# The Balance physiotherapist hologram

HOLOBALANCE

## Technologies Used:

- Smartphone: GPU provides processing of the BPH and stereoscopic presentation on device display which are projected in holographic manner via lenses in head mounted device. Supported android devices with Google AR Core and IOS devices with AR Kit.
- HoloBox: HDMI port interfaces between BPH hosted on PC and holographic projector which provide holographic sensation by projecting virtual coach on holographic foil. Supported devices are PCs with windows OS.
- Desktop computer running real time evaluations of the sensor captured data, in order to give real-time feedback to the virtual coach if an exercise is executed in the proper way or if the user should improve it.

## Methodology:

- HTTP protocol is used for communication between BPH and Edge computer via JSON formatted messages in RESTful manner.
- Mobile application made using Unity Holokit framework for presenting content onto AR head-mounted device.
- Desktop application for displaying virtual avatar onto the 3D Holobox interface using Unity
- Lip Sync pro unity plugin for lip-syncing and facial animation
- Avatar movements and exercises have been recorded in TakeOne studio, whose capture studio is among the biggest in Europe. With surface area of 200 square meters, and with 54 Vicon cameras we were able to achieve the highest standard and even the most demanding animation requirements.

## Beyond the state-of-the-art

Balance Physiotherapist Hologram (BPH) is unique solution capable to interact with patient in home environment. Patients are capable to receive personalized exercise instructions as well as feedback through virtual coach using specifically designed sensor infrastructure attached to patient. BPH depends on processing unit (EDGE) capable to run real time evaluations on the sensor captured data, in order to give real-time feedback to the virtual coach if an exercise is executed in the proper way or if the user should improve it.

## Main Functionalities

There are two versions: the smartphone where user wears head mounted adapter to keep a smartphone at a set location on the head of the user and 3D HoloBox where highly efficient holographic foil and high lumen projector are used to create best possible 3D experience without using any type of device on the patient side for presentations purposes. The sensors are attached to patient in both cases.

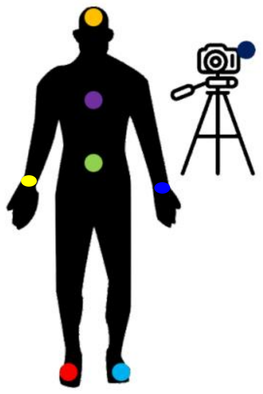
## Results/Interfaces

- Unity framework enabling integration of BPH with Android and Windows in unified manner. It provides access to all hardware resources of the smartphone or laptop enabling holographic presentation and interaction.
- REST APIs has been used as protocol for communication between BPH and Edge computer in both directions in stateless manner. Interface of this kind allows BPH to receive feedback regarding exercise evaluation in real-time and provides interoperability.

## Exercises

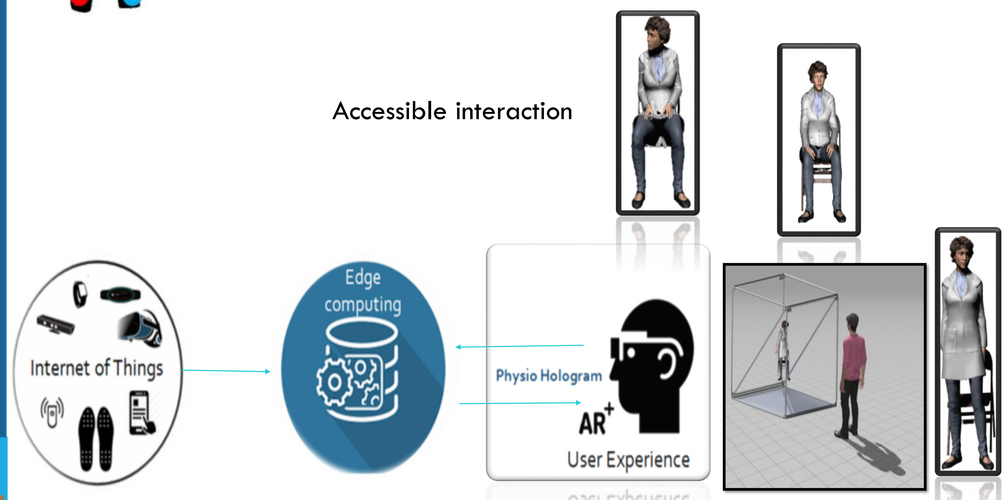

References
https://github.com/holokit/holokitsdk
https://lipsync.rogodigital.com
mocap.me
Manon Kok, Jeroen D. Hol and Thomas B. Schon, *Using Inertial Sensors for Position and Orientation Estimation Foundations and Trends in Signal Processing*, 2017

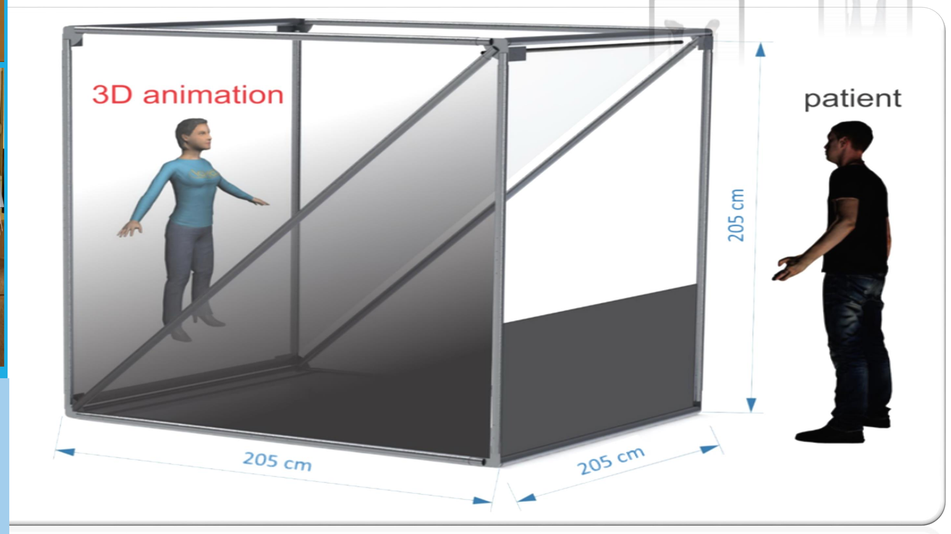
## Hardware setup



| Mounting position | Device |
|---|---|
| Head | Head mounted holographic device |
| Chest | ECG monitor |
| Waist | IMU |
| Right wrist<br>Left wrist | Wristband |
| Right foot<br>Left foot | Pressure sensors |
| Camera | Depth camera |

## Accessible interaction




3D Holobox

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