Multi-User Interactive Applications Using Augmented Reality on Mobile Devices
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Background and Objectives

Problem:
- Most of the augmented reality (AR) applications designed so far have been designed for use by one person.
- To see what one person is doing, other people have to move from their location and crowd behind one screen, causing an inconvenience.
- If multiple people want to work on the same project or task, it is currently difficult to find an augmented reality application that would support that idea well.
- Many current interactive AR require expensive devices that not many people own.

Goals:
- Allow users to be able to participate in activities and games without being bound by physical limitations.
- Allow regular, everyday users to be enriched by augmented reality technology through the use of mobile devices that are already ubiquitous.
- This project hopes to offer an enjoyable and interactive experience in the virtual world.

System Design

To play the games, all the users have to have their own mobile device and be connected to the same network. One of the player creates the game, and becomes the host. That player’s device becomes a server and a local host simultaneously. The other devices connect to the host via IP address and become remote clients. Player 1 and Player 2 can send commands via tactile input to the server which updates all of the clients (including the spectator Player 3) in real time.

System Hardware/Software

- Vuforia Software Development Kit for augmented reality technology.
- Unity3D was used for the object modeling, iOS development, and implemented much of the app functionality.
- Unity Networking (UNET) was used for multiplayer functionality and server/client connections.
- C# was the scripting language used.
- Xcode was used to port the application to iOS devices.
- The application will work on any iOS devices (iPhone 7, iPhone 7 plus, iPad, etc.). An android application is not available at this time.

Discussion

- Most of the users who tried the applications were very interested in it and found it enjoyable.
- Promising outlook for the feasibility of future interactive mobile augmented reality applications
- Some issues with latency affecting gameplay (especially for the Pong game)
- Testing is challenging and time-consuming

Future Work

- Polishing the application, improving aesthetics, and/or adding more features (e.g. an undo move and a turn timer for Chess, and a scoreboard in the Pong game).
- Finding ways to reduce the effects of latency
- Working on a different set of interactive applications, not just games (e.g. an interactive object modeling application).
- Create these games and other apps for android phones, not just iOS devices.