

# Augmented Reality Multiplayer Gaming

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## Abstract

Augmented Reality Gaming is a fast developing technology in the gaming world. It integrates the game's visual and audio content with the user's environment in real time. This technology enables us to use the existing environment and help create a playing field within it. In this paper, we are proposing a multi-player game using augmented reality through Wi-Fi/hotspot to play offline. Here, one can view cubes in their augmented world through their camera. The user in single player mode must locate the cubes in their environment and shoot the cubes to score and progress to the next level. The users in multi-player mode compete with each other to score within the given time frame. This being a completely offline game serves as a biggest advantage as it could be played anywhere and it could be widely used by everyone to have a fun gaming experience.

**Keyword- Offline, Multiplayer, Wi-Fi, hotspot, augmented reality**

## I. INTRODUCTION

Augmented Reality also known as AR, was proposed back in 1990s and has been there for a long time, but it is widely accepted that Professor Tom Caudell from Boeing Computer Services in Seattle, USA was the first one to have used Augmented Reality.

Since then augmented Reality has grown in many sectors and its growth has increased due to the introduction of smart phones since the 2008. Smart Phone has change the entire outlook of augmented reality and opened AR to the public sector. Several AR related companies have sprouted out since the smart phone era.

Famous of these AR related companies dealing with AR gaming is Niantic, they are the creators of the Famous Pokémon GO AR game which took over the entire world in a storm. This made the whole world look at AR and its attributes. Pokémon GO, is a single player social game were you interact with the augmented environment.

Unlike Pokémon GO we wanted to create a multi-player AR game, were more than one player see the augmented object. Any action which is done by a single player on the augmented objects effect all the other objects on other player screen. This sort of gaming would give a greater interaction among players and give a new aspect to multi-player gaming.

We are creating a single and multi-player augmented reality game were a set of cubes would occur as a virtual object layering over the real-time environment of the player. Players must break these cubes to progress to the next level or to beat the competing players score.

## II. AUGMENTED REALITY

Augmented Reality is a fast developing technology in the world. It integrates the visual and audio content with the user's environment in real time. It uses sensory generated technology as input such as audio, video, graphical contents and GPS data. Augmented reality modifies the view of the reality by computer graphics in the environment. As a result, the real world is replaced by a simulated world. Augmented reality happens in real time with environment using advanced AR technology. These objects are sensed by using the accelerometer which is used in the acceleration hence it sends the orientation of the device to know the exact axis of the device and helps the device to augment with the real time elements in a proper axis or position. The main goal of augmented reality is proposing a system which would lack in difference between the virtual world and the real world. Augmented reality is widely being used in robotics, entertainment industry, advertisement, military training and engineering design. In recent days' advertisement industry has being using this AR technology in a vast rage as it gives a real visual experience of the objects which are being advertised. This has changed the way of advertising the products. Pokémon GO has been one of the revolutionary augmented game since its release it provides a layer of virtual world over the real time environment in which the Pokémon's could be caught. Applications such as Blipper have been being used in such industries. This application uses QR codes to read the data and to augment the product. Thus, augmented reality is going to be the future of the world in many sectors.

### A. UNITY3D

Unity is a cross platform gaming engine released on june8, 2005 which was developed by Unity Technologies. The language used was C and C++.Initially it was announced for OS X at apple's WDC (world developer conference). Unity3D provides a suitable platform in any device to support augmentation. This serves as a base where a virtual world is created on top of any physical world. It is dynamically used in texture compression and resolution settings to support the gaming engine. This software also supports

shadow maps, Render to texture and processing effects dynamically. Screen space ambient occlusion (SSAO) which is used to bring the game in a full screen and thus adding effects to process the game it also uses shadow maps which used in creation of shadows in the gaming platform. The famous game makers Nintendo have been using unity3D by unity technologies as their gaming platform to run the game Pokémon. Nintendo also provides free license to all Nintendo developers with their SDKs. Thus, it has been a very supportive platform for augmented reality in all the devices.

#### *B. VUFORIA*

Vuforia is a software development kit used in mobile devices for the creation of applications which uses augmented reality. The computer vision technology is used to track images such as 3D objects, boxes in real time. This enhances the capability for the developers to position certain objects in a particular axis in the virtual world. This objects are being captured by the camera of the mobile device. Vuforia helps to track the orientation and position of the image in the real time environment so that it would match the perspective of the viewer through the device. Vuforia supports a variety of two dimensional and three dimensional targets that includes marker less image targets. Vuforia provides API in C, C++ languages. Vuforia provides a good application programming interface.

#### *C. HARDWARE*

Hardware components such as processor, sensors, display are used to augment the real world. the components co-coordinately work together to develop a replica of real environment elements. This device has accelerometer and GPS which are used to find the orientation and the position of the device respectively.

#### *D. MOBILE PHONE*

This device has components such as camera, display, accelerometer, barometer, GPS in it. All this component work accordingly to replicate the real world to a virtual world. The camera is used to capture the elements in the environment and it sends the coordinates to the accelerometer which defines the axis of the element. Using this display the user could interact with the virtual world created and could communicate with these elements. In this game the cubes are being placed in a fixed axis and the user needs to identify the augmented cubes and shoot it using the display touch.

#### *E. AR EYEGLASSES*

The AR eyeglasses render the camera which intercepts the real world view and augments through the eyepiece. Head mounted display is one of the most popular devices being used for augmentation. This device pair to our head such as a helmet and it creates a virtual world around us which could be viewed by the glass. It stimulates us as if we are present in the real time situation. Over the years the HMD is going to change the way of viewing a video as HMD would create a virtual space around us as if we are in the video well. These glasses could be paired with any of the devices which runs augmented reality.

#### *F. PEER TO PEER COMMUNICATION*

Peer to peer communication is decentralized distributed communication where each peer inside the network has their tasks and workloads divided among them. Peer to peer architecture form an overlay network virtually on top of an underlying physical network to form a subset. The communications are still done by TCP/IP, but the overlay network enables the systems in the network to communicate with each other independently. Each peer in the network can act as both client and server. Peer to peer architecture is widely used in monitoring the traffic in a network. It also used in the control of different peers inside the network like which system to connect and what resources to provide.

Integrating peer to peer architecture in this application enables us to achieve the multiplayer functionality of the game, using an unstructured peer to peer model to connect the different players in the network using a wireless local area network. The unstructured peer to peer architecture does not possess a particular structure but rather connect the nodes randomly to form the network connections. It increases the efficiency of the game as the users (players) using the application is unreliable. The data transfers are legal because no copyrights law is going to be violated in sharing scores between applications. The incredible advantage of using peer to peer system architecture is that the content delivering capacity increases as more number of clients accesses the network. As each node can behave as server and client, any system failure can be masked by the other nodes and takes the role the server. Privacy concerns and the anonymity of the users is a major concern when approaching peer to peer network systems. Since we are using a wireless local area network in this application privacy concerns are ignorable.

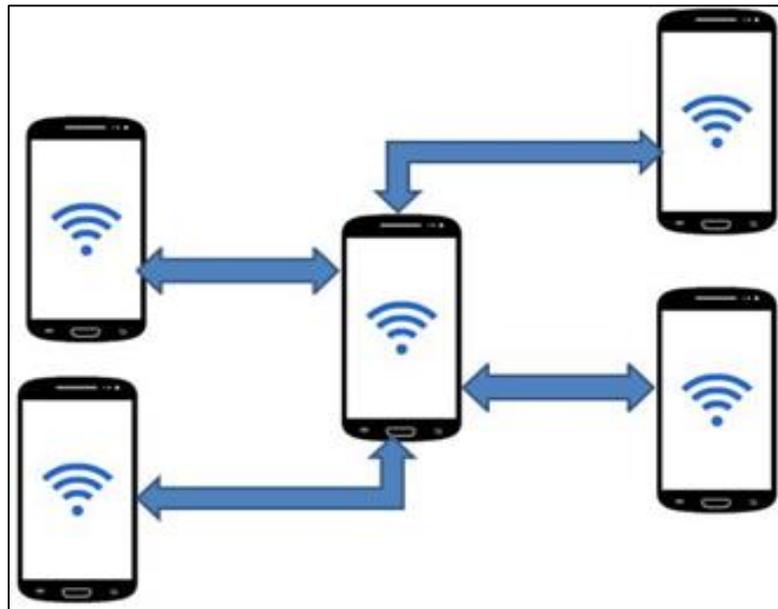


Fig. 1: Peer-to-peer communication

### III. SINGLE PLAYER

In this proposed game the user would get a series of augmented cubes being displayed on the screen with some cubes being static on an axis and some being dynamic. The user gets chance to shoot the cubes one by one and as the cubes gets hit the points are being added to the user. The user must hit cubes before it gets disappear. If the user obtains a particular score, then he is moved to the next level which gets even tougher as the rate of the cubes getting disappear is faster and the cubes move fast this increases the level of difficulty of the gamer. He again moves to the next level as he obtains a certain par score.

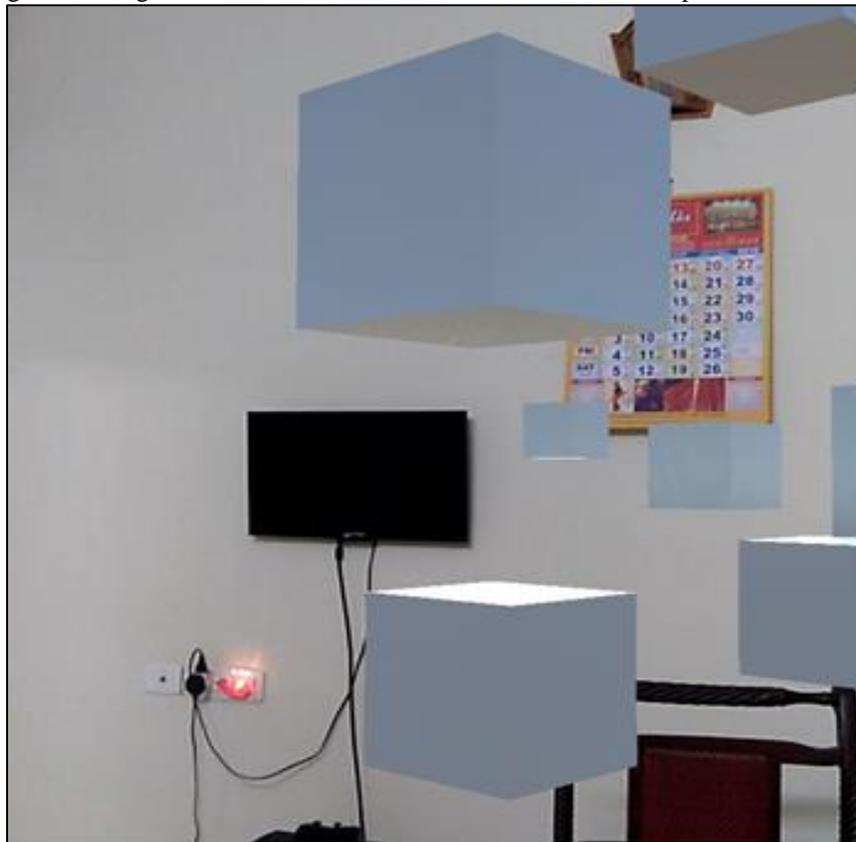


Fig. 2: Single-player

## IV. MULTI PLAYER

In the multi-player mode, the application can accommodate multiple users to share the augmented environment and compete with each other. To connect with other players, the application user should switch on their Wi-Fi connection and connect with other players. Then the players should switch to multiplayer mode to begin the game. As the game starts all the players connected in the network share the same augmented environment and they score points by locating the cubes in their gaming environment before the other players get to them.



Fig. 3: Multi-player

## V. ALGORITHM

### A. FUNCTION CUBE SETTINGS

To define the position of the cube, the speed of the generation of the cube and the scale of the cube is designed in this function.

Function CubeSettings

```
{
mOrbitAnchor <- Camera.main.transform
x <- Random.Range(-1f, 1f) // allocating position on x axis y <- Random.Range(-1f, 1f) // allocating position on y axis z <-
Random.Range(-1f, 1f) // allocating position on z axis
mOrbitDirection <- assigns new position of the cube using Vector3(x, y, z)
// defining speed
mOrbitSpeed <- Random.Range(5f, mOrbitMaxSpeed)
// defining scale
Scale <- Random.Range(mScaleMin, mScaleMax) mCubeMaxScale <- Vector3(scale, scale, scale) // defines the cube size
}
```

### B. FUNCTION SPAWN ELEMENT

To create an imaginary sphere inside sphere in which were all the cubes will be formed. Overhere the size of the sphere and cube are defined

Function SpawnElement

```
{
// spawn the element on a random position, inside a imaginary sphere
GameObject cube <- Instantiate (mCubeObj, (Random.insideUnitSphere * 4) + transform.position, transform.rotation) as
GameObject
Scale <- Random.Range(0.5f, 2f); //defines scale
// defining cube size
cube.transform.localScale <- Vector3 (scale, scale, scale)
return cube
}
```

## VI. LIMITATIONS

The main reason for the growth of AR is due to the growth of smart phone which is also its biggest disadvantage. The modern day smart phone isn't sufficient enough for augmented reality to work efficiently. The cameras of the modern day Smartphone doesn't do object identification on its own. Even though this object recognition technology exists many manufacture don't use it as it isn't relevant to the current day market. Lack of growth in the eye wear technology is also a big reason for the slow growth of AR. Same problem exists with our Gaming app as the cubes could be generated anywhere even inside object which may look very bad and the player might lose the sense that he playing in the real world.

## VII. CONCLUSION

Augmented reality is likely to become more and more integrated into our daily lives. Soon many major gaming, entertainment and technology industries would do more development into augmented reality and its features. With better hardware comes more development on the technology.

There could be augmented reality games using more than just cubes. Future projects could have various other 3D objects instead of the cubes and these 3D objects could be more interactive in the future. Soon there would be more multiplayer games in augmented reality.

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