# Augmented Reality Gamification for Lower Extremity Rehabilitation

## By: Chris Baker, AA and Dr. Wenyao Xu, PhD

In Dr. Wenyao Xu’s Lab at the University at Buffalo in New York we have been researching Augmented Reality Gamification for Rehabilitation. In this study we focused on Lower Extremity Rehabilitation. We have read a few of the existing reports on at home therapy vs inpatient therapy including “Physical Therapy Treatment Effectiveness for Osteoarthritis of the Knee: A Randomized Comparison of Supervised Clinical Exercise and Manual Therapy Procedures Versus a Home Exercise Program”. We **have noticed the need for a more enjoyable approach to patient at home rehabilitation programs** and wanted to explore something new. Several attempts have been made using motion sensing devices such as the Kinect or Wii camera from popular game companies**. However, we are working with Augmented Reality using** Unity, Vuforia, and **Android devices to** **create a more portable and accessible path to recovery.**

Rehabilitation is often expensive and inaccessible. Thus, we have created a video game that aims to improve outpatient recovery that can be **distributed at a lower cost**, **return patient workout data** to the medical team for analysis, and **allow the patient more control over where and how they work out**. The **materials required** are an **android device with a camera and a piece of paper** printed with an image on it**. Patients are not limited to needing a tv and a fixed motion sensing device to carry out their program.** We developed a soccer game that uses a paper printed with an image of stones to create the soccer game in Augmented Reality around the patient. The patient can see the AR world through the device camera including a blue square that represents the virtual button that will detect the user kicking the soccer ball. The user sees a goal post, moving goal keeper trying to block the shots, the soccer ball, and soccer field through the android device. They have 60 seconds to score as many goals as possible. At the end of the game data can be collected and sent to the medical team to assess information such as if the user favors one leg over the other, reaction time, range of motion, and other usable information. **We believe that patient adherence to their programs will increase because of enjoying the process of recovering and that medical teams will have quick and helpful data to help them tailor therapy exercises or other games to maximize the patient’s recovery.**

Conclusions on Poster, It is fun and:

* + **Cameras & Tracking: Continue to improve every year** which will eventually allow **smaller targets** and **smoother virtual button triggering** with movements. Where a series of **buttons may eventually rival or become more accurate than motion sensing devices.**
  + **Portability: With a smart device and a paper** anyone can take this game anywhere and play it whenever they desire. **More control over the road to recovery.** They can choose **the time, where, and which game** to play giving them a variety of options to recover.
  + **Accessibility:** Most families have an android device. If they do not have one, then several devices can be bought for $50 on amazon. **Therefore, for the cost of one therapy session a family could buy a device and potentially have access to an infinite amount of sessions through games.** Friends, medical facilities, and or insurance companies may even loan devices to patients.
  + **Efficiency:** Computer Scientists and Medical Teams can set up and **collect meaningful data** to **adapt** to the **patients’ needs** and respond quickly with **modifications to guide their recovery**. **Lightens the load** on the medical care providers globally and **still report serious issues** which may require the patient to come in for personal attention **that can only be given by direct care.** This is **a win for both patients and healthcare employees.**