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A Framework for Augmented Reality Based Shared Experiences

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Abstract. Meetings occupy 40% of the average working day. According to the Wall Street Journal, CEOs spend 18 hours, Civil Servants spend 22 Hours, and the average office worker spends 16 hours per week in meetings. Meetings are where information is shared, discussions take place and the most important decisions are made. The outcome of meetings should be clearly understood actions, but this is rarely the case as comprehensive meeting minutes and action points are not often captured. Meetings become ineffective and time is wasted and travelling becomes the biggest obstacle and cost (both monetarily and environmentally). Video conferencing technology has been developed to provide a low-cost alternative to expensive, time-consuming meetings. However, the video conferencing user experience lacks naturalness, and this inhibits effective communication between the participants. The Augmented Reality (AR) shared experience application proposed in this work will be the next form of video conferencing.

This work demonstrates the use of AR for creating shared experiences; the main contribution at this time is to demonstrate the ability to use networking alongside AR, and to visually and audibly interact with other users. A shared experience allows users to experience natural human interaction in an AR space. The first AR application was introduced for a smartphone in 2005, a multiplayer AR tennis game. Since then, AR has become more mainstream. In July 2016, Niantic and The Pokémon Company released an AR application called Pokémon Go. This was the first time an AR application became truly mainstream. The application made $795 million worldwide during 2018 alone; and has earned a total of $2.2 billion since its launch. AR is one of the three major elements in the immersive industry alongside virtual and mixed reality. Besides games, AR can be used to help make tasks simpler for many industries and reduce or remove obstacles.

The aim of this work is to create meeting rooms allowing users to have their own virtual rooms to hold conferences. this application will remove the

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obstacles required for the meeting, i.e. venue, available participants and the travel time and costs. This application removes these obstacles and allows the user to have a meeting from their location. Spatial, a new collaboration platform that will allow users to collaborate, search, and share content as if they were in the same room using the Hololens. Spatial is Skype in 3D, provides the same tools as the telecommunication application, converts 2D images into 3D models to represent the users and provides 3D equipment. Spatial has a similar concept 2 however, the application being developed in this work is available on various devices i.e. cardboard headsets (Aryzon, Holokit), smartphones and Hololens. Having multiple hardware options widens the audience as not many people can afford a Hololens. Kato and Billinghurst's paper on marker tracking and HMD calibration for a video-based augmented reality conferencing system have some similar elements, as both applications freely position a user in space. Users can collaboratively view and interact with virtual objects using a shared virtual whiteboard. However, our application is audio based which uses little bandwidth in comparison to Kato and Billinghurst's work where the video based streaming uses 10 to 20 times more bandwidth than audio.

In this work to date, we have demonstrated that it is feasible to develop an AR conferencing application on multiple remote mobile devices with shared experience features. The main aspect and purpose of the work are to demonstrate the ability to visually and audibly interact with other users in a common AR environment over the Internet. Each participant can see an AR visualisation of the other meeting participant's avatars in their own office environment. Besides audio and text communication, the application will record audio and convert it to text, i.e. providing real-time subtitles which will be visualised for each user. The subtitles will persist for a time to aid understanding and increase communication efficiency between meeting participants. This application represents a significant first step towards the goal of this work. Thus far, the application can connect users, communicate with one another over the Internet and display their avatar in a synchronised shared experience. The end result will contain similar elements to what Spatial provide but will also feature automatic speech recognition (ASR) and natural language processing (NLP) to convert speech into text. At the end of the conference meeting the application will save and send a HTML format of the conversation to each user's email.

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