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A.B.C. (Auto Balancing Cube)

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The diploma thesis "A.B.C.", developed in cooperation with the Technical College Wels shall act as a demonstration example for mechatronics. It is meant to thrill children and young people for the mechatronics department. The aim of this project is to make a mechanical cube balance on its edge with the help of flywheels attached to electric motors employing suitable algorithms.

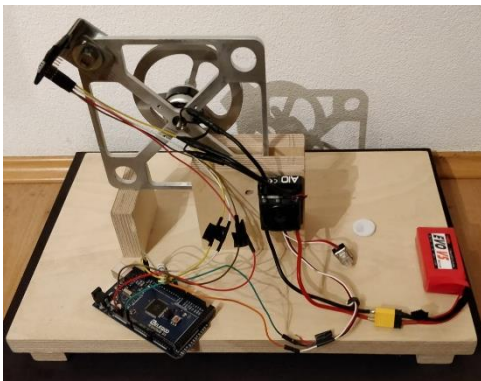


Abb. 1: One-dimensional Prototype

Mechanics:

The flywheels of the one-dimensional prototype are accelerated deliberately to achieve this goal.

The mechanical part has designed a cube with flywheels and expedient disc brakes.

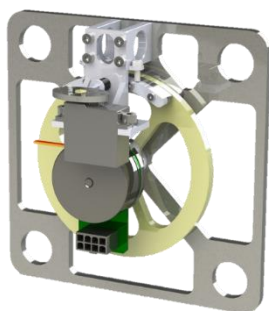


Abb. 2: Construction Prototype

Electronics:

Furthermore, the required electric motors are well-joined with the flywheels and wired to the motor controllers. The system is controlled by a microcontroller from Arduino. The DC voltage is generated via a

SMPS (Switch Mode Power Supply) and a Buck Converter.

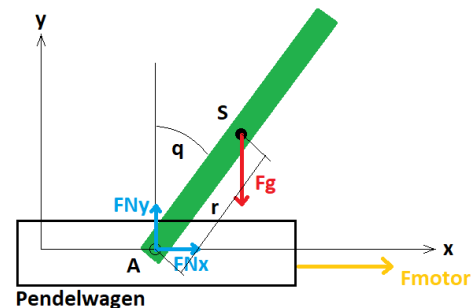


Abb. 3: Inverted Pendulum

Information Technology:

The whole source code of the A.B.C. consists of a tilt-algorithm and a balance-algorithm. The tilt-algorithm turns the cube from his steady state into its labile state (equilibrium). In addition to its main function the tilt-algorithm has an integrated neural network to determine unknown parameters like the demanded acceleration.

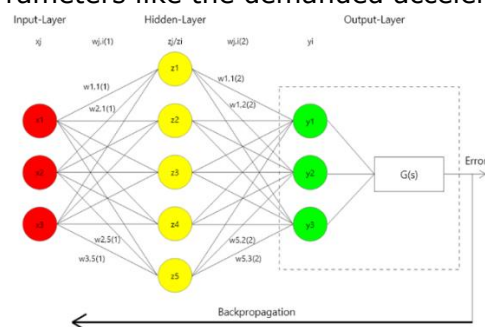


Abb. 4: Deep Learning

The balance-algorithm stabilizes the system by continuously accelerating the flywheels depending on the displacement.