MotionShift Prosthetic Device for Replicating Natural Walking Using Artificial Neural Networks

Grigoras, Antonie (School: Petru Rares National College Suceava)
Hulubeac, Mihai (School: Colegiul National "Petru Rares" Suceava)

The project is addressed to people with below-the-knee amputation and aims to replace the missing leg, fully taking over its functions of pivoting, propelling, maintaining balance and preventing additional diseases such as a result of an asymmetric gait. The forced symmetrization of the gait of a unilaterally prosthetic person, in order to prevent additional health problems, is what this project mainly proposes. We have developed a mathematical model of walking, in which the human center of mass (CoM) behaves like a pendulum that makes two perpendicular oscillations. The model showed us that depending on certain walking characteristics there can be regions of chaos, which we aimed to avoid. The MotionShift device has two parts. The first is an insole that is inserted into the shoe of the healthy foot to measure walking parameters, and the second is the actual prosthesis. The hardware structure of the prosthesis includes mechanical parts, development tools, accelerometers, servomotors, batteries, cooling system. The software symbiosis is executed in 3 stages: the collection of movement data at each step, their processing to determine the chaotic correctness of the next step and its execution. The interpretation of the experimental data aimed at: safety in the exploitation of the prosthesis and the avoidance of chaos areas. The optimal walking symmetry determined with the help of the prosthesis is approximately 90%. In conclusion, the MotionShift device allows both the natural movement of a prosthetic person and the prevention of future health problems.

Awards Won: