Project Proposal for MSc in Games Technology

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# **Project Title:** Social card games in a shared virtual world using multi-modal smartphone based augmented reality

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# Introduction

In 2021 Facebook changed its company name to Meta and declared its intensions to build their “Metaverse”. This term has been taken from the science fiction novel Snow Crash, in which characters would log into a shared virtual world through virtual reality (VR) goggles [CITATION]. This announcement was controversial among certain groups. Some commented that Metaverse is merely a marketing buzzword with no current real word application [CITATION], and even John Carmack, CTO of Meta owned Oculus VR has called it a “… a honey pot trap for architecture astronauts” [CITATION]. However, it is undeniable that many companies around the world are investing in technology that will help achieve their interpretation of a Metaverse[CITATION]. Epic games would argue that their industry defining game Fortnight is a Metaverse [CITATION], as would the makers of the online game making platform Roblox [CITATION]. Mark Zuckerberg has described his vision of the Metaverse as the “successor to the mobile internet” [CITATION] and that it will take place on head mounded displays dedicated for VR. It the stated belief of the Meta company that handheld smartphone screens are no longer where the future of the socializing on the internet will take place.   
  
It is the opinion of the author that the prohibitive cost of VR headsets and their requirements on physical space create high barriers to entry that make socialising in VR unappealing to many. Whereas smartphones technology already has wide adoption and could provide immersive, intuitive, and enjoyable virtual socialising through augmented reality [AR]. This document outlines a proposed design and build of an AR card game that, though multiple forms of input, will let users naturally interact with each other in a shared virtual world.

# Project Description

Over the last decade great strides of progress have been made within AR and VR development. Progress in VR has been driven by advances in mobile head mounted displays like the Oculus Rift and HTC Vive [CITATION]. AR headsets have been developed as well but have been primary directed towards business and industry use cases rather than the public consumption [CITATION]. Therefore, the most popular uses of AR technology come from smartphone users.   
  
Even though both AR and VR are conceptually similar, their current use cases are quite different. The most advanced VR headsets like the HTC Vive Pro and the Oculus Quest use in-headset cameras to map the real-world space allowing games to track player movement around a space. Sophisticated wireless controllers can also add hand tracking to give players realistic in-game hand controls. These methods of control can allow for immersive VR interactive experiences that allow players to move around and interact with virtual worlds as naturally as they do in the real world.

AR games commonly fall one of two of categories that can be described as ‘city-scale’ or ‘room-scale’ experiences. City-scale games like Pokémon Go [CITATION], Ingress [CITATION] and Zombies run [CITATION], are based around moving around the real world. Their gameplay encourages players to explore local places of interest in their town or city. Examples of room scale games include Kings Of Pool [CITATION] or Smash Tanks [CITATION]. Room-scale games encourage players play standing up and interact with 3d models projected into the real world.   
  
Inspiration for this project has been taken from the PC game “Tabletop Simulator” and its VR mode. Like Tabletop Simulator, players of this game will be equally spaced around a circular table; they will have free movement of their camera as well as the ability to pick up and interact with cards on the table or in their hand. This seated and locked position gameplay model could be described as ‘desk-scale’ AR.  
  
One of the primary design goals of this project is to allow enough freedom of movement and communication that no card game rules need to be coded into the game. If the players have enough control over the cards, they should be able to either play card games already known to them, learn from their friends, or even make up a card game while in the app.

Smartphones do not come with controllers, nor do they have in-built multi-camera room mapping technology. But they do have multiple dimensions of player input that, when used in unison could create an immersive social experience.

Head tracking In VR a game the camera is tied directly to the movement of the head mounted display. The smartphone replacement for this input method should therefore be the movement of the phone as tracked by the onboard gyroscope. VR games work intuitively as with a first-person camera model, but the AR card game should use a mixture of first and third-person camera design.

Replicating the functionality of physical game controllers in augmented reality could be achieved in one of two ways. The swipe/tap gestures on the phone screen could be combined with the location and direction of the camera to allow for contextual controls. Or hand recognition software could be used to detect player hand movements and gestures.

One advantage that smartphones have over VR headsets is that smartphones have front facing cameras. Through this front facing camera the player head position relative to the screen could be tracked to give a 3d parallax effect. An in-game player avatar could also be created and modelled after the players expressions using face filter techniques that apps like Snapchat or Instagram use [CITATION]. The live video feed from the front facing camera could also be added to the in-game world and mapped onto a surface that responds to the players phone position and direction.

To save on development time the project will be developed in the Unity engine. This allows for the use of AR focussed cross-platform plugins that would be too time consuming to design from scratch. Lightship ARDK from the makers of Pokémon GO will be used for real time mapping and multiplayer programming [CITATION]. Manomotion SDK will be used for hand tracking [CITATION] and Unity’s own AR Foundation SDK will be used for face tracking. The primary testing platforms will be an iPhone Mini, iPad Mini and a Google Pixel 3.

# Objectives

To make the best use of the time available. The project will be split into three versions. The first will be to establish the game basics and proof of concept feature tests. The second version will be focussed on the core feature set. The last version will be for non-essential features and bug fixing.

* Version 1
  + Literature review of relevant AR apps.
  + Basic unity setup and device setups for testing.
  + Basic multiplayer session setup using Lightship ARDK
  + Hand tracking test
  + Face tracking test
  + Streaming video call test
  + Multiplayer Audio test
* Version 2
  + Creation of game space, and player placement.
  + Implementation of primary interaction technique (hand gestures or phone touchscreen)
  + Card mechanics
    - Placement of cards on table
    - Pick up / Drop Mechanics
    - Add and remove cards from the players “card hand”
    - Show single cards to individual players.
  + Card Deck mechanics
    - Shuffle and deal
    - Pick up multiple cards
  + Player audio.
* Version 3
  + Player presence through animated avatars or floating video call screens.
  + Refinement of interaction techniques based on user testing
  + Improved graphical treatment using shaders lighting and models taken from the Unity store.
  + Camera parallax through face tracking.
  + Player hand modelling.
  + Refactoring of game code.
  + Remote multiplayer testing.

# Beneficiaries

There are multiple beneficiaries for this for this project. Primarily, the author will gain experience in multiple technologies that will be important to the continued development of their career. Further experience with Unity and augmented reality plugins and packages will allow for the author to specialise in augmented reality development post graduation.

The author is also being partially financed through this part time masters course by their employer, Territory Studio. Territory is a multidisciplinary design studio whose work ranges from creative advertising to motion graphics and to post production visual effects for film and television. The studio also has a growing immersive department which, thus far has focussed on interactive exhibitions using Unreal engine. By financing the authors studies, Territory is also investing in the studios technical skillset around mobile based AR and Unity based projects.

The planned development of the project incorporates 3rd party tools that are active in promoting successful uses of their tools. Hand tracking toolset Manomotion promoted community projects on the YouTube channel [CITATION]. Niantic’s AR development toolset, Lightship ARDK was released at the end of 2021. The company is promotes their toolset through their website, social media channels, community game jams and yearly awards. If this project is successful, it could be added to the each companies community showcases.

# Critical Context

Technology like the magic leap [CITATION] or a LIDAR equipped smartphone [CITATION] could be used to achieve greater accuracy when reading player movements, but that would in opposition one of the primary goals of the project. As a response to the high barrier of entry for VR headsets, this project should have a low barrier to entry which will be helped by using readily available consumer grade technology.

Since the project uses technology that has existed since at least 2016 [CITATION], there is a large community of AR developers who may have attempted a similar project to this. The author has been able to find games and demos that contain some of the features planned for in this project but they a have been unable to find an example of all the features used together.  
  
The proposed card game will use the camera to place a 3d table in the game environment on which the card game will be played. Knightfall AR is strategy game that similarly, places a game map on a flat surface in front of the player. From there the player can point their phone at items on the medieval battlefield to direct attacks.  
  
Unlike Kightfall AR, this project will attempt to use hand recognition to play the game. The Manomotion YouTube channel has dozens of examples of hand recognition apps. Specifically, there is an example of a beer pong game could have a similar interaction model to the proposed card game. Players of the beer pong game can use a pinching motion to hold a ball and then by moving their hand while pinching they can throw the ball. This pinching motion could be used to move cards to and from the table.  
  
It is desirable that the physical presence of players on the game world is communicated to each other. This could happen through in game avatars or projected video call screens. In-game avatars could be designed similarly to Apple’s Animoji system [CITATION], where facial movements are mapped to a 3D character. Unity software themselves have shown how to replicate this behaviour in their engine [CITATION]. Alternatively, the front facing camera feed could be projected onto a 2D surface in the game world. In both and that surface could move according to where the phone is.

not been able to find any project that combines multiplayer card games, hand recognition, face recognition and group video calling. However, have been found that have attempted one or more of the features of the proposed project.

This form of interaction is common with AR games. The games project a 3D model into the world and the player interact

# Methodology

Info about project planning and review sessions

Feasability

Are the goals too ambitous?

Evaluation

How will I get feedback from users

# Project Plan

Gant chart

# Risk Assessment

Risks ETC

# References

Links etc

# Ethics Checklist

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