Augmented Reality Games for Upper-Limb Rehabilitation (Android based)

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Know Thyself - Living by Numbers

- Widespread Connectivity
  - Smart Phones
  - Cell phone users > 4 Billion
  - 4G Broadband
  - Ingenious sensors

- A data-driven health revolution promises to make all of us better, faster, stronger

- The personal metrics movement goes way beyond diet and exercise.

- It’s about tracking every facet of life from sleep to mood to pain 24/7/365
The data-driven health revolution
Over one million Americans are affected by neurological impairments every year:

- TBI (traumatic brain injury), stroke, CP (cerebral palsy)
- 50-75% of survivors are left with impaired arm function
- Costs associated with stroke were $68.9 billion in 2009.

Making it one of the most costly health conditions to manage.
Project Objective

- Develop a framework based on augmented reality exercises and games.
  - Designed to improve:
    - Hand-eye coordination
    - Motor control
    - Endurance
    - Shoulder strength
    - Range-of-motion
Approach

- Understand the needs of the patients
  - Basic exercise
  - More complicated, high passed, entertaining

- Understand Augmented Reality (AR)
  - Live view of a physical, real-world environment whose elements are *augmented* by computer-generated sensory input
Approach

- Get last years code running
- Pick a compatible library/platform
- Become familiar with code and platform
- Get sample programs working
- Start editing/modify sample code
- Create new games from scratch
- Debug, debug, and some more debugging
Challenges

- Selecting AR Platforms
  - AndAR
    - Open source
  - DroidAR
  - Qualcomm
    - Easy to use
Game Concepts

- Pong
- Dodger
- Whack a mole
- Follow the leader
- Falling Rock
Pong
Dodger
Testing

- **Distance Test**
  - How far away you can trace makers

- **Speed Test**
  - How fast you can move markers without losing tracking

- **Accuracy Test**
  - Testing how accurate the marker tracks, moves, including smoothness.

- **Real world environment testing**
  - Bring working games and apps to rehabilitation facilities
Plans For Next Semester

- Continue to improve Pong and Dodge Games
  - Difficulty settings
  - More astatically pleasing
  - Varying distance/range of motion
  - Saving high scores

- New Game Concepts
  - Whack a mole/Follow the leader

- Field Testing
  - Meeting with actual patients and doctors
    - Gather opinions, thoughts, and suggestions
Questions?