming with Supervisor about Project Title | 1 day | 10/16/17 | 10/16/17 | |
| 3 | | Discuss with Supervisor about the Project Schedule | 1 day | 10/16/17 | 10/16/17 | |
| 4 | | ▲ Planning | 2 days | 10/17/17 | 10/18/17 | 1 |
| 5 | | Develop Project Plan | 1 day | 10/17/17 | 10/17/17 | |
| 6 | | Time Estimation | 1 day | 10/18/17 | 10/18/17 | 5 |
| 7 | | ▲ Analysis | 9 days | 10/19/17 | 10/31/17 | 4 |
| 8 | | Review Similar System | 2 days | 10/19/17 | 10/20/17 | |
| 9 | | Analysis the Strength and Weaknesses of the Similar Application | 1 day | 10/23/17 | 10/23/17 | 8 |
| 10 | | Research Additional Information and Knowledge about the Project | 1 day | 10/24/17 | 10/24/17 | 9 |
| 11 | | Define Motivation and Problem Statement | 1 day | 10/25/17 | 10/25/17 | 10 |
| 12 | | Define Project scope | 1 day | 10/26/17 | 10/26/17 | 11 |
| 13 | | Define Project Objective | 1 day | 10/27/17 | 10/27/17 | 12 |
| 14 | | Define the Impact, Significance and Contribution of the Project | 1 day | 10/30/17 | 10/30/17 | 13 |
| 15 | | Define Background Information | 1 day | 10/31/17 | 10/31/17 | 14 |
| 16 | | ▲ Design | 7 days | 11/1/17 | 11/9/17 | 7 |
| 17 | | Design Flowchart | 1 day | 11/1/17 | 11/1/17 | |
| 18 | | Design Block Diagram | 1 day | 11/2/17 | 11/2/17 | 17 |
| 19 | | User Interface Design | 2 days | 11/3/17 | 11/6/17 | 18 |
| 20 | | Database Design | 1 day | 11/7/17 | 11/7/17 | 19 |
| 21 | | Determine Methodology | 1 day | 11/8/17 | 11/8/17 | 20 |
| 22 | | Determine Development Tools and Technology | 1 day | 11/8/17 | 11/8/17 | 20 |
| 23 | | Poster Design | 1 day | 11/9/17 | 11/9/17 | 22 |
| 24 | | ▲ Development | 15 days | 11/10/17 | 11/30/17 | 16 |
| 25 | | Develop System Prototype | 10 days | 11/10/17 | 11/23/17 | |
| 26 | | Unit Testing Prototype | 2 days | 11/24/17 | 11/27/17 | 25 |
| 27 | | Integration Testing Prototype | 2 days | 11/28/17 | 11/29/17 | 26 |
| 28 | | Prototype Demonstration | 1 day | 11/30/17 | 11/30/17 | 27 |

**Figure 3.4**: The Gantt chart shows the tasks to be done for FYP 1 in the current semester.

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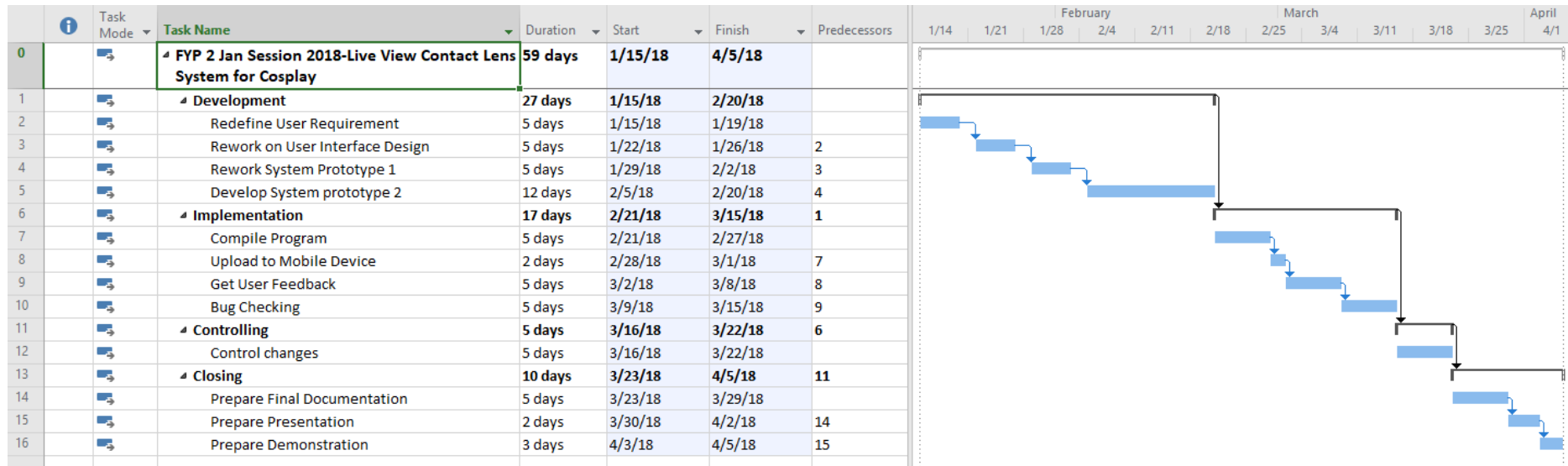| | | Task Mode | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|---|---|
| 0 | | | ▲ FYP 2 Jan Session 2018-Live View Contact Lens System for Cosplay | 59 days | 1/15/18 | 4/5/18 | |
| 1 | | | ▲ Development | 27 days | 1/15/18 | 2/20/18 | |
| 2 | | | Redefine User Requirement | 5 days | 1/15/18 | 1/19/18 | |
| 3 | | | Rework on User Interface Design | 5 days | 1/22/18 | 1/26/18 | 2 |
| 4 | | | Rework System Prototype 1 | 5 days | 1/29/18 | 2/2/18 | 3 |
| 5 | | | Develop System prototype 2 | 12 days | 2/5/18 | 2/20/18 | 4 |
| 6 | | | ▲ Implementation | 17 days | 2/21/18 | 3/15/18 | 1 |
| 7 | | | Compile Program | 5 days | 2/21/18 | 2/27/18 | |
| 8 | | | Upload to Mobile Device | 2 days | 2/28/18 | 3/1/18 | 7 |
| 9 | | | Get User Feedback | 5 days | 3/2/18 | 3/8/18 | 8 |
| 10 | | | Bug Checking | 5 days | 3/9/18 | 3/15/18 | 9 |
| 11 | | | ▲ Controlling | 5 days | 3/16/18 | 3/22/18 | 6 |
| 12 | | | Control changes | 5 days | 3/16/18 | 3/22/18 | |
| 13 | | | ▲ Closing | 10 days | 3/23/18 | 4/5/18 | 11 |
| 14 | | | Prepare Final Documentation | 5 days | 3/23/18 | 3/29/18 | |
| 15 | | | Prepare Presentation | 2 days | 3/30/18 | 4/2/18 | 14 |
| 16 | | | Prepare Demonstration | 3 days | 4/3/18 | 4/5/18 | 15 |

**Figure 3.5**: The Gantt chart shows the remaining tasks to be done for FYP 2 in the next trimester.

**CHAPTER 4: USER VALIDATION**

**4.1 Platform**

User validation is used in this project's application when there are new or current users trying to sign in to the application. The platform used to validate users is important as it has to be secure and also easily accessible by the application. Therefore, Firebase has been chosen as the platform for verifying current users and to register new users.

Firebase is an online mobile platform developed by Google that provides user authentication, cloud storage and many other functions such as error analytics and usages. Firebase uses encryption when transmitting information through the web and has servers located in many locations that allows quicker access to the database. Therefore, it is a good choice for using it to facilitate the user validation when signing in or registering a new account using the application.

**4.2 Account Creation**

Users are able to create new accounts when they launch the application, while registered users can directly sign in. Account creation is done through Firebase, by sending the email and password to Firebase and validating whether the same email has been used. Then, an automated email will be sent to the user's email account for additional verification so that they are not able to simply register a new account using another person's email or a non-existing email account.

After the user clicks the verification link that has been sent to their email inbox, they will then be able to sign in to the application using their email and password. Users that have yet to verify their email will be prompted to do so as a reminder by the application and will not be allowed to sign in which provides some additional features.

**4.3 Local Sign In**

After signing in to the application for the first time, Firebase provides a simple authentication mode that is stored locally so that users can be automatically signed in the next time they launch the application. Therefore, avoiding the hassle of entering their email and password every single time they use the application. Furthermore, this function can also be used when there is no Internet service, ensuring that users can still enjoy the features that is provided after signing in.

**4.4 User Preferences**

One of the main convenience and feature provided by the application is user preference, which is available to users that have signed into the application. User preference stores some personal information and preferences that will help to enhance user experience. Therefore, certain functions or even colours can be customized to the user's choice automatically after setting it once.

User preference will also provide users a quicker navigation when using the application as users can set their desired activity on start up. Therefore, reducing the loading time and user response in selecting their intended actions in the usual home activity.

Nonetheless, there are some limitations on the user preferences, which includes incapability of online syncing. Meaning that users are not able to store their preferences on the cloud database, therefore, the user preference will only work independent towards the device instead of the user account. However, this feature can be added in future development where user preferences will also be uploaded to the Firebase database to be sync across devices of the same user account.

# CHAPTER 5: CONTACT LENS VIEW GENERATION

## 5.1 Mode Selection

When a user uses the application, there are two modes to be chosen to preview their contact lens. The first method is to preview their contact lens on an image that can be chosen by the user through gallery (local storage) or camera, which they can capture the image right away. The second method is to try the contact lens on directly using the camera's live video feedback, which can be more user friendly and also provide greater user experience when using the application.

These modes will be available on the main screen selection, while image preview can be processed faster and easier by the application, the live preview mode will consume more processing power to continuously provide live preview contact lens feedback to the user.

### 5.1.1 Lens Selection

Upon choosing the mode, users will also be given the choice of selecting their desired contact lens for preview. Therefore, a recycler view will be used where users are able to swipe left and right to choose their desired contact lens in a user-friendly way. After choosing the contact lens desired, the application will then automatically forward users towards the mode selected, which is the image mode or live preview mode accordingly.

Nevertheless, users can always change their contact lens choice by pressing the back button and then choosing another contact lens from the recycler view. Therefore, a simple navigation is provided for the user to enhance user experience in quickly choosing a contact lens to preview.

## 5.2 Image Mode

If a user selects image preview mode, the application will prompt user to provide an image that will be used to preview a pre-selected contact lens. Users will then be asked to either complete this action using camera or gallery which gives users the choice to decide whether to take a picture or choose an existing photo.

After the user provide an image to the application, the application will then try to process the image to look for a face by using face recognition algorithm. After recognizing a face, certain features of the face will then be detected such as the position

of the left and right eye, the mouth position and the chin position. These positions will be crucial in creating a realistic preview of the contact lens. The application will use these positions, also known as facial landmarks, to determine how to place the Augmented contact lens on users left and right eye.

### 5.2.1 Iris Size Detection

The size of a human's iris is also an important factor to be considered when placing the contact lens, as the lens have to be scaled accordingly to the distance between user and the smartphone. Therefore, an interesting study on calculating the iris size has been published by Satpute that uses Pythagoras Theorem to calculate the size of the iris by utilizing the distance between two pupils (Satpute, 2015).

As the facial recognition algorithm is capable of providing the information on the position of the left and right eye, it is then able to calculate the distance between the left and right eye which can then help to scale the size of the contact lens accordingly. Therefore, the same technique has been used in image mode which will detect user's right and left eye to provide a better and more realistic preview of the contact lens on their pupils.

### 5.3 Live Preview Mode

Another mode to preview contact lens is the live preview mode which allows users to have a real-time preview of wearing contact lens while using their smartphone cameras. The live preview mode utilizes the exciting feature of AR that gives user an enhanced experience for being able to preview their contact lens in live mode.

The main difference of live preview mode in contrast with image mode is the animation and immediate movement of the contact lens in live preview mode, whereas the image mode is only a still image and therefore may require a few images with different angles and perspective before being able to satisfy the user's need.

### 5.3.1 Eye Recognition vs Facial Recognition

Eye recognition in live preview mode is slightly different from image view as live preview mode requires the application to continuously detect user's facial movement and eye position. Therefore, it requires more processing power and estimation to provide a better contact lens live preview. However, eye recognition algorithm is not a simple task that can always be fully functional due to low lighting, user movement, camera movement or even low video quality. Thus, facial recognition

will take over momentarily and some estimation based on previous data to position the contact lens approximately accurate to user's pupil location.

The reason being facial recognition is faster and almost fully functional at all time when a face is within the camera's view. While eye recognition is much slower when compared to facial recognition and might not be always available during live preview. Hence, when eye recognition is not available, the application will detect for a face, and if a face exists, the application will attempt to position the contact lens on the previous location of the eye detected that is relative to the scale of the facial landmarks that can be detected at a particular frame during runtime. Meaning that the application will place the contact lens at an estimated position that is adjusted according to the facial landmarks such as forehead position and chin position and their relative angle at the moment.

**CHAPTER 6: CONCLUSION**

The project will be a useful tool in helping contact lens sellers to promote their products more efficiently with the capability of allowing customers to try on first. With the try on feature, customers become more confident and can decide better on which product should they choose for their next Cosplay. Therefore, helping the contact lens seller to maintain a good reputation and retain customers because the majority of customers will be satisfied with their received products.

Besides, the application aims to achieve a better contact lens preview quality than most of the current applications available in the market by using a good eye recognition algorithm. This is because the application will also provide customisation on the lighting and colour adjustments to create a more natural view of virtual contact lens. Furthermore, by using face recognition algorithm, the relative length and shape of the face can help the application determine the angle of the user's face, aiding the application to skew the contact lens image accordingly.

Therefore, it is a powerful tool that can be used by contact lens sellers all over the world, boosting their company image by having a try on preview. Besides, there are some exciting new features that can be included in the future development of the project. These includes adding try on glasses, try on makeups and try on face tattoos; there are endless possibilities but limited only to one's idea.

# BIBLIOGRAPHY

*About Us – XLabz Technologies, 2013*. Available from: <http://www.xlabz.com/about-us> [13 August 2017]

Alcon Labs, Inc, 2017, *AIR OPTIX® COLORS - Color Studio*. Mobile App. Version 1.2. Available from: iTunes <https://itunes.apple.com/us/app/air-optix-colors-color-studio/id1051009853?mt=8>. [13 August 2017]

Choudhury, A, 2016, *Essay on E-Commerce: Meaning, Advantages and Disadvantages*. Available from: http://www.yourarticlelibrary.com/essay/e-commerce/essay-on-e-commerce-meaning-advantages-and-disadvantages/64218/> [14 August 2017]

Lim, H., 2017. *Why I love Firebase (and what is Firebase)*. Available from: <https://medium.com/@limhenry/why-i-love-firebase%EF%B8%8F-and-what-is-firebase-%EF%B8%8F-96b54509d450> [31 Mar 2018]

*Mobile Augmented Reality (MAR) Market Trends, n.d.*. Available from: <http://www.strategyr.com/MarketResearch/Mobile_Augmented_Reality_MAR_Market_Trends.asp> [16 August 2017]

Satpute, B., 2015. *Pdfs.semanticscholar.org*. Available from: <https://pdfs.semanticscholar.org/2ffe/355606df80a33ad6808250e5df3597624768.pdf> [31 Mar 2018]

*TryLive Acquired by ACEP, 2015*. Available from: <http://www.trylive.com/news/trylive-acep> [13 August 2017]

Underwood, R, 2013, *Augmented Reality for Businesses*. Available from: <https://www.inc.com/magazine/201310/ryan-underwood/augmented-reality-for-businesses.html> [13 August 2017]

*Virtual Try on Solutions Overview, 2015*. Available from: <http://www.trylive.com/solutions> [13 August 2017]

Vishwanath, A, Kadambi, R, n.d., *Verification Planning for Core based Designs*. Available from: <https://www.design-reuse.com/articles/16141/verification-planning-for-core-based-designs.html> [10 November 2017]

Bachelor of Information Systems (Hons) Information Systems Engineering
Faculty of Information and Communication Technology (Perak Campus), UTAR.

VysionApps, 2017, *NiceEyes - Eye Color Changer*. Mobile App. Version 1.0.1. Available from: Google Play <https://play.google.com/store/apps/details?id=com.vysionapps.niceeyeslive&hl=en> [16 August 2017]

WinterGreen Research, 2016, *Augmented Reality (AR): Market Shares, Strategies, and Forecasts, Worldwide, 2016 to 2022*. Available from: <http://www.reportsnreports.com/reports/697142-augmented-reality-ar-market-shares-strategies-and-forecasts-worldwide-2016-to-2022.html> [14 August 2017]

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