Games and Assistive Technologies for Rehabilitation

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Game Development

In the United States alone, millions of people are living with upper limb impairments that severely diminish quality of life. GATOR seeks to provide new methods of rehabilitation for people affected by these impairments. GATOR features games created in JavaScript and HTML5 that utilize the Leap Motion controller. The games provide positive reinforcement and an enjoyable experience for the patient. The suite of games included the following.

1. Dolphin Run
   - KiwiJS
   - Up & Down movement strength improvement
   - Endurance training

2. Alien Invaders
   - KiwiJS
   - Left and Right
   - Multi tasking
   - The game is effective for improving endurance.

3. Fruit Viking
   - KiwiJS
   - Patient favorites
   - Left and right and push and pull
   - Rapid movements
   - Improves motor controls, and hand-eye coordination.

4. Pirates Cove
   - Remake of inherited game from previous team
   - KiwiJS
   - Push, pull, left, and right
   - First game to feature mini games within the game

5. Pong
   - Legacy style game for elderly patients
   - Only push and pull movements – endurance & strength building.

Tools for Occupational Therapy

In order to increase therapist productivity and provide the patients with a better idea of how they were progressing we created new tools. These tools included the following.

1. Dynamically generated progress reports following each game.
   - Distance covered, velocity of the patients hand, score, high score, time played, as well as dynamically calculated score measures to give the patient an idea of how they are progressing.
   - Patient progress downloads into excel spread sheet.
   - The patients progress consists of score, distance, velocity, time played, difficulty, etc...
   - Maintain all pertinent information.
   - Graphs of game scores for patients to see how they are progressing.

Current Work

- The games that have been developed are currently in clinical testing.
- As a result large changes to the system are not desired by the occupational therapists.
- Minor fix features.
- Assisting therapists with their rehabilitation sessions to ensure proper operation of the games.

Due to the light workload we decided to evolve GATOR by utilizing a new technology that was made available by the help of our sponsors. We chose to use a new technology to help improve the quality of life for victims of traumatic brain injury (TBI) and spinal cord injuries (SCI).

Emotiv Headset

The Emotiv Epoq + headset is a neural net headset that is capable of interpreting brain activity and translating the brain activity into electro signals. The headset is able to do this using 14 electroencephalography (EEG) nodes. The headset allows us to interpret basic thoughts and commands of the headset user. The headset came with built in functions however using the test bench we also had the capability of interpreting the brain activity to create our own signals.

Emotiv Smart Home

- More intuitive commands to interact with the smart devices.
- Advanced smart devices to further implement a smart home like environment.
- Preliminary patient testing.

Future of Rehabilitation Games

The future application of the rehabilitation games is immense. Games can be developed to help for more than just upper limb rehabilitation.

- Microsoft Kinect 2.
- Creation of games that track the entire body – physical rehabilitation of the entire body.
- Larger clinical trials.
- Local occupational therapy trials.
- Occupational therapists at Craig hospital.
- Occupational therapists hire at CSU.

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Sponsors

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