# Design

This chapter provides an overview of the design of the implemented system. The components will be further discussed in detail in Chapter 5.

## Overview

The AR application is divided into four separate parts. The first part is the data extraction process, where data is collected for training, both for the augmented reality aspect of the application, and for the recommendation process. The second part involves feature extraction, where relevant features are extracted and fed to the implemented or applied model for training. The third phase entails building a suitable user-query model for user recommendation. The last part is implementing the trained data within the custom-built user interface to provide a user-friendly augmented reality experience.

## Data Handling

The data extraction process is further divided into three phases. The first phase is gathering relevant images of the area around the workplace, while phase two entails building 3D models of chosen markers for the Augmented Reality. These 3D models must capture as much detail as possible of the actual marker. The images and 3D models are then fed into Vuforia’s Library for training. The third phase is gathering data from a good number of previous users who rated the application when they performed a task. This third phase is necessary in order to perform collaborative filtering techniques using a set of machine learning algorithms and probabilistic methods to achieve a set of user preference recommendations. The yielded results are subsequently combined with the item similarity-based matrix.

1. Image extraction process of the workplace;
2. Building 3D models of the markers chosen from the extracted images; and
3. Building a user-task rating dataset of the previously used system.

## Feature Extraction

As explained in [15], feature extraction follows two steps, namely, feature construction and feature selection. In this project, feature extraction is done on images, 3D models, and previous user ratings. Firstly, feature extraction on images is done using Vuforia’s natural based feature selection technique [2], which is similar to the ones used in Sift [24] and Surf [8] algorithms. The next step involves passing the 3D models to Vuforia’s model target generation [1], making use of the library deep learning techniques. For the collaborative filter techniques, the SVD model makes use of the rating and user-task ID features [15].

## User-Query Model

Two user-query models will be created. The first one is related to the intern, where every intern goes through a similar process of integration on their first day on the job. Since this is a prototype, it was decided to provide a step-by-step process as feature implementation for the intern. Furthermore, they will have the option to choose whether they prefer the following for augmentation: the games room, toilet rooms, or kitchen. Then, the next part is to allow the intern to first find the secretary, then the human resources office, and finally, the manager’s office. For each task, the system will be queried according to the preferred options the user would have previously queried and the office they wish to visit.

The second user-query model is related to the visitor querying the augmented reality system. Here, the visitor is presented with the top 3 recommendations according to which task they would need to accomplish when visiting the office. The system must accommodate visitors with the following tasks: a delivery, an interview, and a visitation. Once the user chooses the relevant task and selects the appropriate recommendation which falls under their preference, they are presented with relevant augmentation. For both the intern’s and visitor’s query, the system further considers the rooms and offices which the user will walk past while visiting an office. Therefore, it not only considers what the user prefers based on previous users’ preferences, but also what they might require based on the location they are in. Therefore, the user-query model for the visitor makes use of both collaborative and item similarity-based filtering techniques.

## User Interface

The user interface must be as user-friendly as possible, and needs to provide the user with several options about what information they are interested in. The user will be presented with a main menu, allowing them to augment information about the coffee machine [17], or the offices while wandering around, or to locate an office. The coffee machine interface is augmented once the coffee machine is recognised, allowing the user to learn how to make a cappuccino via an augmented video and text. The offices information interface is augmented once the user’s phone recognises the correct marker, allowing them to view details about the office or locate a particular office from where they are. Navigation is not provided through an artificially intelligent algorithm, and it is not within the scope of this research to implement it. Navigation is provided through a 3D sketched holographic map which gives an idea of where the visitor or intern needs to go to find the office.

## Conclusion

This chapter discussed the custom design of the methods to apply the workplace assistant augmented reality, while taking into consideration previously applied implementations and methods using Augmented Reality in similar areas. The following chapter will delve further into the implementation and application of the designed methods.

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# Appendix





