
Final report for the Mixed Reality WS2017/2018 final project: Dragonhood

Akash Castelino

Saarland University

s8akcast@stud.uni-saarland.de

David Liebemann

Saarland University

s8dalieb@stud.uni-saarland.de

Abstract

.

Author Keywords

Final report; Mixed Reality; Augmented Reality; Interactive video game; Puzzle game; Cooperative game;

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous; See [<http://acm.org/about/class/1998/>]: for full list of ACM classifiers. This section is required.

Introduction

The final project developed for the Mixed Reality seminar is a Mobile Game with Augmented Reality aspects, set in the real world neighbourhood of players. The real aspects are enhanced with fictional scenarios players have to cooperatively solve to win the game.

Previous projects

The project is built on basis of two prototypes developed over the course of the seminar, which were combined, enhanced and improved in order to build a complete experience.

The "Travel Guide" mobile application enables users to connect with nearby users in order to determine the next travel goal. Users can view their current surroundings on a map

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

ACM.

Saarbrücken, Saarland University

ACM Unknown.

Unknown

and experience the position of certain Points of Interest by seeing the direction they are looking at in the real world. The map view and the display of the real world rotation were used in the final project.

The "Point and Click Neighbourhood Adventure" prototype is the main precursor of the final project. It enabled users to connect to other nearby users and solve two scenarios, one of which could only be solved cooperatively.

In this paper a *scenario* is defined as a sequence of tasks which players have to successfully solve in order to gain a reward. A scenario is activated by scanning a so called "Vuforia Marker", a certain image printed on paper.

Vuforia is an Augmented Reality Software Development Kit for mobile devices that enables the creation of Augmented Reality applications. It uses Computer Vision technology to recognize and track images in real time. [10] Examples for Vuforia Markers can be seen in figure 1 [12] and figure 2 [11].

All aspects of finding and solving scenarios during a game session will further be called an *adventure*. The prototype focused on the gaming aspect of such an adventure and offered only limited cooperative play. The final project enhances this prototype by providing a Creation Mode and mandatory cooperation between players in order to win the game.

Final project

The newly added Creation Mode allows players to choose the amount of markers they want to set per scenario and at what GPS-position to set them. This information can then be saved to a file.

The improved Play Mode allows users to load save-files

created during Creation Mode and share the scenario positions with other players over the network. Scenario positions can then be viewed on an Augmented Reality map, which is displayed when scanning the corresponding Vuforia Marker.

While the Puzzle-box scenario received improved usability and touch controls, the Dragon scenario was enhanced with mandatory cooperative gameplay elements – just as with the Puzzle-box scenario, players now have to work together to complete the Dragon scenario.

Motivation

In modern day life, especially in metropolitan areas, people often do not know the names of their neighbours or have never explored their neighbourhood. It is hard for parents to motivate their children to go outside and play there – the perspective of staying at home and playing video games is more appealing. On the other hand, exploration of the neighbourhood is sometimes discouraged by parents, if dangerous areas are nearby.

This game motivates players to explore their surroundings while looking for good spots to create scenario locations during Creation Mode or while searching for scenarios during Play Mode. It demands cooperative play in order to accomplish tasks, players will have to find people nearby to play the game with. To successfully finish adventures, players have to speak with each other in the real world, conveying team play and communication skills.

Children can be motivated to play outside and engage in physical activity due to the mix of having to search for scenarios combined with virtual gameplay on the mobile device. Parents can create adventures for their children to either have some fun family time or keep their children away from dangerous locations.



Figure 1: Vuforia-marker for the scenario "Puzzle-box".



Figure 2: Vuforia-marker for the scenario "Dragon".

Requirements for using the application

The application will be usable on mobile phones running Android: OS 4.3 or higher or iOS 7.0 or higher [6]. The phone will need the following sensors and features for the application to work correctly:

- Gyroscope
- Accelerometer
- GPS
- Camera
- Mobile Hotspot creation [8]

The application has been successfully tested on a Samsung Galaxy S3 (2012) with Android: OS 4.3, a Samsung Galaxy S8 (2017) with Android: OS 7.0 and an iPhone 6 with iOS 11.2.2 installed.

Related work

Positive experiences with Geocaching® Mobile App as motivation

Positive experiences with Pokemon Go

Todo: introduce Geo Caching and Pokemon Go. Our application is a mix of both

Choice between Creation Mode and Play Mode

On start-up the player is presented with a simple menu, in which he can choose between entering Creation Mode or Play Mode.

Creation Mode

The Creation Mode allows players to create an adventure, adjust it to their neighbourhood and save the adjustments to file.

Entering Creation Mode

Upon entering Creation Mode the player is presented with a map depicting the real world surroundings, centred on the current GPS-position of the players phone. Map textures are downloaded from Google Maps [3] using the Google Maps Developer API [4].

The player position and view direction are represented by a small figurine and a pointer.

By holding the button labelled “Zoom” and tilting the phone, players will be able to zoom in and out of the map.

An example scene upon entering the Creation Mode can be seen in figure ??.

Setting Scenario-markers

todo

Saving the adventure

todo

Exiting Creation Mode

todo

Play Mode

todo - general introduction to play mode

Entering Play Mode

todo

Network connection

todo

Class selection

todo

Loading an adventure

todo

Navigation and locating adventures

todo

Scanning a scenario

todo

Puzzle-box

todo

Completing the scenario

todo

Improvements over the original prototype

todo

Dragon

todo

Implementation

The following section will discuss the implementation of the presented concepts. Naturally the project can be divided into two parts: A creation section and a play section. Each part is contained in its own Unity-Scene [9] and gets loaded up when the corresponding button in the selection menu is pressed.

Creation Mode

todo

Google Maps

todo

Setting marker locations

todo

Saving an adventure

To save an adventure, the serialization options of C# [7] are being used. Once the Save button is pressed, the relevant information of each marker – ID, name and the GPS-position – are written into a serializable data-object and stored in a C# List [5]. This list is then serialized by a binary formatter [1] and stored as an “.adv” file on the local machine data storage.

Such a file can then later be deserialized again into a list of data-objects containing the stored information.

Play Mode

The Play Mode implementation can be further subdivided into network, Puzzle-box and Dragon implementation.

Network

todo

Puzzle-box

todo

Dragon

todo

Conclusion and future work

todo

Differences to original concept

In a preceding concept document, mandatory and optional features of the final project were presented and discussed.

The finished application implements every mandatory feature as planned, except for the navigation aspect during Play Mode. As discussed in the concept document, the implementation of the optional feature of splitting up Vuforia Markers into multiple pieces forced the development of a new navigation method, as discussed in the section “Play

Mode”.

This adjustments lines up well with the Augmented Reality aspect of the application and builds a highlight of the Play Mode and thus is considered as an improvement of the original concept.

Possible Problems

As the creation of adventures is community driven, real world aspects of the game – like the correct positioning of Vuforia markers in the real world – can not be controlled by developers. Experiences with related applications, like the Geocaching® Mobile App [2], support the assumption that creators will act with caution while creating an adventure, as it is in the best interest of everyone using the application.

Future work

Enable players to connect, without having to set up a WiFi-Hotspot.

Power consumption because of missing performance optimization

Disconnects during gameplay are not handled - if a player progresses the game state during a disconnect, the changes will not be synchronized correctly.

Vuforia can recognize markers even if only a part of the image has been gathered.

REFERENCES

1. 2018. BinaryFormatter Class. (2018).
[https://msdn.microsoft.com/en-us/library/system.runtime.serialization.formatters.binary.binaryformatter\(v=vs.110\).aspx](https://msdn.microsoft.com/en-us/library/system.runtime.serialization.formatters.binary.binaryformatter(v=vs.110).aspx)
2. 2018. Geocaching® Mobile App. (2018).
<https://www.geocaching.com/play/mobile>
3. 2018a. Google Maps. (2018).
<https://www.google.de/maps>
4. 2018b. Google Maps API for developers. (2018).
<https://developers.google.com/maps/?hl=de>
5. 2018. List<T> Class. (2018).
[https://msdn.microsoft.com/en-us/library/6sh2ey19\(v=vs.110\).aspx](https://msdn.microsoft.com/en-us/library/6sh2ey19(v=vs.110).aspx)
6. 2018a. Requirements to run Unity3D. (2018). <https://unity3d.com/de/unity/system-requirements>
7. 2018. Serialization (C#). (2018).
<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/concepts/serialization/>
8. 2018. Software Hotspot (Wi-Fi). (2018).
[https://en.wikipedia.org/wiki/Hotspot_\(Wi-Fi\)#Software_hotspots](https://en.wikipedia.org/wiki/Hotspot_(Wi-Fi)#Software_hotspots)
9. 2018b. Unity Scenes. (2018). <https://docs.unity3d.com/Manual/CreatingScenes.html>
10. 2018. Vuforia explanation. (2018).
https://en.wikipedia.org/wiki/Vuforia_Augmented_Reality_SDK
11. 2018. Vuforia-marker image used for the dragon scenario. (2018). <https://benwootten.deviantart.com/art/Red-Dragon-118573547>
12. 2018. Vuforia-marker image used for the Puzzle-box scenario. (2018). http://wallpaperswide.com/question_marks-wallpapers.html