The F1 Connectivity Innovation Prize

2016 Challenge 2 – Team Engineers

How do the teams at home and at the track work better together?

Overview

In 1971 Professor Mehrabian famously came up with the rule that communication is only 7% verbal, referring to the actual words spoken, and 93% non-verbal. The non-verbal component was made up of body language (55%) and tone of voice (38%.) So having radio communications between team members gets you about half of what we would like when trying to communicate. Adding video cameras to meetings, in theory, gives you the rest, but in reality we know that nothing replaces in-person communication. But what if we could use technology to bridge that gap, where participants were in distant locations but appear to each other to be in the same room?

I propose using Augmented Reality, (AR,) technology to enhance an F1 Engineer's world with virtual representations of people and objects.

Team members at a race track and back at base should be able to wear AR headsets that keep them unencumbered from performing their duties. These headsets should be able to track the wearer's position and orientation to accurately recreate other people and objects within the space. Recording equipment should also be setup in each space in order to capture these people's movements to stream over to the remote team. This should all equate to a fairly small amount of additional equipment that would need to be transported for the track-side team to each race.

One of the issues that all team members face is a limited amount of space to work in, particularly the track-side engineers. There is no reason that these people and objects need to be recreated at full scale. A full car and collection of team members could be represented on a table for the remote team to observe and communicate with. Virtual screens could be displayed on the walls with important telemetry data being flagged, (each team could have a dedicated screen at the remote base that they could control to virtually project data to for sharing.)

Let's take an example. Imagine during a race a front wing gets slightly damaged in a collision. The team needs to decide quickly whether to bring the driver in to change the car's nose out. Engineers could very quickly meet virtually by being constantly connected. An expert could be walking around a virtual car to discuss the impact of the damage on the expected downforce being created, what that does to the tyres, etc. Being able to point and gesture makes it much simpler to convey information. From there the team can make a call on how to proceed.

Key Features

For F1 engineers it wouldn't be practical to put them into a virtual environment, detached from what is really going on around them. It also wouldn't make sense to fill their hands with peripherals in order to track movement. This makes current VR setups impractical. As such, I propose using AR technology

which allows engineers to maintain their freedom of movement while enhancing their world with virtual representations of people and objects.

Being able to gesture and point can make a huge difference to speeding up communication without requiring the extra effort that needs to be put into radio-only, or even video conference conversations.

Being able to create virtual objects in the real world means you can put recreations of people, cars and parts for discussion anywhere they need to be. You can also create virtual screens in order to share information, which has the benefit of reducing equipment needed for transport and enabling private information to be displayed that rival teams would not be able to see over your shoulder.

Technology

To enable team members to communicate and see the virtual people and objects around them, while still maintaining their sense of the physical world around them, I would suggest using AR headsets such as the Microsoft Hololens. This is a standalone device that could perform all of the functions needed here. Conceptually it is like wearing a laptop on your head, with a display added to a transparent visor in front of your eyes. This kind of device could potentially be built into track-side engineers' helmets in future.

While expense may not be an issue, comfort may be. An alternative to an all-in-one unit like the Hololens could be the Meta 2 headset which is tethered to a PC. This means only the visor display is on your head while the PC does the work of processing information to display. This may be more suitable for those seated back at home base rather than track-side engineers that need to move around the garage.

Both of these devices offer both voice input and hand tracking to interact with the virtual objects. This keeps the team members unencumbered by peripherals so that they can continue to work as normal and communicate with each other.

The software side of things could be achieved in a 3D rendering engine, essentially a video game development too. Unity would be a good example to get this up and running quickly, or it could be done with some custom code.

Recording equipment would involve a multi-camera setup, which should be simple to setup in the corners of the rooms. This is used to create 3D, textured models of the participants. This data can then be streamed to the other team members, similar to how video games can animate characters in real time.

Supporting Images

Hamilton, Lauda and Wolff analyze an AR car in the garage after a successful session.

Example from a Volvo demo of HoloLens: https://www.youtube.com/watch?v=DilzwF90vec

"Holoportation" example from Microsoft: https://www.youtube.com/watch?v=7d59O6cfaM0

http://prize.tatacommunications.com/