



Faculty of Computer Science and Information Technology

***AN ANDROID-BASED AUGMENTED REALITY INTERIOR
DESIGN MOBILE APPLICATION***

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Bachelor of Computer Science with Honours
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INTERIOR DESIGN MOBILE APPLICATION**

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This project is submitted in partial fulfilment of the requirements
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ABSTRACT

Augmented reality is currently an emerging technology in various fields. One of its noteworthy application is in interior design, as augmented reality helps visualising ideas and perceiving spaces in real time. The main objective of this project is to develop an Android-based mobile application to ease interior design process using augmented reality, and to evaluate the usability of the product. The Agile methodology is applied throughout the development of this project. The significance of this project is to ease users on interior design processes with real time visualisation of interior elements.

ABSTRAK

Augmented realiti kini merupakan satu teknologi yang berkembang dalam pelbagai bidang. Salah satu aplikasi yang patut diberi perhatian adalah dalam reka bentuk dalaman, kerana *augmented reality* membantu dalam visualisasi idea dan penggambaran ruang dalam waktu sebenar. Objektif utama projek ini adalah untuk membangunkan aplikasi mobile yang berasaskan Android untuk memudahkan proses reka bentuk dalaman dengan menggunakan *augmented reality*, dan untuk menilai kebolegunaan produk ini. Metodologi Agile digunakan sepanjang pembangunan projek ini. Kepentingan projek ini adalah untuk memudahkan pengguna dalam proses reka bentuk dalaman dengan visualisasi masa nyata unsur dalaman.

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Augmented reality is one of the most popular emerging technologies as it brings an interactive experience enhancing the real world. It can be defined as a system comprising reality and virtuality, and in the meantime, providing real-time interaction.

One of its remarkable applications is in interior design, as it enables visualising ideas and perceiving spaces in real time. AR interior designing mixes real world with virtual design plan to visualize different interior designing elements such as furniture, wallpaper, lighting, and curtains.

This project proposes an Android-based app used in interior design with application of augmented reality technology. According to Lanham (2018), comparing to conventional designing tools, AR implementation provides more immersion and imagination in designing process.

1.2 Problem Statement

Interior design process can be painful when the end result does not meet the user expectation. Interior design needs to be planned properly before starting its physical development. Mismeasurement, incorrect colours, and limited spaces are common problems in interior designing.

Interior designers often use 2D plan to illustrate their ideas. However, this conventional way of designing does not often satisfy them as the interaction between the designing tools and designer is limited. It seems relatively hard for designers and clients to visualize their ideas.

1.3 Scope

The app will be usable on Android OS. Testing and release versions will both be developed in Android platform.

1.4 Objectives

- To develop an Android-based mobile application to ease interior design process using augmented reality technology
- To evaluate the usability of the proposed mobile application

1.5 Methodology

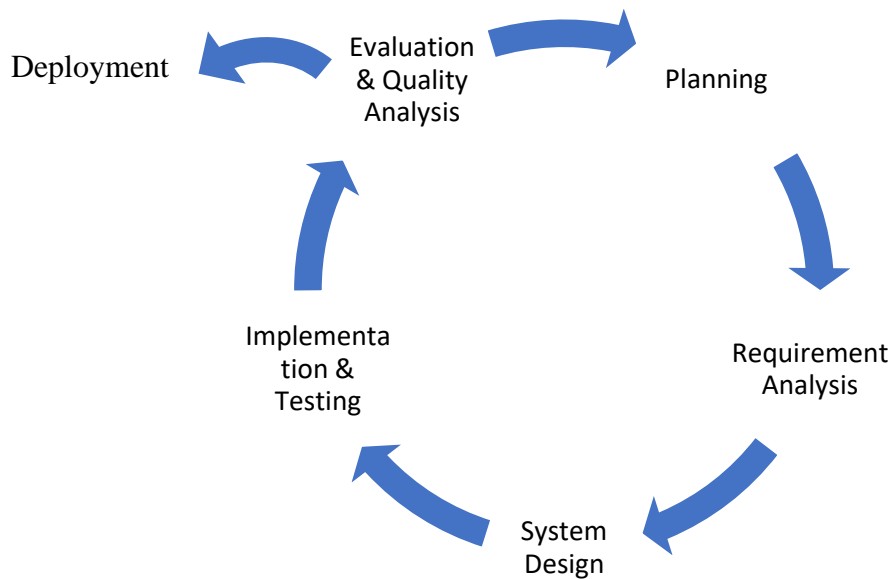


Figure 1.1. Agile methodology.

Figure 1.1 depicts the cyclic processes of Agile methodology, which is one of the most effective methodologies in Android mobile development. Its flexible, adaptive, and iterative characteristics make it a preferable candidate in mobile application development, which commonly consists of shorter cycles, changing requirements, and frequent modification (Almuraikhi, 2017).

1. Planning

Planning stage is inclusive of preparing project idea, drafting brief description, and collecting information on similar project.

2. Requirement Analysis

Requirement analysis defines the scope of the project, by documenting and verifying the expectations. A detailed scope statement serves as a basis for all future project decisions.

3. Design

The flow of the mobile app can be illustrated in a series of diagrams. These diagrams act as a blueprint of the project as to ensure an effective development.

4. Implementation and Testing

To implement the project, Android Studio will be chosen as the main development tool as it is the industry standard in Android development. Meanwhile, Android Studio provides full-fledged testing modules for debugging process.

5. Evaluation and Quality Analysis

Evaluation will be made through collecting feedbacks upon users of test version of the app. Quality improvement can be made continuously to satisfy expectations.

6. Deployment

Deployment will be made when the app is considerably met to requirements. Presentation of project will be conducted to supervisor, examiner, and audience.

1.6 Significance of Project

The product of this project eases users on interior designing processes with real time visualisation of interior elements.

1.7 Project Outline

This project consists of these following chapters.

Chapter 2: Literature Review

This chapter focuses on reviewing existing mobile applications that are available on the market. The comparison between three selected similar interior design mobile applications is discussed in detail. Meanwhile, explanation of selection of tools and technology is included here.

Chapter 3: Requirement Analysis and Design

The requirement analysis of Agile methodology will be explained further in this chapter. Analysis on collected data of questionnaire and interview will be conducted. Both functional and non-functional requirements of the project, such as user interface wireframe and UML diagrams, are prepared throughout here.

Chapter 4: Implementation and Testing

The implementation of the proposed mobile application is started in this chapter. To implement the mobile application, Android Studio is selected as the IDE in development and testing phases. Backend core functionalities are first planned to be done before construction of frontend with guide of wireframe done beforehand.

Chapter 5: Conclusion and Future Work

The project is ultimately concluded in this chapter. Discussion about the lesson learnt and future work is tracked down to further improve the quality of the project.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

In this section, there will be several reviews on the selected existing mobile apps, namely IKEA Place, Houzz App, and Homestyler. These reviews comprehensively introduce and discover the main ideas and features of an AR app. A detail comparison between these apps and the proposed app will be discussed in the next section.

Meanwhile, review on tools and technologies are briefly explained in the last section, which mainly involves the crucial ones in the developmental process.

2.2 Review of Existing Mobile Application

2.2.1 IKEA Place

IKEA Place is an iOS platform app that was announced in 2017. Pardes (2017) explained that it let users to visualise the placement of furniture into real environment. The augmented reality technology is implemented via Apple's ARKit, a toolkit specifically for augmented reality development on iOS devices (Parders, 2017). Pardes (2017) further pointed out that, the usage of the augmented reality technology in the app, makes the shopping experience more immersive and delightful. For instance, it scales up the 3D furniture to fit accurately in the environment, with true-to-life rendering of texture, lighting, and shadows (Parders, 2017).

Other than that, there are several key features of the mobile app. To boost user's inspiration, there are curated collections and product announcements to be experienced. Multi-placement enables for various items to be placed together in single space, so that the combination can be visualised. It also provides room sets that allows consumers to check out entire room sets easily. Last but not least, user can add product to their wish list and edit their profile to have a better shopping experience.



Figure 2.1. Virtual furniture well fitted in the environment.

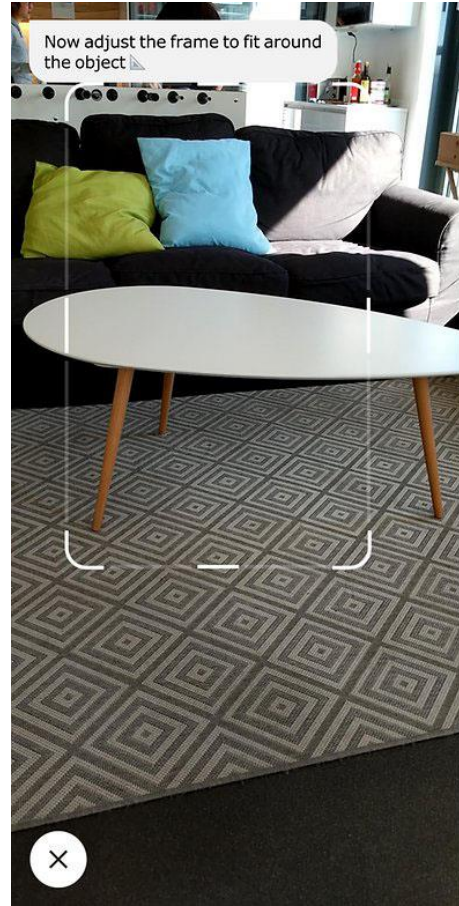


Figure 2.2. Searching of similar furniture.

Figure 2.1 shows the rendering of virtual chair being well fitted in the environment. User can move around the space and have the furniture placed still in the point. Meanwhile, the graphical enhancements such as lightning and shadow casting applied on the furniture gives a true-to-life touch.

Figure 2.2 depicts the ability of the app to search for similar furniture from its store. It obviously solves the problems of finding for the same model of a furniture. However, one of its limitations can be considered that the search result is only restricted for IKEA's products.

2.2.2 Houzz App

Houzz App is a mobile cross-platform app that was updated with Google's ARCore support in 2018. The enhancement enables the visualisation of furniture and decoration in the real environment via application of augmented reality (Diaz, 2018). It is certainly one of the most popular Android apps that ease user interior designing process. Notably, there are huge range of products from the Houzz Marketplace selectable by users to be virtually placed and inspected in their home, before making the purchase (Diaz, 2018). This in turn undoubtedly improves the users' experiences.

One of the well-known features of Houzz is the ability to create Ideabooks. Ideabook acts as a project notebook, with paint chips, fabric swatches, and measurements, to showcase and share the artist's idea, to either websites or Houzz bookmarklets. Furthermore, Houzz offers a variety of professional guides contributed from architects and interior designers to help along with the designing process. Houzz's visual match, a great tool, enables searching of similar products within more than 6 million pieces in the store.



Figure 2.3. Fitting the furniture.



Figure 2.4. Browsing the gallery.

Figure 2.3 presents the way of placing a furniture into the environment, with amazing colour matching and shadow dropping rendering.

Figure 2.4 shows the gallery consisting of various designs come from the contributors, with a friendly search bar.

2.2.3 Homestyler

Homestyler, a mobile app introduced by EasyHome, is another design tool that allows users to enjoy in space redesigning and decoration in an entirely new way. There are lots of astonishing features, ranging from colour selection to plan design, available for users to experiment with interior and exterior spaces (Louie, 2018). Without the physical movement of furniture, the app projects the planned 3D models in the screen, suiting in the environment in terms of position, lighting, and shadows using augmented reality.

Homestyler provides a huge community allowing discussion on inspiration, renovation trends, and design feedback. Moreover, it allows designing with tremendous interior elements, such as home furniture, art accessories, decorations, and lighting fixtures from various stores, including IKEA. Sharing and recreation of ideas and concepts on other apps can be made easily in Homestyler. In addition, it is able to search and view products suitable for the environment and layout, to ease users in selecting preferred designs.



Figure 2.5. Furniture blended in Homestyler.

Figure 2.5 shows the blending of furniture and the environment in Homestyler. The rendering of furniture is not as true-to-life as in aforementioned apps, but still acceptable.

2.3 Comparison of Existing Mobile Applications

Table 2.1. Comparison of existing mobile apps.

Functionalities	Mobile apps			
	IKEA Place	Houzz app	Homestyler	Proposed app
General features				
2D Plan Design	✓	×	×	×
3D Plan Design	✓	✓	✓	×
Customisation of furniture	×	×	×	✓
Augmented reality features				
Visualise in surrounding space	✓	✓	✓	✓
Realistic and accurate visualisation	✓	✓	✓	✓
Wall styling	✓	✓	✓	×
Changing of furniture variation	✓	✓	✓	✓
Measurement of dimensions	✓	✓	✓	×
Market features				
Furniture purchase	✓	✓	✓	×
Social features				
Social sharing	✓	✓	✓	×

Table 2.1 summarised that most of the existing mobile apps are all having the same or similar features, and notably with full-fledged features in the implementation of augmented reality. Comparing all the basic features reviewed, all the apps does not support for furniture customisation, except for the proposed app, which gives user the potential of creating a new customisable furniture, as to encourage user to unleash the creativity on designing.