Bi-Weekly Report: Period ending in 22nd November 2019

Overview: What we've done

At the beginning of the project, we spent two weeks on **human computer interaction** tasks. This helped us to think about the interface of the project and put ourselves in the shoes of future users. We built a basic prototype using WiARframe. We conducted user interviews and a small survey about the appearance of the avatar. This gave us a clearer idea of the main functionality we would want our AR avatar to have as well as issues particular to designing with AR.

In the last two weeks, we moved onto the **research and development** phase. Although we knew from the start that we would be using IBM technology to underpin the chatbot, voice recognition and voice generation aspects of our AR avatar, there were still areas of functionality where we needed to research possible technical solutions and make decisions about what technology to use. We decided to use Unity game engine to render our avatar since we discovered that there are existing SDKs for implementing IBM Watson technology in Unity. We still need to research how we will connect this with database service in order to hold staff information, and a notification service to send a text to alert someone that a visitor is there to see them.

Since we are using many new tools (IBM Watson, Unity and Docker, for example) we have had a steep learning curve to get acquainted with them and to start to make a more concrete plan of how we will build out our must-have requirements. We have been following online tutorials to understand how to get started with building some basic functionality. We started learning **IBM development tools** and exploring the Watson Unity SDKs which will probably form a large part of our development pipeline. We encountered numerous bugs and issues with implementing example projects from these SDKs and spent time with debugging. As a result, we developed a simple **Bug log** so that we could share knowledge with each other about bugs we had encountered and how to solve them.

We researched more generally about **existing AR avatars** and the kind of functionality they can have. The interactive avatar market is emerging rapidly due to the overlapping development of several necessary technologies such as mobile 3D rendering, deep learning algorithms and availability GPUs[1]. This has led to new companies experimenting with 3D avatar technology and innovating new functionality such as sentiment analysis of the user[2], using machine learning to create more naturalistic animations[3], and using neural nets to synthesise more realistic human voices[4]. This researched allowed us to see the potential for building an AR avatar inspired us to fill out our "could have" functionality with some basic versions of these more advanced techniques.

In the past two weeks we worked on our **communication and task management** as a team. We realised that unless we work together effectively, the hours we put in alone are redundant, because we end up wasting time working on the wrong problem or on a problem that one of the

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[1] https://medium.com/twentybn/intelligent-avatars-ais-adjacent-possible-75fbdb9c8dc

[2] https://vrscout.com/news/ar-platform-intelligent-avatars/

[3] https://blogs.unity3d.com/2018/06/20/announcing-kinematica-animation-meets-machine-learning/

[4] https://deepmind.com/blog/article/wavenet-generative-model-raw-audio

others was also working on. We don't have a lot of time to build our product and so we need to be as efficient as possible for this reason we started using a Kanban style Trello board to organise our project, so that everyone can clearly see what tasks others are working on and what needs to be done next.

Finally, we discussed building a **custom avatar** with our supervisors. We had wanted to design a custom avatar for this project that could take on the branding of the organisation that it is 'working' for. Originally, we wanted to learn the 3D modelling skills ourselves, but our supervisor advised us that this would take up too much time and that we would not be rewarded for it during the marking of the project since it was not related to computer science. We decided to reach out to animation students at other universities to organise a collaboration, but unfortunately we were not able to find anybody after reaching out to several universities and realised we were wasting time on something that could be added to the project later. For this reason we decided to abandon the idea of having a custom avatar, for now. However we can build functionality into our project so that the avatar we use could be replaced with a custom one later on.

Tasks completed:

- Conducted user research
- Created a basic prototype
- Formalised our requirements
- Researched existing AR avatars
- Researched building a custom avatar
- Contacted animation programs to try and find an animation student to collaborate with
- Created IBM developer accounts
- Created Azure accounts and experimented with the interface
- Implemented Watson SpeechToText in Unity
- Experimented with the Watson SDKs
- Looked through IBM Code Patterns
- Completed IBM tutorials about Watson Assistant, Speech to Text and Watson Discovery
- Created and started using a team Trello Board
- Created a Bug log
- Created service instances of Assistant, TexttoSpeech and SpeechToText
- Looked through documentation of IBM Watson

Are we on track?

Our next big project deadline is on the 17th January when we should deliver working code for our 'must have' functionality, as well as a basic website, presentation and video. Although we have made good progress in getting instances of IBM services in Watson, we have not yet made a formal timeline plan for how we will build out this functionality in the next four weeks. We know that what we plan to do is at least feasible using the tools available, since there is a Watson tutorial online showing something similar. However this week we have encountered many bugs in the Watson SDKs and have spent a lot of unexpected time solving these bugs. For this reason we would say we are slightly behind where we would ideally be at this point and we need to push to have a productive two weeks ahead.

Problems to be resolved → Steps we intend to take

- Time management - increasing our hours spent on this project → Having clear deliverables for each person each week
- "Credentials" bug when implementing Unity AR avatar tutorial → Try to rebuild project using a different unity version and/or different branch of SDK
- Increasing accuracy of SpeechToText → Try changing microphone
- Figuring out how to attach animation of avatars to speechToText commands → Follow online tutorial
- Having issues with Gitignore to use Git for unity projects → Try a different Gitignore file, try pushing from a different computer
- Get a paid asset from unity store → Communicate with supervisor about getting access to department funds
- Issue with getting public classes to show up in the unity inspector panel → Look online for solutions
- Missing "Compiler required member" for Watson Unity SDK when building for Android → Look into known existing issues when trying to use Watson with unity on an android build
- What's our testing strategy? → Research writing tests for AR
- How can we technically implement a system that texts a staff member when someone is there to see them? → Research APIs for text messaging

Plan for the next two weeks

Week one goals:

- Implement a basic unity project with an avatar, speechToText, TextToSpeech and Assistant linked together
- Research database linking in unity for implementing a basic database of staff info
- A concrete timeline for next four weeks leading up to must-have deliverables, as well as clear allocations of responsibility for each team member

Week two goals:

- Demonstrable working development pipeline including version control
- Get an avatar from unity asset store and implement basic animation
- Build alternative text input and output for debugging