Good morning everyone, so for my final year project I conducted a research called Workplace Assistant Augmented Reality with Collaboration with CCBill under the supervision of Dr.Camilleri.

Content

Here is the layout of my following presentation: 5 sec

Introduction

Starting a new job in an office can to some extent be stressful especially on one’s first day there/ Job-stress is an existing problem commonly found in many employees. The employees would generally need to go through a phase of learning the ropes within their new work. So providing an assistant AR application can facilitate in providing the tool necessary in making their first day and the rest more easier to adjust especially if an employee might suffer from shyness for example. Therefore, it was interesting in researching whether it can be implemented by using a combination of object and image recognition as well as user profilin.

Aim and Objectives

The aim of my final year project was to combine user profiling techniques with image and object recognition to tailor make an AR application suitable for a workplace for the employees and even the visitors to make use of, in adjusting to a new environment. Therefore the objectives were:

* Perform image and object detection techniques using the Vuforia library
* Applying AR techniques to overlay augmentation and provide information about offices, devices in this case their coffee machine for prototyping, and provide directions
* To develop user profiling techniques allow the system to show the user relevant information
* Finally to evaluate the system and techniques applied using quantity and quality testing.

Literature Review

To go through some research I personally carried out. I initially researched about Workplace AR technology. The technology presented would generally provide on the job or off the job training and sometimes both. However it is notable that not every workplace might necessitate AR technology. Although one can tailor make the application to provide tailored information for the trainee. Secondly I looked into recommendation systems in connection to AR technology. One must mention Collaborative filtering is widely adapted as a recommendation system. According to the cited research by … SVD++ performed best when applied to the MovieLens Dataset. However, for AR technology, visibility, location and distance based filtering, is commonly adapted. Hence I was interested in applying a combination of the two aforementioned techniques.

Finally I researched about computer vision approaches in AR specifically with regards to deep learning. We can all agree if applied properly in the right context Deep NN ensure high accuracy. Marker-based AR is a main driving force, however normally Traditional CV techniques are generally applied yet the are very limited to occlusion for example. So I personally looked into the provided technologies which solve this problem by applying deep learning such as Tracking by detection, S-G Hybrid approach and 6-DOF tracking method.

The main 3 components

So to give you a basic idea the system was decided to encompass three components these being , the user which is highly essential the AR system and the RS system.

Methodology process

So the first step was gathering all images of the workplace, generating 3D models myself from the images and generating the user-rating datasets. Then the markers were chosen whereby I used Vuforia to extract the feature using CV techniques and Deep Learning techniques provided by Vuforia. Finally features from the user rating datasets were also extracted using an SVD++ model.

The third step was building two user query models one for the intern and the other for the visitor. This was done by applying and implementing a combination of collaborative filtering via SVD++ and item to item based filtering for the visitor query and an item to item filtering for the intern query model. Last but not least the UI and system architecture were designed and implemented within unity to provide the end product for the user to use according to their needs within the workplace.

Test Results and Evaluation

Two sets of tests were carried out that being quantity and quality testing.

For the AR component I quantity tested using variance tests to test the AR components ability and extent to recognise the markers provided. In general, the application was promising when tested to its limits. It was notable that model targets due to using deep learning were generally more successful than image targets however this was not always the case as one can see.

For the RS component the SVD++ was compared using precision accuracy by baseline comparison using a 5 cross validation process with 9 other machine learning algorithms. The models performed on avg best both on RMSE and MAE values. The best hyperparameters were also extracted.

Finally quality testing was performed to extract user feedback on the overall system and its components. 30 participants took part half of which were CCBill employees. On average users found the app as assisting, mostly they found it as helpful provinding the necessary information. On avg most participants found the recognition as stable natural and realistic and they did not see occlusion as a major factor. However, it is quite notable that some participants found the recommendation as confusing yet still helpful.

Future Work

Future work involving improving the UI, applying deep learning to the RS side, include smart nav via an indoor positioning system, including location based tracking for corridor augmentation as well as explainable ai to keep a level of transparency.

Conclusion

To conclude In the FYP it has been presented the methods and procedures necessaery on how one can achieve a marker-based ar for a workplace. The methodology used is backed up by relevant research and evaluations. The results obtained show that marker based AR can be provided using the mentioned AI techniques to facilitate assistance withing a workplace environment.