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

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Summary

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

Non-Invasive and Integrated Into Daily Routine

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 tremmor is the most visible PD's motor symptom, but the bradykinesia is the most

A Game-Based Approach to Monitor Parkinson's Disease

A non-invasive Health Monitoring System (HMS) for Parkinson's Disease motor symptoms based on games

Main Objective

Continuously provide to neurologists with data regarding patient motor symptoms, while collecting the data of patients without reminding them that they are under a disease's treatment

Main Requirements

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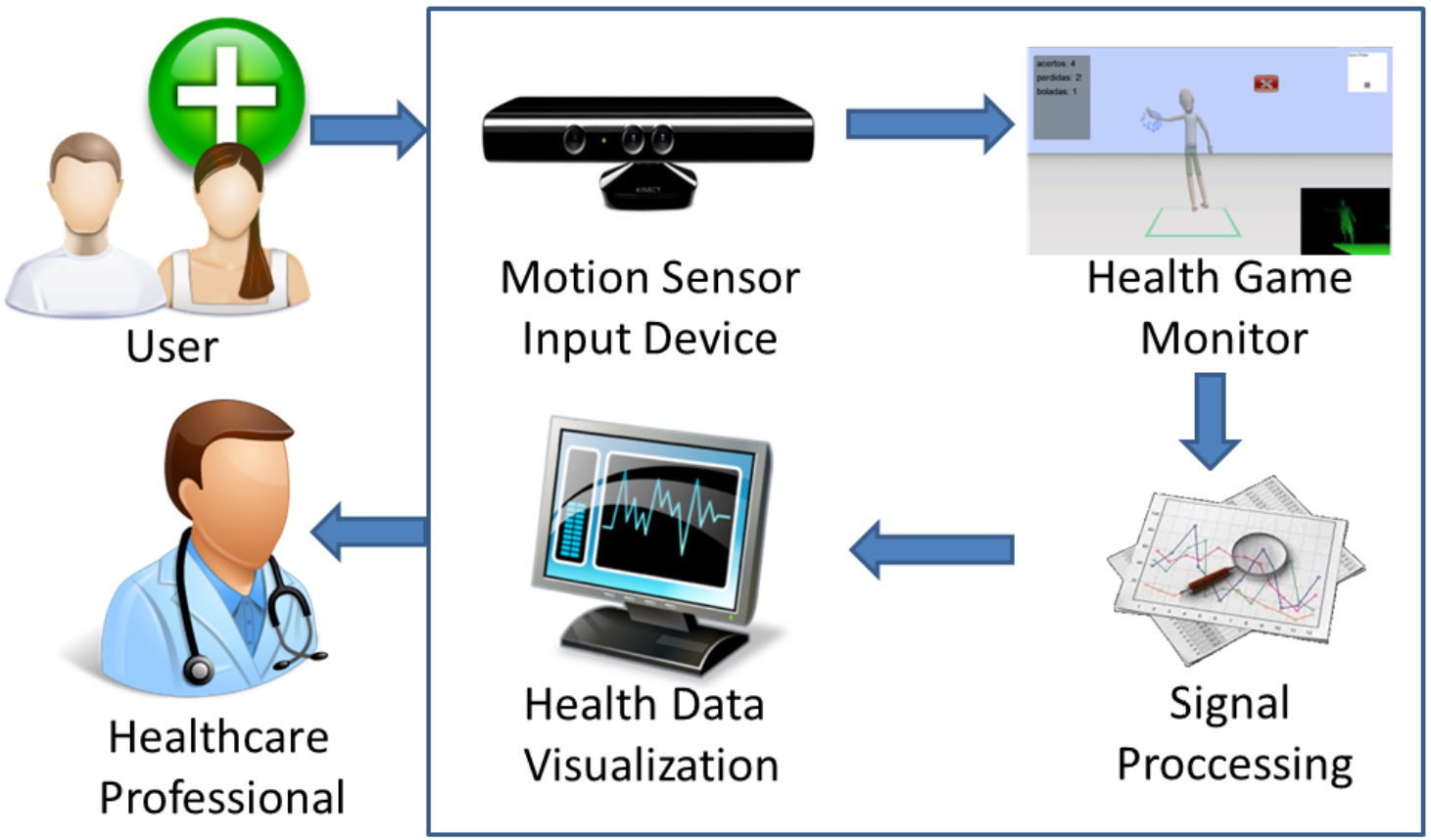
- So, the motor signs are sent to HGM Server;
- The HGM Server process the user's data and identify the occurrence of the PD's disease bradykinesia symptom;
- Then, the neurologist visualize the user's health information to assess the patient's level of motor deficiency.

System Overview



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- The development of the HGM Server, responsible for processing the data and making the results available to the health professional;
- 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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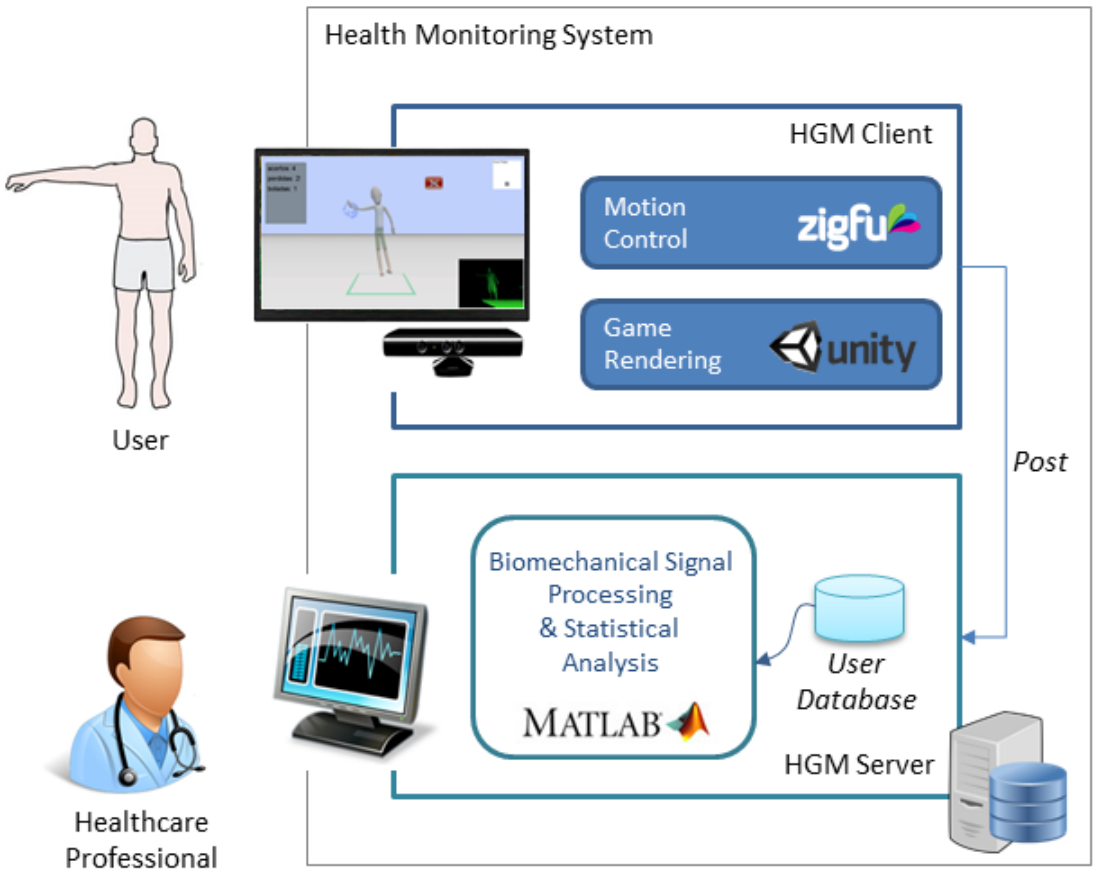
- Incite the player to perform specific movements that are required for the measurement
- Game with clear and entertaining goal and adapted to the user's skills
- Provide a informative visual way to the healthcare professional

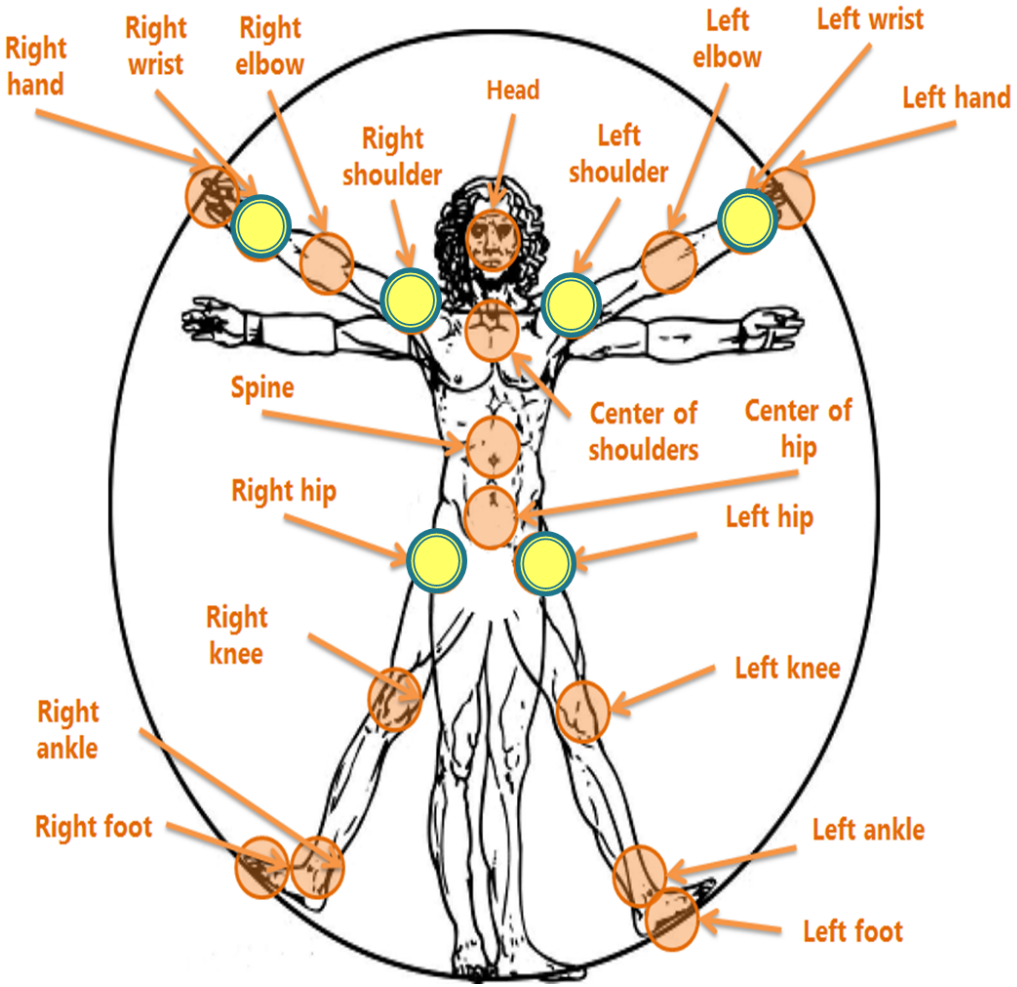
System Architecture



The Biomechanical Analysis of Human Movement

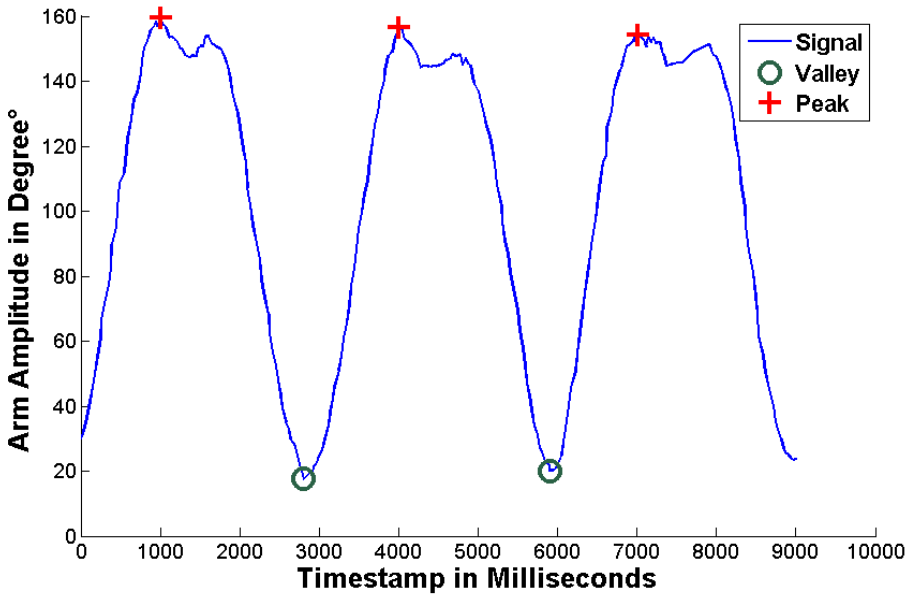
The diagnosis and treatment process for PD uses the biomechanical analysis of human movement, where the patients are asked to lift their arms, one after the other, at the highest amplitude and velocity they are able to, in order to check the bradykinesia progress.

Ms-Kinect Joints Acquisition



Adduction and Abduction involves: **wrist, shoulder, and hip**

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 ?