Scientific report - TRUE REHAB 2020

Introduction

This is the scientific report for the first stage of TRUE REHAB, spanning from 01 September 2020 until December 2020. Even though only three months have passed since the project has begun, we are already at full speed with the work envisioned for this project. The specific developments concern mainly organisational matters, and are described in the following sections.

Project and Team management

One of the first steps of this project was to organise the team, ensure that each member is aware of the developments foreseen in this project, share responsibilities and tasks, and decide on suitable working methods. This was started from day one of the project.
The team consists of the members that were initially mentioned in the submitted proposal. Tassos Natsakis is the Principal Investigator, and the project is run together with dr. ing Alexandru Codrean, and Bsc. Ioana Ulici. Through our initial discussions, we have distributed the following tasks to each team member:

Tassos Natsakis: Project management, musculoskeletal modelling, high level task definition
Alexandru Codrean: Controller design and implementation, simulations for controller validation
Ioana Ulici: Hardware connection, implementation of controller in ROS, dissemination activities

All members of the team will participate and prepare for the validation study at the final stage of the project.
To ensure continuity and proper exchange of information among team members, we set up bi-weekly meetings to share work updates and to plan ahead the upcoming tasks. Separate working meetings between team members are also envisioned, which are being organised ad-hoc.
Furthermore, to have a constant overview of the work that is being performed, and of the follow-up tasks, we have set up two virtual task boards on the online platform Trello (www.trello.com): One board for the weekly tasks, following the waterfall approach, and one board for all the deliverables of the project organised by work package.
Finally, we set up an online collaborative working space on Google drive, for sharing documents and visual material created during the project.

Deliverables

Website (D6.1)

The first deliverable of this project (D6.1) concerned the creation of a website for the project. Following the successful example of websites previous projects (e.g. www.beterrehab.eu), which attracted interest from a diverse audience, we created a website along similar lines. The website features some static pages for the project and team description, and offers the possibility of creating posts. The plan is to write posts whenever we have substantial project developments. A key objective is to include graphics that will help non-experts understand the work that is being performed within this project. The website is hosted in the server of the research group and can be accessed through this url: http://rocon.utcluj.ro/true-rehab

Contingency (D5.1) and dissemination (D6.2) plans

The second deliverable of the project concerns the creation of a contingency plan (D5.1) for mitigating any possible risks. Starting from the risks that were already identified during the application period for this project, we discussed within the newly formed team about possible risks that we had to address. The list of risks, contingency, and prevention measures are described in the Contingency plan that is available on the project website.
Furthermore, we created a Dissemination plan (D6.2), that outlines the actions we will take in order to disseminate the results of this project. Our main target audience is the academic community of control and rehabilitation sciences, and we have therefore identified possible conferences and journals that we will submit our work to. The dissemination plan is also available on the website of the project.

Medical contacts

As a big part of this project concerns rehabilitation, medical advice is of utmost importance. It has been our goal since day one of the project to involve the medical community in this project, request their feedback on the developments of the project, and get assistance in recruiting patients for the final study. So far, we have contacted several medical personnel, such as rehabilitation scientists from the recuperation hospital of Cluj, and hands-on kinesiotherapists, promoting the project and receiving insights on the methodologies they use in the practise. Our plan is to contact them on a regular basis to update on our developments and invite them to our laboratory for demonstrations and live discussions.

Acquisitions

A very important aspect of this project is the use of a robotic manipulator for rehabilitation. Since we did not have an appropriate manipulator in our laboratory for such a task, we have included budget in the project to acquire one. After research on the market, we have identified the Universal Robots UR5 robot as the most suitable robot that we could afford. This robot is a

collaborative robotic manipulator which makes it safe to use close or in contact with humans. This is necessary for this project, to avoid any harm on the volunteers that will participate in the tests and validation study.
We have successfully acquired the robot using the funds of the project, and the robot is already fully functional in our laboratory ready for the first tests.

Block diagram

To be able to construct the controller envisioned by this project, and to be able to communicate the essence of the project to specialised scientists, we have created a block diagram that describes the components of this project. With this diagram as a guide, we can distribute the work among team members and work in parallel, ensuring a successful integration of the components at later stages. The block diagram will be further detailed within some of the blocks (e.g. 'Trajectory generator', 'Controller' etc), and the diagram will be updated during the project.

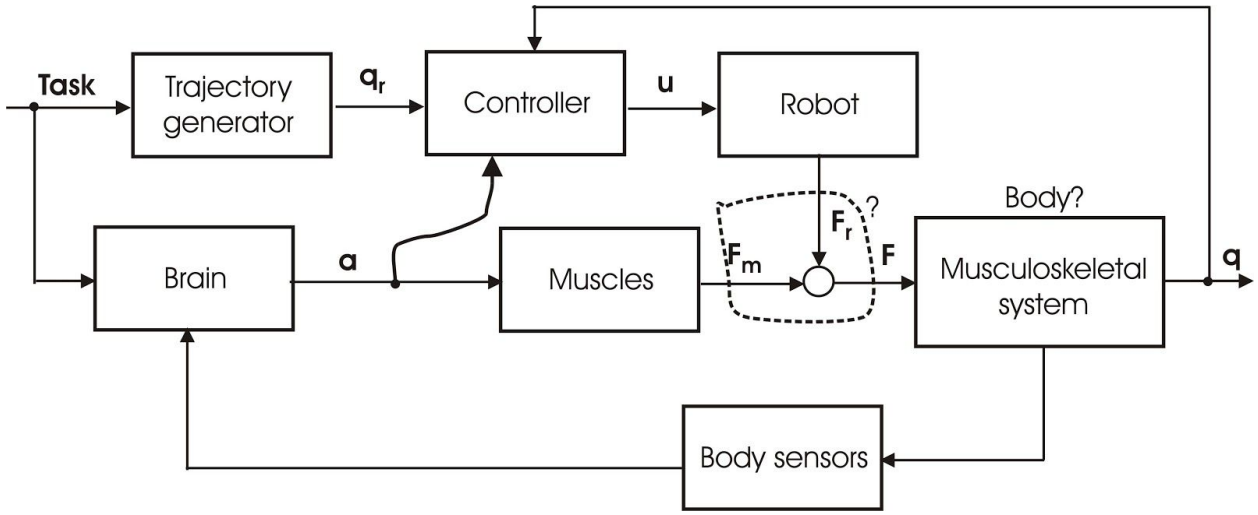

Figure 1: Block diagram describing the components of the project and their connection

Next steps

Since most organisational matters have been arranged, we are now able to proceed and produce the research that was envisioned for this project. The following steps include the connection of the robot with the Robot Operating System (ROS) (T3.1) and implementation of the Virtual Walls approach (T3.2), the investigation on defining subject specific muscle parameter estimation (T1.2), as well as the definition of constraints for the trajectory optimization (T2.1). We are also aiming at submitting the preliminary results of these tasks at conferences during the beginning of next year and final results for a publication to a journal.

Principal Investigator,
Tassos Natsakis