SUMMARY

This thesis evaluates the EduExo Pro exoskeleton, a wearable robotic device designed by Auxivo AG for educational purposes, by focusing on its assembly, usability, and performance. The objective is to assemble the EduExo Pro exoskeleton, conduct simple tests to assess its functionality, and provide a comprehensive analysis of its design, assembly process, usability, and performance.

The assembly of the EduExo Pro involves intricate mechanical and electronic components, presenting several challenges and limitations. Detailed documentation of these challenges offers insights into potential areas for improvement in the exoskeleton's design and assembly process.

Experimental protocols conducted at Tallinn Health College and Tallinn University of Technology included a lifting task and a fine motor task, aimed at evaluating the exoskeleton's assistance in performing basic physical activities and its impact on user comfort and usability. Metrics such as the Borg CR-10 scale, and the System Usability Scale (SUS) questionnaire were utilized to gather user feedback.

Results indicated significant challenges in the exoskeleton's usability and comfort. Many subjects reported discomfort, primarily due to issues with the vest size and design, which often resulted in tightness around the throat and upper body. Additionally, problems with the elbow strap mechanism and the servomotor's fastener rubbing against the body were noted. These issues were particularly pronounced for individuals with larger body types, emphasizing the need for exoskeleton designs that accommodate diverse user profiles.

Furthermore, alignment issues with the shoulder joint and recurring detachment of the wrist cuff with padding further complicated usability. Concerns were also raised about the overall quality of the product, specifically its sturdiness and the effectiveness of attachment points to the body.

The implementation of the EMG sensor, although initially unplanned, was explored during the lifting test but could not be fully evaluated due to time constraints. Future research should revisit the integration of the force sensor with Arduino to address the current inaccuracies in movement and conduct a comprehensive analysis of the EMG sensor using a larger pool of subjects and additional electrodes for more reliable results.

The SUS questionnaire scores ranged from 30 to 68 out of 100, indicating varying levels of user satisfaction. These scores highlighted significant differences in comfort and usability perceptions among the subjects.

In conclusion, while the EduExo Pro exoskeleton is a valuable educational tool that demonstrates the fundamentals of exoskeleton principles, it requires significant improvements to enhance its usability and comfort. Future development efforts should focus on addressing the identified design and manufacturing faults, improving fasteners and 3D printed parts, and ensuring compatibility with a diverse range of users. By addressing these issues, exoskeleton technology can better realize its potential in educational, industrial, and medical applications.

Future work should include a thorough analysis of the EMG sensor's performance, the integration of more reliable force sensor, and expanded user testing to refine the design and functionality of the EduExo Pro exoskeleton.