

Supportive Auto Belay for Climbing

Degree programme : Master of Science in Engineering | Specialisation : Mechatronics and Automation
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After bicycles, skateboards, SUP's and everything else that moves by muscle power, the Supportive Auto Belay „E-Climber“ is now also electrifying climbing. It provides the necessary support for climbing whenever needed. It is intended to make climbing easier and make it accessible to people who are not or no longer able to climb due to an impairment. The E-Climber will be the e-bike for the climbing wall.

Introduction

Climbing is becoming increasingly popular among the population and has established itself as a recreational sport in recent years. Climbing is a healthy sport that trains strength, endurance and coordination. It also promotes well-being, strengthens self-confidence and teaches people to remain calm in difficult situations. In addition to sport climbing, therapeutic climbing, under physiotherapists guidance, has also become more and more popular. The target groups are people with chronic illnesses, sensorimotor disorders or physical impairments. However, to be able to climb, basic physical requirements must be met. People with overweight or paraplegia, for example, usually do not meet these requirements and are, therefore, unable to climb a route using only their muscle power. In contrast to other sports, there is currently no device that can provide the necessary support for climbing.

Objective

The master's thesis is about the development of a „Supportive Auto Belay for Climbing“. The focus is on designing and constructing mechanical hardware components with the additional integration of electric and mechatronic components. The overall goal is to develop a competitive device with full functionality according to the required standards.

Implementation

In previous projects, a proof of concept was made, and the requirements for the fully functional Supportive Auto Belay were defined. Based on the requirements, the mechanical design has been worked out in the first step. In the design phase, the manufacturing processes, suitable for small batches, had to be respected. Further on, all strength verifications of the critical mechanical parts were necessary and have been done. In the next step, the electrical and mechatronic components were included in the design. The challenge was to find a compromise between functionality, safety and the device's compactness. In

a last step, the Supportive Auto Belay had to be tested and its safety verified. The somewhat experimental approach of the previous prototypes was professionalised and resulted in a fully developed product.

Result

The operation principle of the developed Supportive Auto Belay „E-Climber“ is simple. The climber can select the desired support at the beginning of the route. This support makes the body feel lighter and therefore requires less strength and endurance for climbing. In addition to the support, the E-Climber reliably secures the climber. It has a specially developed gearbox, ensuring the climber's safety, regardless of an electrical malfunction. In the event of a fall, the built-in mechanical brake is activated, and the person is lowered slowly and safely to the ground.



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Design of the Supportive Auto Belay «E-Climber»