MILORD: A NOVEL PLATFORM UTILIZING GAMIFICATION TECHNIQUES FOR THE REHABILITATION AND PROGRESS ASSESSMENT OF PATIENTS WITH NEURO-MYOLOGICAL DISORDERS

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Introduction

The effectiveness of video games on the rehabilitation process has attracted the scientific attention in the past years [1]. As such, there is a recent shift towards research in the domain of serious games, exergames and gamification paradigms with focus on rehabilitation and physical therapy (PT), in an attempt to establish the value of these methods. This is the drive behind the implementation idea that we will present.

The idea consists of a platform aiming to improve motor control of people with upper limb motor disorders. It will utilize modern technological interfaces such as motion detectors and 3D graphics software. Further objective is to bring the rehabilitation in the patient's own environment and provide asynchronous monitoring to the physician in charge.

Materials and methods

The platform currently has one scenario developed in a 3D graphics engine (Unity3D), a flying simulation game where the user controls an airplane avatar. Gate-shaped game objects emerge in the path and the user's purpose is to guide the avatar through them, while there are moving towards the avatar on a steady velocity. The avatar mimics the movement of the user's hand. It can move along the X and Y axis and rotate around Z axis. The hand's movements are tracked and interpreted by the Leap Motion Controller [2], a sensor that can track upper limb motions in real time with high accuracy. The implementation's main characteristics are:

- **Supportive tool to physical therapists**: Recording of the improvement of upper limb use from the patient. **Quantify treatment**.
- **Enhanced motivation**: **Increase Treatment adherence**
- **Asynchronous monitoring**: **Physicians can view and evaluate the data** generated by the patient from a distance.
- **Customizable**: Setting parameters affects the gameplay and changes treatment goals.

Analysis

The analysis evaluates the subject's performance in the game (points scored, etc.) and the hand movement itself. The movement pattern is split into 3 parts:

1. **Response time**: the subject becomes aware of the next target and starts moving towards it.
2. **Reach-to-target time**: the subject is moving their hand towards the target.
3. **Waiting for the target time**: the subject has reached the target's X,Y coordinates and waits for the target's arrival.

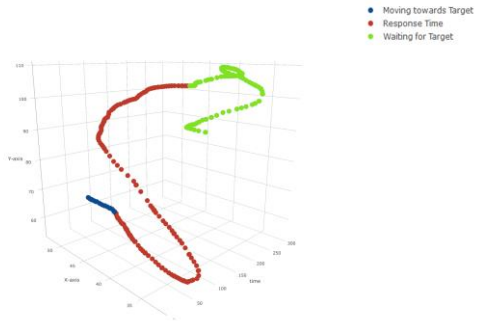

Figure 1. Movement from one target towards the next

Recordings from healthy subjects will be collected in order to establish a baseline. Features describing the movement are calculated (velocity, acceleration trajectory, tremor, time-frequency related features, etc.) that will enable the physicians to obtain an objective and quantifiable measurement of the patient's progress and response to the rehabilitation.

Keywords:
Gamification, Serious Game, Rehabilitation, Signal-Analysis

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References

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