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ASBGO*: A MECHATRONIC IMPROVED SMART WALKER

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ABSTRACT

The ASBGo* Smart Walker (SW) is a research project from the *Adapative System Behaviour Group*. This device is used as a medical solution for rehabilitation of patients with gait disorders. To meet the user's needs this device was designed and developed into an improved and reliable system from both mechanic and electronic point of view. Thereby, in this paper a brief outline of the smart walker's system and design architecture will be presented.

Keywords: mechanical design, system architecture, smart walkers.

INTRODUCTION

Mobility impairments can affect both elderly and young people. Thus, gait training therapies using robotic devices, like SW, are emerging. Fulfilling the different needs and constraints by expanding functionalities of conventional walkers, SW devices promote an effortless and continuous way of gait training (Martins and Santos, 2015).

The ASBGo* SW leads to a training focused in the self-correction of the patient's walk. In the last few years the ASBG counts already with three versions that have proved its success in clinical environment (Martins *et al*., 2015). Nonetheless, to meet the patient's needs it is now presented a new model with improvements in the mechatronic and ergonomic design, comprising a robust and reliable system. The mechanical improvements, with new design features, were already discussed in previous work (Alves *et al*., 2016).

Besides advancements in mechanical design, the electronics architecture comprising the robotics and tools of the device, were also developed. The use of frameworks allows to simplify complex scenarios such as medical applications that use multi-modal sensed data to extract environmental information and act accordingly. Thus, to improve productivity, quality, reliability and modularity of the new software the electronics' system will be supported by the Robot Operating System (ROS).

RESULTS AND CONCLUSIONS

The main goals of this work were designing of mechanical structure and implementation of a unified modular system architecture by developing software components and electronic hardware required to its implementation, ensuring robust and user-friendly solution. The result is presented in Figure1.

The potentiometers, installed on the handlebar, interpret the user's intention to drive the device accordingly. Load cells, infrared sensor, Inertial Measurement Unit (IMU) and real

sense camera detect the postural and gait parameters of the user. Ultrasonic Range Finder (URF) will be used for obstacle avoidance in robotic navigation. Motors and encoders comprise the motion of the walker. The system is centralized in the main controller and localized on the base of the device along with the batteries and the remaining electronics.

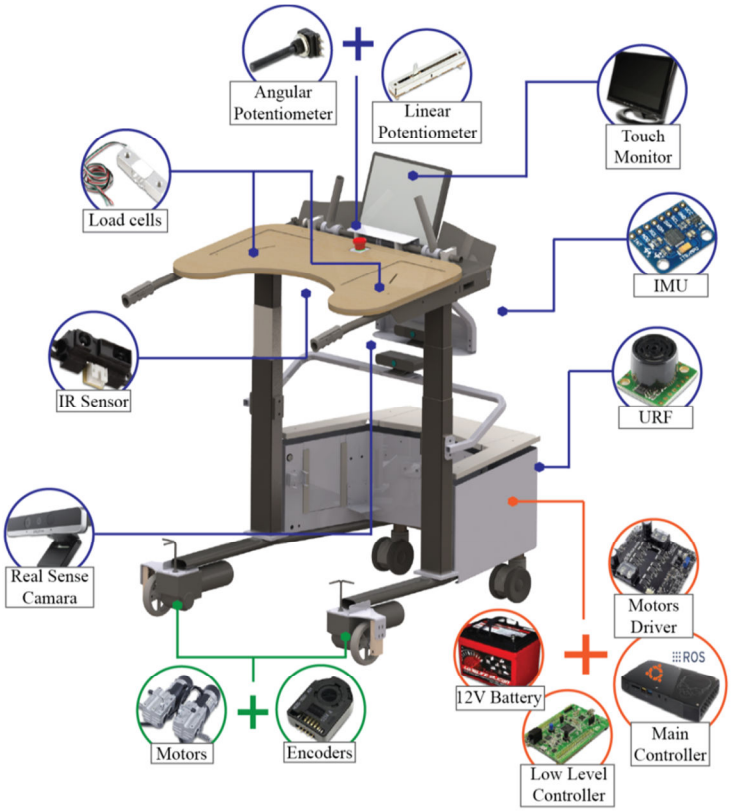

Fig. 1 - ASBGo* SW overview. Mechanical frame and localization of the main components.

Overall, the system structure and behavior are already defined. The integration of sensors, the development of a modular software architecture, which will assure the device's autonomy and enhance the user's monitoring, along with an ergonomic and user-friendly mechanical design, are important in gait rehabilitation. In this way, the ASBGo* is ready to be used in physical rehabilitation to help patients to improve from their motor impairment and so, helping them recover the confidence in their locomotion.

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