# Abstract

Starting a new job in an office can be very stressful for an intern or a new employee, especially their ﬁrst day at the office. It takes time to adjust and learn what other employees’ jobs are and how they can be beneﬁcial to them. It might additionally take some time for new members to learn the ropes and their purpose within the office building, while understanding and learning how to use certain equipment, for example, an automatic key lock or simply a coﬀee machine. Therefore, the Workplace Assistant Augmented Reality will try to identify the user through user proﬁling, while providing the necessary process for the user to learn and understand the information relevant to them.

The application is intended to guide interns through an adapted process which enables them to get to know the people around them, the building, and any relevant equipment which they might use daily. It will have user proﬁling implemented, as well as object and image recognition techniques, using Vuforia to overlay new information on their tablet or mobile phone. The application will provide navigation, using only image recognition techniques provided by the Vuforia Library to guide them through the building, as well as information on every oﬃce, the people who might be working in that ofﬁce, together with some additional information, such as, how to use the coffee machine. The expected main outcome is that users will adjust easily to the workplace through a user-friendly immersive experience provided by the augmented reality application.

The conducted research and experimentation will ultimately determine whether using Vuforia's augmentation techniques is sufficient to complete certain augmented reality tasks. If not, better augmentation techniques will be compared with Vuforia's techniques and ultimately recommended.

# Introduction

## Problem Definition

“Person-job fit is a substantial factor for decreasing job stress and the adjustment of employees to an organization is an important issue for eliminating stress” [???]. [Job-fitToJob-stress]

“New employees all bring expectations to their new jobs that are based on factors like their previous job experiences, their understandings of the profession, beliefs and experiences held by peers or family, promises made during recruitment, and their evaluation of the work situation during their interview” [???]. [Adjustment To The Work Place By New Recruits In Libraries] The ﬁrst month at the workplace might seem overwhelming for new employees. Therefore, during their first few months of settling and adjusting, the company may allow “a period of learning how to ‘fit in’ and adjusting to how things work in the new setting” [???] for the employee’s benefit.

Providing an assistant augmented reality application to help speed up the process for the employee to adjust to their new workplace environment may offer several challenges. There are several Augmented Reality libraries which provide all the necessary techniques for one to build such applications, with no need to be highly skilled in any form of programming, especially where it involves Artificial Intelligence. When it comes to feature extraction, things can be challenging, especially if one is making use of traditional computer vision techniques, such as, SIFT and SURF alone. For instance, “[t]he SIFT algorithm deals with the problem that certain image features like edges and corners are not scale-invariant. In other words, there are times when a corner looks like a corner but looks like a completely different item when the image is blown up by a few factors” [???]. [Comparing Deep Neural Networks and Traditional Vision Algorithms in Mobile Robotics]

## Motivation

“Whilst employees can be reasonably expected to adjust to changes in jobs over time, poor job or employee job ﬁt can result in increased stress and ineﬃciency in organizations” [???]. [Job-fit-To-Job-stress]

A workplace is defined as the environment where people work. Adjusting to a new environment, especially one’s workplace, can come with several challenges, such as, adapting to new people, finding certain offices within the environment, and using certain job equipment. “When humans feel a loss of control this causes physiological changes which can exacerbate feelings of stress” [???]. [Job-fit-To-Job-stress] Job stress has become a common term in industry since several companies endeavour to sustain a healthy working environment for their employees. “Workload is one of the major factors which affect the employees’ productivity and efficiency. Job stress caused by high workload has become common in today’s scenario” [???]. [Impact of Job stress on employee’s job]

Such level of stress can increase from certain necessary adjustments for the employee to settle within a company, such as, filling in papers and handing them to the right offices, and learning to use certain equipment around them. Therefore, proper training should always be provided, whether it is detailed or otherwise. “Application of training in the workplace and proper implementation of training can directly lead to improving the employees' performance” [???]. [A Study on the impact of on the job training]

There are two types of training, namely, on the job and oﬀ the job training. On the job training is a method of imparting knowledge and training directly while on the job. Conversely, off the job training is a method of imparting knowledge and training while not at the place of work, for example, through a site. The idea behind training is to minimise stress levels and allow the employee to improve without any pressure. “Training, which aims at empowerment, development, and qualifying employees through knowledge and skills, refers to end-oriented, organized, logical, on-going planned attempts to bring about the desired change in the knowledge, skills, capability and attitude of employees” [???]. [A Study on the impact of on the job training]

### Why the Problem is Non-Trivial

There have been previous attempts at making indoor augmented reality applications to guide users around a place. However, most attempts are usually made using ArCore and acquiring a 3D model of the building. ArCore is useful for catching movements and current positioning, as well as light detection. It further has the anchoring feature where a virtual object is given a marker to monitor its displacement. However, ArCore is incompatible with several devices, and it would thus be futile to apply it in real-life scenarios since not everyone will have the latest phone with the latest specs. Vuforia, on the other hand, is more user-friendly and can be used on several operating systems.

The second problem is that the augmented reality application can be fed a 3D model directly to anchor positions within the map and display the respective augmented information. This can be useful when applying indoor augmented reality navigation. However, creating a 3D model of the workplace can have several problems. Firstly, the company would not want to hand out freely a plot of its indoor workplace as this goes against its policy. Secondly, one would not be testing and experimenting with anything if a 3D model of the workplace were used. In this project, several features will be tested from Vuforia’s library, such as, feature detection, and the library will be used to its full potential.

## Approach

The proposed solution is to develop a workplace assistant augmented reality (WAAR) application to assist users by providing them with augmented reality information to guide them to offices, provide them with information about offices and rooms while walking down the corridor, and give instructions on how to use the office coffee machine. The application will make use of user profiling techniques to understand users’ requirements, and will display relevant information related to the purpose for using the application. It will be necessary to fill in a form prior to using the application. The form will be quite short, and the collected data will not be stored anywhere and will only be used to display relevant markers on the augmented reality application. Once the application is closed, all data about the previous user will be forgotten, at least, for our testing purposes.

Augmented Reality development will be handled by Vuforia’s libraries since Vuforia has some features which the application can well beneﬁt from. “It enables businesses and app developers to quickly spin-up high ﬁdelity, mobile-centric, immersive AR experiences” [???]. [M. Romilly. 12 Best Augmented Reality SDKs. (2019, Jan 25).] For our research, image and object segmentation will be used to identify ofﬁce workplace markers and Unity, and the proper content will be overlaid using game objects. There will be instances where model target and Vuforia’s deep learning techniques are used to scan some objects in 3D. Vuforia is ideal because it can develop augmented reality application for Android and IOS devices.

Indoor navigation can be done in several ways. One can use GPS signals, beacons, RSS or WIFI signals, or simply Augmented Reality itself. Furthermore, Augmented reality can be either location-based or marker-based. Therefore, the proposed solution for our problem is to use Augmented Reality marker-based navigation by using several markers around the oﬃce building to segment images or objects, while displaying the proper directions by recognising the markers in view thereby enabling the company to keep the application useful for oﬄine use. For scenarios where WIFI or any other signals are down, users can still make good use of the application, for example, in case of an emergency to ﬁnd the ﬁre exit.

## Aims and Objectives

### Aim

The aim of this project is to research and develop a workplace assistant augmented reality application, using image and object detection provided by Vuforia, and filtered through user profiling.

### Objectives

* Collect images and perform image and object detection techniques using the Vuforia Library.
* Use Augmented Reality techniques from the detected images and objects to overlay and augment information and navigation information.
* Provide user profiling to filter out unnecessary information for augmentation.
* Compare and contrast other image and object recognition techniques apart from the ones provided by Vuforia.

### Report Layout

The layout of the report is as follows. Chapter 2 provides background information about the technologies used. Subsequently, Chapter 3 includes the literature review which was conducted while attempting to solve the problem at hand. Chapter 4 is a brief overview of the system and its design. Chapter 5 presents the implementation process, while Chapter 6 discusses the evaluation methods and approaches for the application, including both user and AI evaluation. The chapter further analyses the obtained results. Chapter 7 outlines the limitations and challenges encountered during the project, while offering recommendations for further development of the application and technologies used. Finally, the project is brought to an end with a conclusion.