



Medical Augmented Reality

Rehab-Track – Mixed Reality Obstacle Course for Physical Post-Stroke Rehabilitation

Project Members: Ayman Iraqi, Natalia Avendaño-Prieto, Julia Schwan, Umaid B. Zubair

Mentor: Kevin Yu



Technische Universität München



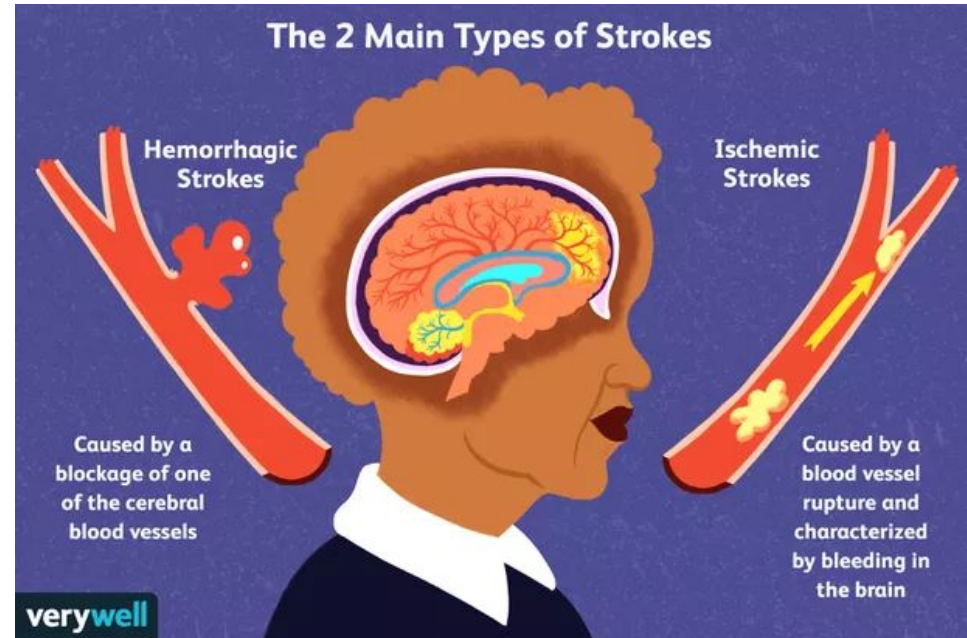
JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING



Challenge

What is a Stroke?

- Occurs when blood flow to an area of brain is cut off.
- Brain cells are deprived of oxygen and begin to die.
- Impact abilities controlled by the area of the brain that is affected.
 - **Cognitive Functions**
 - Memory
 - **Motor Functions**
 - Muscle control



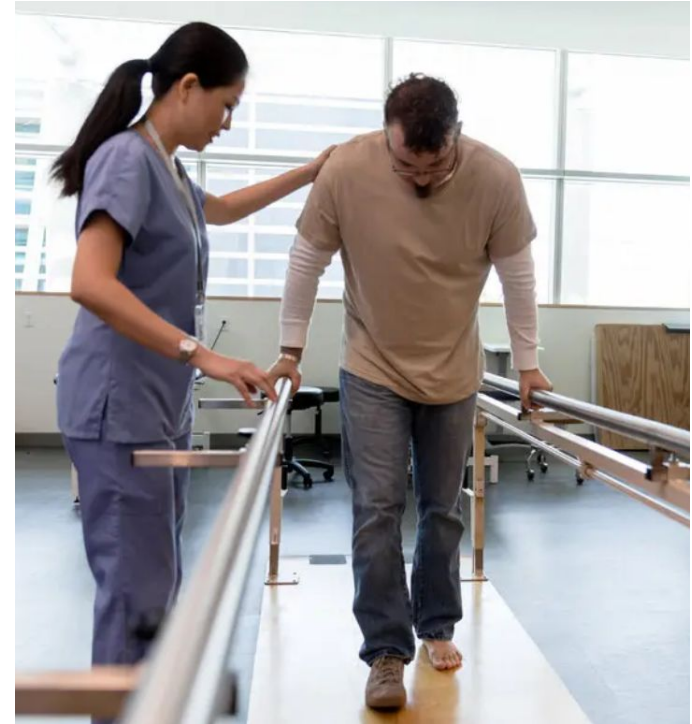
<https://www.verywellhealth.com/stroke-causes-4014093>

<https://mindthegraph.com/blog/stroke-symptoms-and-risk-factors/>



What is the problem?

- Post-stroke patients regaining their **physical** and **cognitive strength**
- Specific obstacles performed only at physical therapist
- Performance tracking mostly in-person with professionals



<https://www.nytimes.com/article/physical-therapist-search.html>

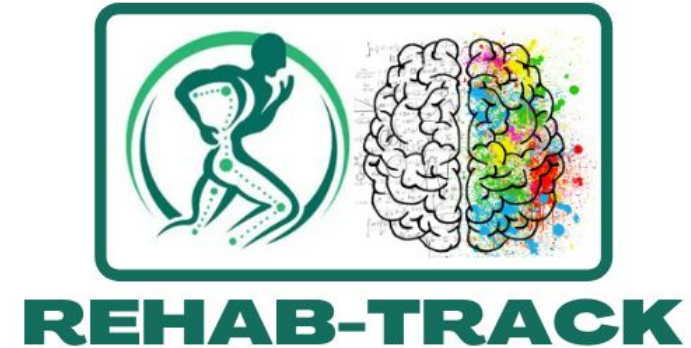




Solution

Augmented Reality Solution

- Mixed reality obstacle course to guide patients through a series of trials
- Multitasking elements
 - **Cognitive Rehabilitation**
 - Spatial awareness - Sonification
 - Memory game - Simon Says
 - **Motor Rehabilitation**
 - Balance - Hole in the Wall
- Accessibility
 - Working within limited space
 - Hololens



REHAB-TRACK



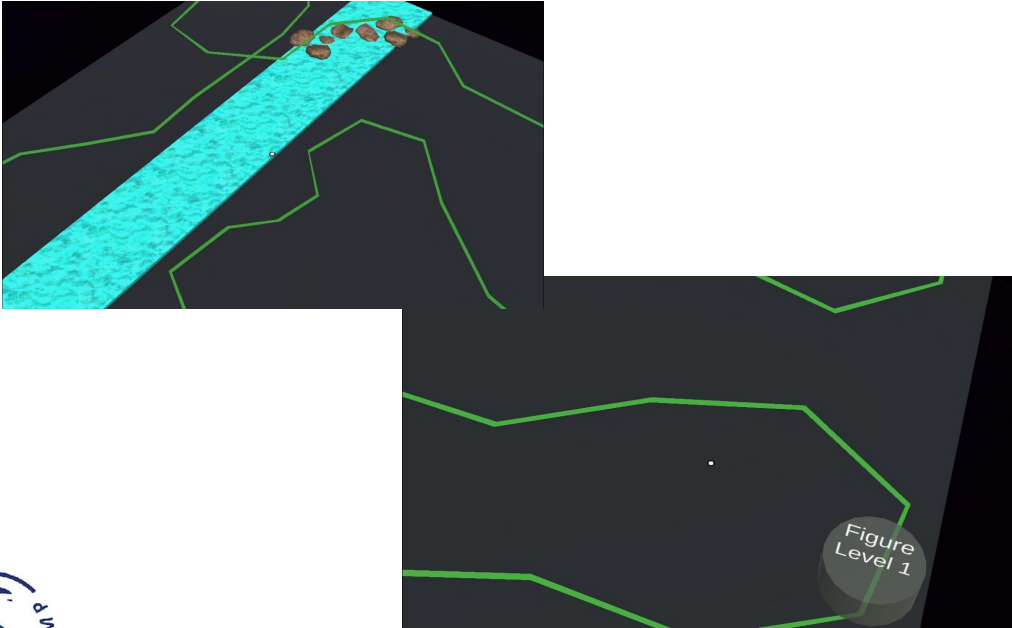
Rehab-Track - Hololens Calibration

- Mixed Reality ToolKit (MRTK)
 - Provides functionality to work with HoloLens and Unity
 - Camera Settings
 - Spatial awareness
 - Easy setup and testing
- Camera in Unity represents Position in real space



Rehab-Track - Path

- Has to fit for small room (3 by 3 meters)
- Changes when turning at the end of one path
- Heel-to-Toe balance exercise in-between stages

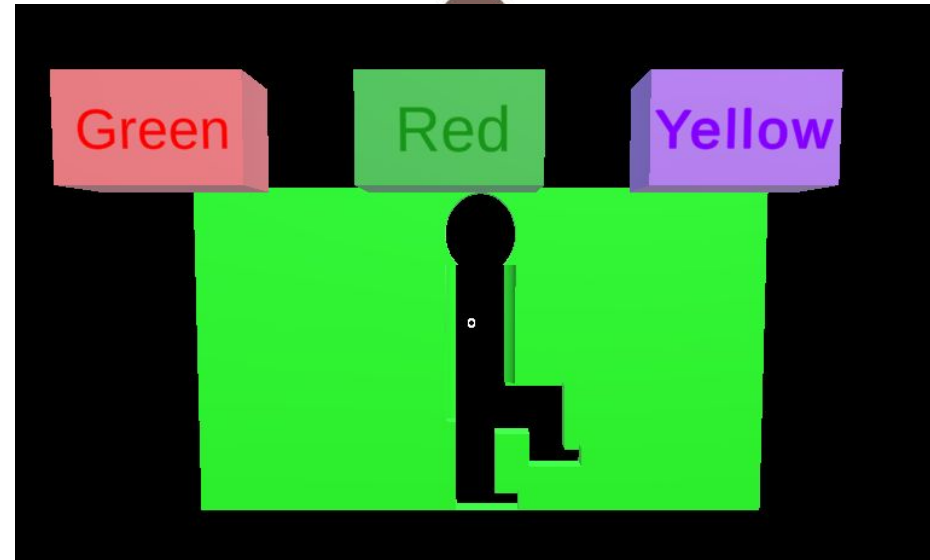


<https://www.saebo.com/blog/reclaim-your-stability-with-these-balance-exercises-for-stroke-recovery/>

Rehab-Track - Hole in the Wall

Benefits

- Cognitive and motor function therapy
 - Balance Exercise
 - Concentration Exercise
- Auditory Feedback
- Improve chances of recovery
- Have fun during therapy



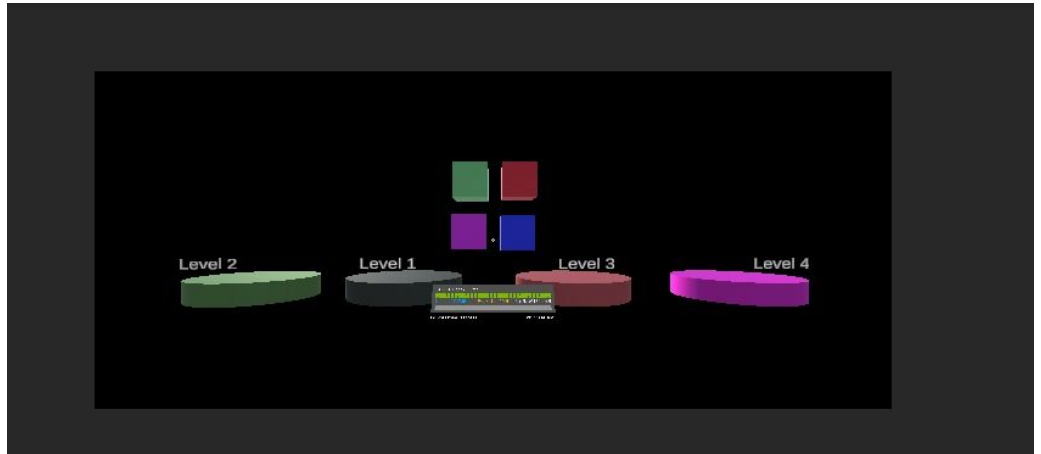
<https://www.saebo.com/blog/reclaim-your-stability-with-these-balance-exercises-for-stroke-recovery/>



Rehab-Track - Simon Says

Benefits:

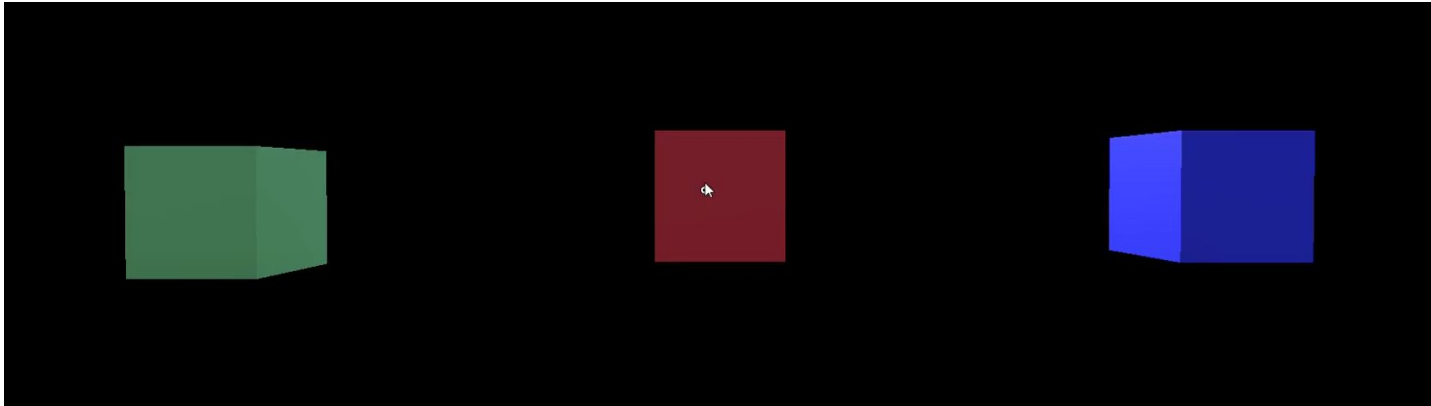
- Developing cognitive development
- Visual modeling
- Develop sequencing skills
- Auditory feedback
- Increasing challenges



Rehab-Track - Sonification

Benefits:

- Focus on auditory cognition
 - Spatial awareness
 - Auditory feedback
- Comfortable amount of time for user
- Immersion



Rehab-Track - Aspects to Improve

- Add to the obstacle course:
 - Deeper validation measurements
 - Cosmetics.
 - Vocal guidance
 - Scoring

Hole in the wall:

- Kinect Calibration
- Repetition exercises

Simon Says

- Improve audio feedback

Sonification

- More variety





Thank You!
Any Questions?