

Virtual Rehabilitation Robot-Preliminary Thoughts

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Introduction

Robotic rehabilitation is a promising approach to rehabilitation of post stroke impairments. For that reason, a robotic arm will be used for the upper-limb rehabilitation of stroke patients. This device must allow the following features:

1. Eye-hand coordination.
2. Combined movements (functional movements).
3. Certain amount of resistance to increase the muscle strength.
4. Completion of visual tasks.
5. Passive movements for some cases.
6. Plane motion (draw circles or squares).
7. Suitable for both body sides.
8. Flexibility and Portability.

Proposed project

An electro-mechanical device with measurement sensors that use computer game as an interaction tool. As the patient moves end-effector of the mechanical device in the workspace, sensors detect this motion and translate the change in position into electrical signals. These sensors are connected to a microcontroller which in turn will send the signals to a XBee module. The computer can now deal with signals as they represent the position coordination in the game that is displayed on the screen.

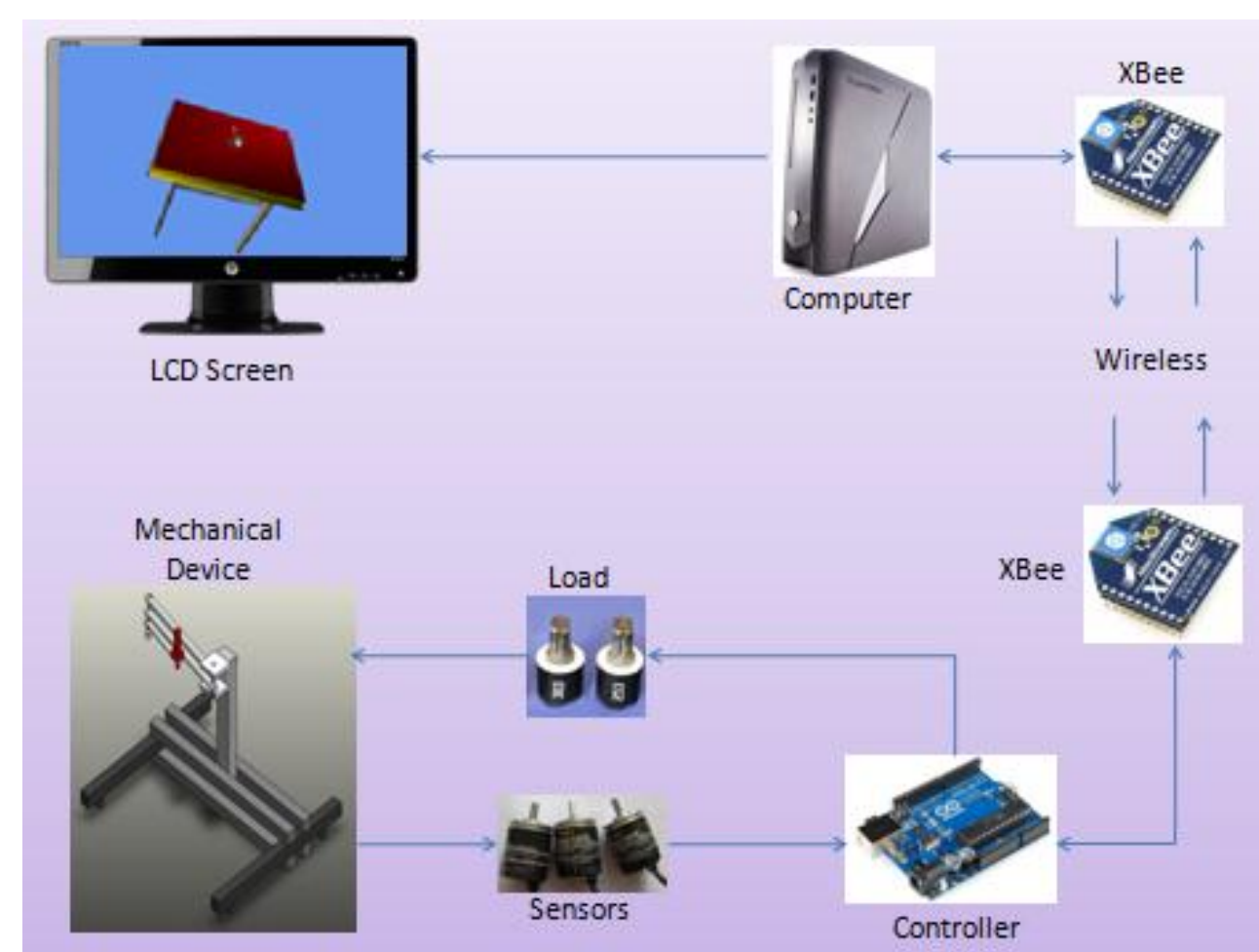


Figure 1: Virtual Rehabilitation Robot Idea

System Design and Implementation:

The software system must control the signals that come from the sensors, represent it on the LCD Screen, and send the suitable signals to control the load, because all of the project's parts must work simultaneously in real time, to achieve the synchronization.

The user of the system (patient, physiotherapist or even the system administrator) will be allowed to access the patient's profiles, games options, and the device settings by graphical screen that is easy to use. The keyboard or the mouse of the computer can be used directly to enter the user interface screens or to modify the onscreen components.

The general flowchart diagram that controls the flow of information between system components is shown in Figure 3.

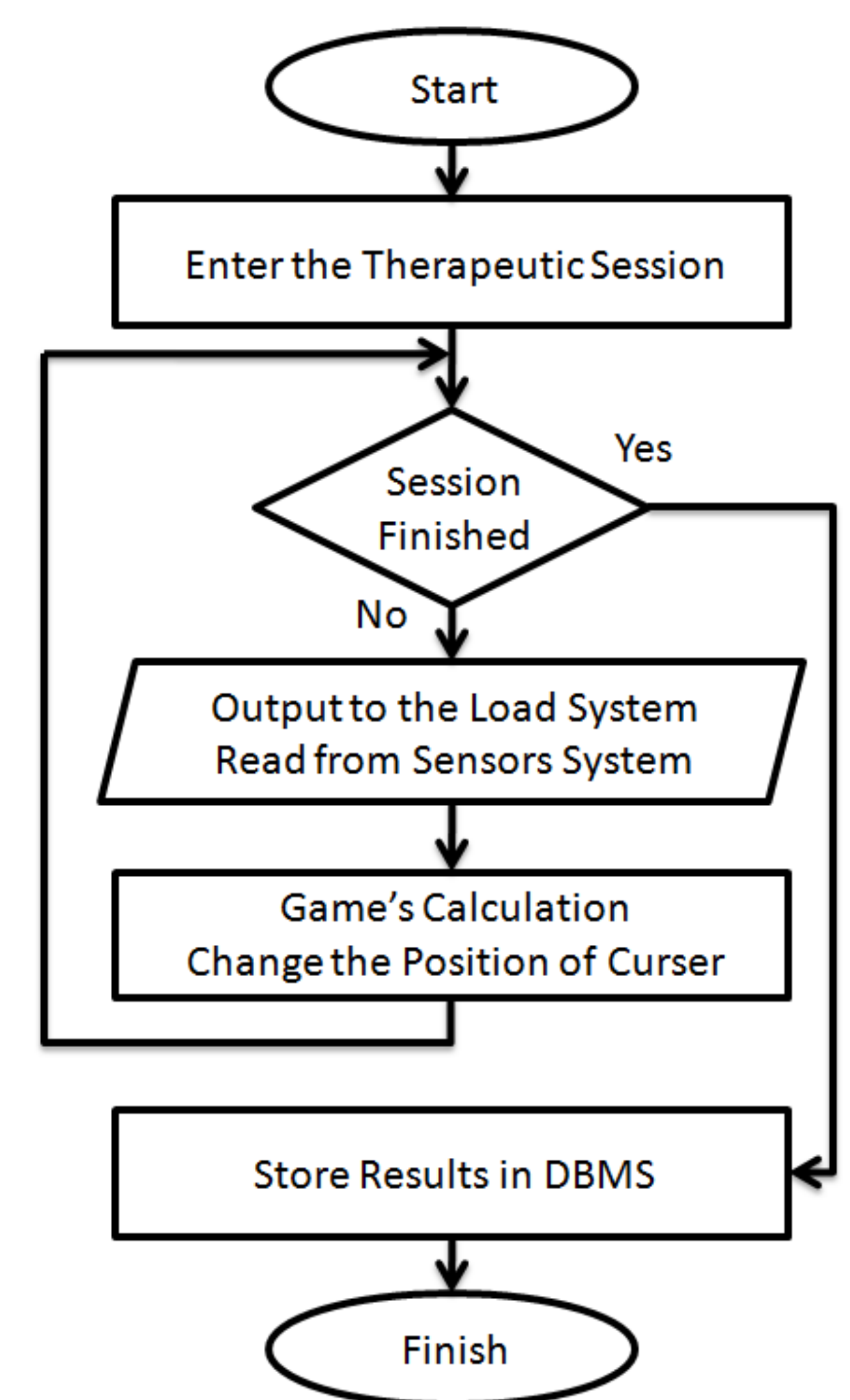


Figure 3: System Flowchart

Project Objectives:

1. To build a robotic device that will be used in stroke rehabilitation.
2. To introduce a new technology for the domestic market.
3. To build a device that combines the mechanical, electrical and computer engineering.
4. To try a new method for virtual loads using dampers.

Conclusion and Future Work:

It has been concluded that there is a need for virtual rehabilitation robots in Palestine. These robots can assist therapists during rehabilitation sessions to get the maximum possible benefit to patients.

The planning work to the next summer and first semester is

1. Performing strength analysis.
2. Modifying the equation of motion to include dampers effects after choosing the appropriate location.
3. Manufacturing the manipulator links, and frame.
4. Buying the components of the project.
5. Programming games.
6. Installing and testing the project parts.
7. Testing the device on real cases (patients).

Project Block Diagram:

Figure 2 is the general block diagram for a project, the device is divided into systems, these are: Mechanical device system (block 1), Load system (block 6), Sensors and interfacing system (blocks 2, 3, 4), and Computer and software system (block 5).

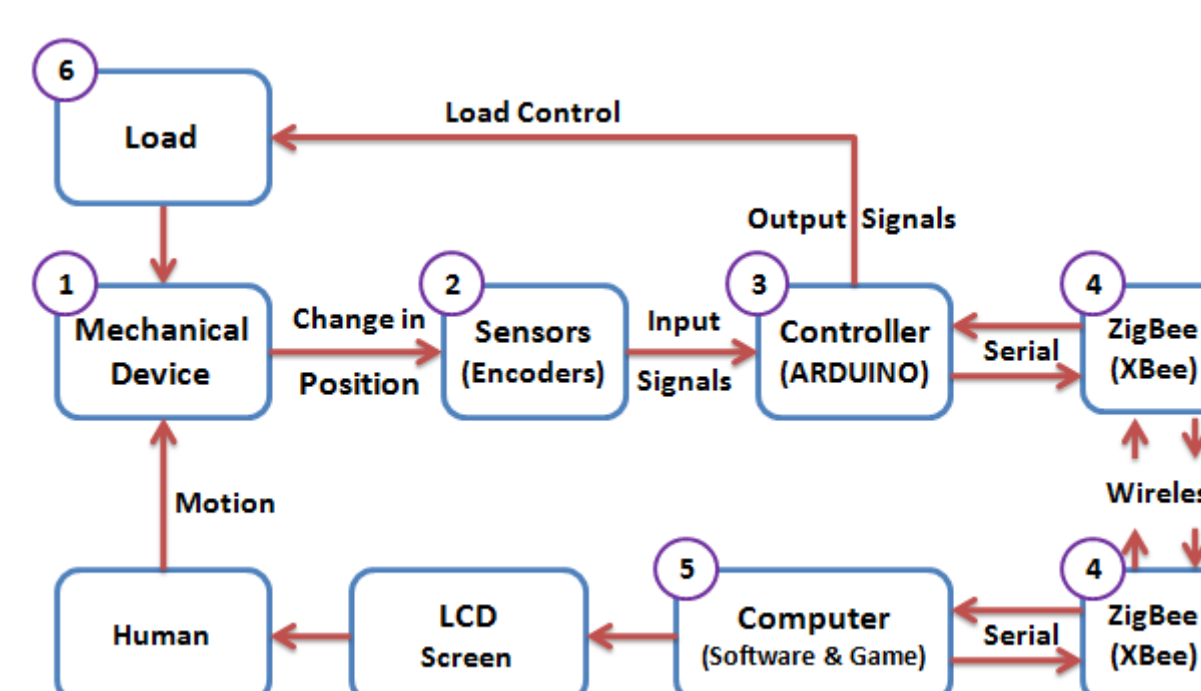


Figure 2 : System General Block Diagram.

The design must be based on a parallelogram linkage choice was based on an open source design called Braccio di Ferro. The main features of this arrangement are: good rigidity of the structure, direct drive of the manipulandum, which eliminates any backlash in the force/motion transmission and minimization the overall inertia, because most of the mass is either fixed, or close to the rotation axes.