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**Group 3 Proposal**  
**Kinect-based Therapy**

## 1. Introduction:

According to the National Institute of Neurological Disorders and Stroke more than 700,000 people suffer from a stroke each year. About two-thirds of these victims survive and need to have rehabilitation to get back to an independent lifestyle. This rehabilitation can greatly effect in creating the most positive outcome. Skills needed to be re-learned -- mostly involving coordinating movements such as walking or getting dressed -- need to be repetitive, practiced, and focused efforts just as though they were completely re-learning the skills.

For this type of therapy to be carried out, most of the time the patient would need in-patient care at a hospital until he or she is evaluated as stable and eligible for release from the hospital's care. After a stroke, patients are coached in independent movement since most are paralyzed or very weakened. The first movements could be as simple as changing positions on their hospital bed. It progresses until hopefully the patient can hold his or her own weight and carry out more complex tasks such as bathing themselves. This process could take months to years for them to fully carry out in the most severe cases, and involves these patients getting to and from the hospital or facility based on their specialists individualized therapy plan. This is both time consuming, inconvenient, expensive, and disheartening for many.

Our question then how can a patient do all of this in the comfort of their own home? More specifically can we accompany this change of location and still provide some of the meticulous and much needed care only achieved in traditional hospital or facility settings with enjoyability? The ultimate goal is to create a game. This game should be simple enough that you shouldn't needed to be computer or video game literate to understand how to play. It should also have scores based for correct and stable independent movements of the patient that is more fun than just physical therapy. We need to create

very accurate and reliable motion tracking including when the patient would be sitting or laying down. Then this information should be sent to a server where it may be further processed and can be accessed by the doctor.

## **2. Motivations:**

This question is interesting because of the current methods of rehabilitation. Is it possible that we can save these patients stress of trying to get to the doctors and could we also make these therapies something the patients want to do. This in-home process has not been completed before. Using modern technology , such as the Microsoft Kinect, we can create a non intrusive system that would be easy to use and encourage physical activities these patients need. Right now, patients need to go to the specialists to receive the rehabilitation and may not be practicing it when they get back home. This system will help create a way that helps patients want to keep trying by playing entertaining games. This also may lead to cheaper health care solutions to this problem. It creates a way for patients to create a pace to keep active and competitive scores keep them motivated.

## **3. Related work:**

The students at University of Southampton have been researching this problem. They're solution was creating a series of sensors that would monitor movements. They could then see exactly the movement on screen and collect data to see where exactly the patient would be. The problem with this solution is this technology is a separate item that would need to be created and also need to be worn. The intrudes on the patient and makes rehab include putting on a sensor outfit.

This team at the University of Ulster was also researching games when it comes to stroke rehabilitation. They first knew that they would need to find games that are not too challenging that the

player doesn't want to continue, but also not too easy that the player gets bored with. Example game they came up with was called rabbit chase. This included showing the user on screen using a camera and showing four holes. The goal is to hit the rabbit when it comes out of one of the four holes. The issues I see with this game is that the movements are very unspecific. Yes this does promote movement but it doesn't promote for example raising up one finger or so. They also researched that they would need a very simple user interface so that the game could be started easily. They wanted to find low cost items as opposed to the students. They started more research using the wii controllers and sensor bar. Once again it would be easier for the patient to not need a controller to hold onto.

4. **Proposed approach:** What is your plan for working out the solutions to the question? what are the main features in your proposed system? How do you implement your proposed system (e.g., what kind of database do you choose, what are your main programming languages, are there any particular techniques you are going to use)?

Our solution features a motion tracking suite coupled with the unobtrusive gaming device the kinect. This low cost alternative to the expensive and time consuming therapies, that consist currently, use specific scoring methods to monitor a patient's progress through rehabilitation. Our system collects data on the patient and sends this to a server accessible to his or her doctors.

For our solution, we plan on using linux operating system as the platform coupled with the microsoft kinect. We will be using openni sdk for the development of the software using the libraries it has to control the kinect. To do this, we have to use simple-openni which contains the barebone framework. We will then use NITE which is a freeware for turning the images gathered into meaningful data including hand tracking etc. We also are going to use a community maintained driver called

SensorKinect for allowing the openni to work with kinect. Also to control the tilt motor and LED light we will use libfreenect We will be using c++ and writing the following mechanics: a user interface, a scoring system based on how closely each motion matches a given animation,, a motion tracking algorithm, and code to send this data to the server.

## 5. **Evaluation:**

Proper testing of our product would consist of correctly scoring based off the NIH scoring system for stroke patients with motion tracking. Compared to other ideas, this consists of low cost, unobtrusive hardware along with an easy use interface. With full demonstration of a user in multiple positions being able to be scored, our product will prove that it is easy to use and more affordable than other options.

## 6. **Timeline:**

milestone 1 (1 - 2 month )

- get I/O working
- detects user position and posture

milestone 2 (1 month )

- get skeleton/motion tracking
- get scoring method working on animations

milestone 3 (1 month )

- get process to send data to server
- refine score method with user interface

milestone 4 (1 month )

- refine UI