



virtual object accordingly but most of the technologies used today cannot solve this problem which as a result, affects the user experience.

**Working around occlusion:** The main goal of occlusion in Augmented Reality is to maintain the basic rules of line of sight i.e. if there is a real-world object in the LOS of a virtual object partially or fully covering it then the virtual object should be occluded correctly. To resolve the occlusion problem these 3 main functions must be kept in mind: Sensing the 3D structure of the real world. Reconstructing a digital 3D model of the world. Rendering the model as a transparent object that hides the virtual objects. Currently, there are 2 main approaches being used to resolve the issue of occlusion:

- I. Model-Based Approach
- II. Depth-Based Approach

**Model-Based Approach:** This Approach is usually used when the environment is fully known and completely understood so that a 3D model of the real world environment can be integrated into the AR system. The process of occlusion is depended on the information received from both, the real world objects and the virtual objects. As the information is already incorporated in the AR system so the occlusion process becomes much easier. In this approach, a single camera is sufficient to make the Augmented Reality work.



Fig. 1 Model Based Approach

The face filters used in the Snapchat are a really good example of the Model-Based Approach and the same can be seen in figure 1, the money-emoji floating in the air is occluded in front of the face as Snapchat has integrated a 3D model of a face that can be detected in the app and the filter can be applied. Although being an easy approach to implement, Model-Based approach has some limitations which are cover by Depth-Based Approach

**Depth-Based Approach:** This approach is rather complex, but really comes in handy when there is no prior information about the terrain. In this approach unlike the Model-Based Approach, two or more cameras are required to determine the depth of the real world and integrate the virtual objects as per the positions of the objects in the real world.



Fig. 2. Depth Based Approach

The above images are an example of Depth-Based approach. In these images, the application detects the sky and the images are modified and occluding the rest of the objects in the image.

**2. Lighting:** To make an Augmented Reality application seem more realistic, the virtual objects must be indistinguishable from the real world objects. This is achieved by giving the virtual objects proper shadows. Lighting and illumination both play a major role in AR applications, as a basic Augmented Reality system requires lighting to detect the surface and orientation of the virtual objects to be placed in the real world. Light helps the AR system to interpret the objects within the space, and shadows help the system in depth perception. Shadows also play a major role in improving the user experience as it makes the virtual objects a real-world touch.



Fig. 3. Lighting and shadows

The algorithm for the operations performed in the above figure is:

- i Create shadows of the virtual objects.
- ii Subtract the real object shadows from the virtual world.
- iii Superimpose on the real images.
- iv Render the virtual objects receiving shadows.

**B: Game Concepts:** Everyone fantasizes about surviving a zombie apocalypse at least once in their life. So now, using the concepts of augmented reality(AR), we can bring this fantasy to the dawn of living, unlike the zombies. We have recreated a scenario where the main goal of the player is to survive to the best of their abilities using various useful items that are found throughout the game such as weapons can be found which can be used to crowd control the zombies. Medikits are also placed throughout the map which can be used to heal up to face the zombies again. Use your skills to survive the Zombies of the virtual world by any means necessary but beware of the dark coz thats when the zombies come in number.



Fig. 4. Start Screen of the game

#### IV.

#### Related Work

**Proximie** is a telehealth augmented reality based company that provides tools for doctors to bring them together and deliver quality health care services to the patients. The idea of proximie is to connect doctors such that they can exchange ideas to make, skill building as well as teaching and remote proctoring. All that proximie requires is an active internet connection be it wireless, wired, 3G, 4G. The professional impact that it has on the plastic surgeons is that they were able to learn techniques but with guidance in real life. During the course of the procedure, doctors can help each other by putting their hands and instruments into other doctors surgical field in real time to show maybe more efficient way to do surgical steps just by using the technology of Augmented Reality

#### V.

#### Conclusion & Future Scope

The following research paper describes FaceOffZombie, an Augmented Reality powered application. Our goal is to use the camera lens as an interaction mechanism which in this case is picking weapons, shooting zombies and interacting with the zombie-verse. With these techniques, we were able to create a separate universe which is both similar and different at the same time. The application has been evaluated on the basis of performance, usability and gaming experience. From the performance test result, we concluded that the game worked smoothly on multiple mobile devices. The usability and gaming experience results make us believe that the majority of users were quite pleased with the game and the overall gaming feel. Similar tests will be conducted in the near future to ensure the best experience of both the worlds. FaceOffZombie team is also considering to upload the beta version of the application on the market for further improvements. Through FaceOffZombie, we are trying to provide a stress-busting environment. Finally, it would be in our best interest to explore Augmented Reality in all of its depth as it is the future of technologies.

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