

# A Game-Based Approach to Monitor Parkinson's Disease: The bradykinesia symptom classification

## CBMS 2016

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20/06/2016

# Summary

Motivation

Objectives

System Requirements

System Development

Data Classification

# Health Monitoring Systems (HMS)

Designed to support continuous treatment by moving healthcare services from the hospital to the patients' home.

# The HMS's Major Challenge



# Parkinson Disease (PD)

The symptoms associated with PD are caused by a **degeneration of dopaminergic neurons** in the substantia nigra. Common treatment focuses on **drugs that activate dopamine receptors**. However, the medication's effectiveness decreases over the years **requiring higher dosages**

# PD's Treatment and Disease Management

- ▶ Clinical trial evaluation: subjectively and sporadically;
- ▶ Motor fluctuations (*on/off* phenomenon).

# Bradykinesia Symptom

- ▶ Bradykinesia describes a slowness in the execution of movement. It is one of the four key symptoms of parkinsonism, which are bradykinesia, tremor, rigidity, and postural instability
- ▶ The tremor is the most visible PD's motor symptom, but the bradykinesia is the most

# Main Objective

A non-invasive HMS for Parkinson's Disease motor symptoms based on games to continuously provide data regarding patient, without reminding the disease's treatment



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2. Use of a popular consumer electronic device as input to have a non-invasive, cost-effective solution for home use.

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- ▶ Neurologist and physiotherapist responsible for patient's treatment.

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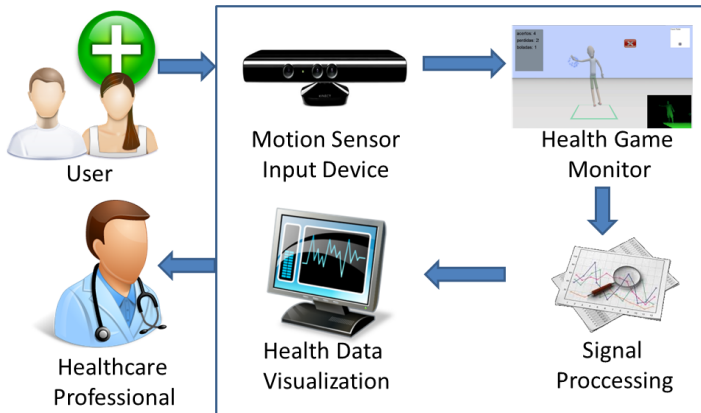
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- ▶ So, the motor signs are sent to HGM Server;
- ▶ The HGM Server process the user's data and identify the occurrence of the PD's disease bradykinesia symptom;
- ▶ Then, the neurologist visualize the user's health information to assess the patient's level of motor deficiency.

# System Overview



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- ▶ Experimental studies with target users.

## Qualitative Research Analysis

The respondents suggested focusing on the bradykinesia motor symptom due to its debilitating progress. Thus, treatment benefits could be correlated with the **increase of amplitude and angular velocities of an arm's adduction and abduction movements.**

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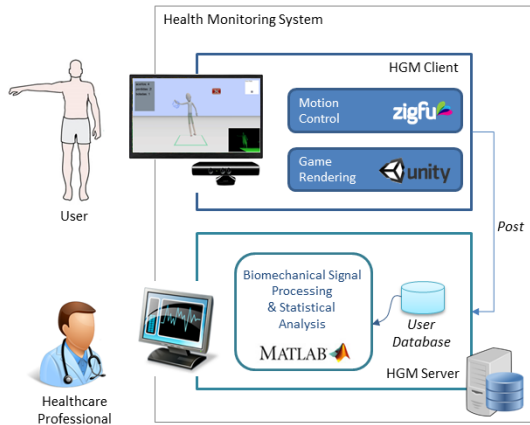
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- ▶ Easy and safe to use equipment
- ▶ Incite the player to perform specific movements that are required for the measurement
- ▶ Game with clear and entertaining goal and adapted to the user's skills
- ▶ Provide a informative visual way to the healthcare professional

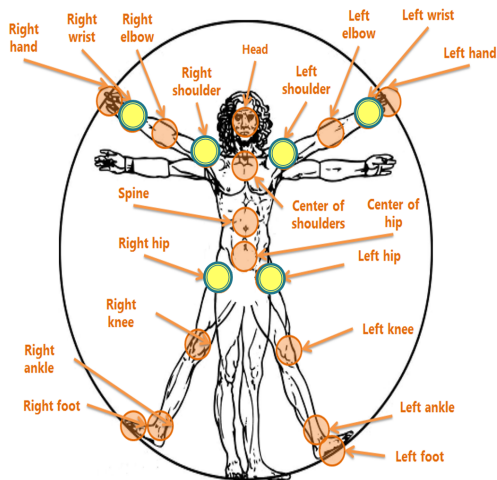
# System Architecture



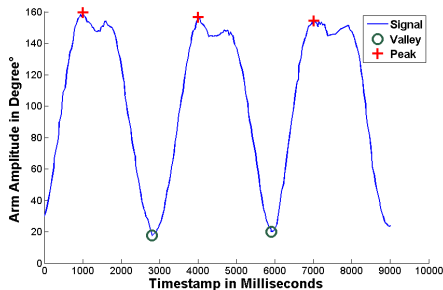
# The Biomechanical Analysis of Human Movement

The diagnosis and treatment process for PD uses the biomechanical analysis of human movement, where the patients are asked to lift their arms, one after the other, at the highest amplitude and velocity they are able to, in order to check the bradykinesia progress.

# Ms-Kinect Joints Acquisition



# Angle over time with the peak and valley detection technique



## Angular motion calculation

The cycle movement and transform the MS-Kinect data into angles. Thus, we calculate the **angular motion** of the adduction and abduction movements.

Questions ?