SMART AIRHOCKEY Demonstrator

Entertainment pure: with the SMART AIRHOCKEY Demonstrator, AMK and ITQ demonstrate important technological analogies, which are pointing the way ahead in industry sectors like the packaging industry. The specialist for motion control and the software expert exhibit how one can playingly grasp the exciting challenges from the industry at a gaming device. The integration of innovative technological concepts like controlling the robot with artificial intelligence, that is developed with machine learning algorithms, is one of the many project goals. According to the requirements of todays operators, the machine sets an example for the engineering of the future. It addresses the shortage of young talents and the requirement for further education concerning digitalization among other topics – ideal to look, gape and learn.

Objectives:

- **Making "Industrie 4.0" tangible:** Illustrate complexity and interdependencies with a concrete project example
- **Prototype development:** Implementing a modular demonstrator for trade fairs with the help of up-to-date and innovative technologies
- **Artificial Intelligence:** Training of neural networks on the digital twin with machine learning algorithms, in order to control the robot
- **Practical oriented education:** Interdisciplinary project-work in international teams and cooperation between universities and companies
- **Virtual systems engineering:** Application of agile, mechatronic development methods and engineering with digital twins

The Team

An interdisciplinary and international team of 4 students and 4 engineers develop and enhance the SMART AIRHOCKEY Demonstrator in continuous sprints across four different locations. New and innovative technologies are constantly being integrated in order to explore and evaluate them.

About Us

The AMK Group has been one of the market and technology leaders in the electric drive and control technology, industrial automation, and automotive areas for more than five decades. Numerous AMK developments have formed the electrical drive and control technology. The success of AMK is created by the employees with a lot of know-how and passion. To maintain the high level of qualified employees in the future, AMK trains junior employees every year. Internships and Master's Theses are available to students to gain practical experience.

ITQ GmbH consults and supports during all phases of software development, allowing for special mechatronic problems in mechanical engineering. One particular focus of the company are sustainable training concepts that shape the future. For that reason, the company fosters young academics in practice-oriented assignments such as the project „SMART AIRHOCKEY".

The joint support of student projects from AMK and ITQ are part of their modern approach to Recruiting 4.0.

ITQ GmbH | www.itq.de
AMK Holding GmbH & Co. KG | www.amk-group.de

ITQ AMK

SMART AIRHOCKEY

Industrie 4.0 Demonstrator

SMART AIRHOCKEY

through modern methods and concepts in machine design to play against a robot

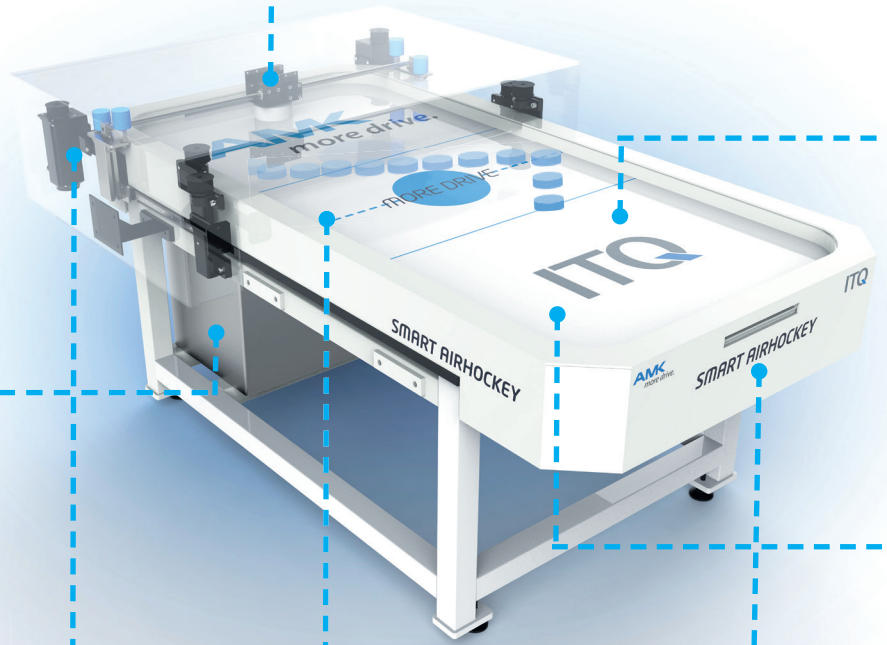
- Accelerations up to 30 g
- Agile project management
- Highly modular setup with „Plug and Play“
- Testbed for trends in technology
- Digital Twin with Virtual Reality
- Controller in the Cloud
- Motion strategy based on artificial intelligence
- High consistency of data
- Modern Interface architecture
- Real-time Image Processing
- Minimized electric cabinet through compact drive-technology „MultiServo“

Agile Project Management

- Continuous development in sprints
- Short iterations and integration in the system enable steep learning curves
- Organization, coordination and coaching of an international team

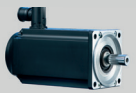
Human vs. Machine

- Thanks to the SMART AIRHOCKEY Demonstrator, every body can experience playing with a smart robot
- The machine observes the play behavior with a high-speed camera and reacts according to the skill of the opponent
- The information processing and control in real-time in combination with extremely dynamic drives, make it close to impossible to win against the machine



MultiServo und High Torque Servo Drives

- Compact inverter module
- Integrated, application specific APPS for motion control and synchronization in real-time
- Up to four servo axis including power supply
- Direct communication with mobile devices
- Quick and simple adaption to any desired application



- Standardized APPs for typical motion, customized APPs for special requirements
- Various fieldbus systems possible: Ethercat, Profinet, Varan, EthernetIP, OPC UA,...
- Extensive Service APPs
- Highly dynamic positioning with powerful servo drives from AMK

Controller in the Cloud

- Modular design of the software
- Calculation of the path of the puck
- Interface to neural networks for the control of robots
- Decision making based on the path of the puck
- Transmission of control signals by means of up-to-date communication protocols
- Data acquisition and analysis of game data

Plug and Play

- Simple setup by intuitive user interfaces
- Quick exchange and implementation of digital and physical modules

Realtime Image Processing

- High-Speed Camera as single sensor for detection of the puck
- Puck detection through adaptive recognition of color and form
- Image recognition in real-time with up to 300 frames per second
- Communication over GigE-Interface

Artificial Intelligence through Machine Learning

- Neural Network to control the robot
- Reinforcement learning with a digital twin
- Analysis of different training environments
- Test of various training algorithms (PPO, TRPO, ...)
- Transfer of trained networks to the real machine