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CONCEPTUAL DESIGN OF A UNIVERSAL ROBOTS GRIPPER ENABLING REHABILITATION OF THE UPPER LIMB - FROM CONCEPT TO PHYSICAL MODEL

Keywords: rehabilitation robot, upper limb, prototype of the exoskeleton, conceptual design

Dysfunction of the movement organs resulting from the aging, injuries and also the aftermath of diseases is quite a problem nowadays. Regaining the desired mobility requires an arduous and lengthy rehabilitation process. The approach to rehabilitation has changed with the development of robots. Their use brings a number of benefits, first and foremost, greater effectiveness of rehabilitation, through less involvement of the therapist in the recovery of an individual patient, objective quantitative and qualitative analysis of rehabilitation progress, as well as the possibility of practically uninterrupted therapy. Robotization contributes to the reduction of rehabilitation costs, as well as the time that the patient as well as medical staff must spend on it [1].

This paper presents the conceptual design process of robot gripper from Universal Robots, which enable the rehabilitation of the upper limb wrist joint. The design process is presented from the review of available solutions on the market, through the creation of several concepts of the device, the selection of the optimal solution, the design using the 3D software Autodesk Inventor, to creating the actual model of the device using 3D printing technology. The idea of the project was to create a conceptual solution using available and low-cost components and manufacturing technologies, allowing for a quick creation of a prototype in order to verify the sense and idea of the target device.

The work carried out confirms that by using low-cost and readily available parts, such as the modelling servos used in the prototype along with a universal controller, as well as widely available manufacturing technology through 3D printing using FDM technology, it is possible to make a physical prototype, which in turn enables initial verification of the idea and principle of the device operation, and also allows you to tangibly assess its ergonomics and design. Such an approach positively influences the design process of the target device, enabling the detection of the potential for improvement earlier than in the case of making a prototype of the device using target components and manufacturing technologies. In addition, the implementation of such a project has a positive impact on the education of student-future engineers, who can relate the theoretical knowledge about a virtual design to reality, that gives a different, more practical perspective on the design process.