

AVT Pike Makes Foosball Robot Nearly Unbeatable

Fachhochschule Köln University of Applied Science Cologne



Fachhochschule Köln, founded in 1971, is the outcome of an amalgamation of renowned predecessor institutions. These included “factory schools” (Kölner Werkschulen), colleges of mechanical and construction engineering, the German

Insurance Academy and schools of photography and social work. Later additions included the Gummersbach campus and the former colleges for library and documentation studies as well as completely new fields of study like restoration and conservation, design, along with an institute for technology in the tropics.

Some 18.000 students in 10 faculties, counselled and taught by 450 professors, make the Fachhochschule Köln Germany’s largest “University of Applied Sciences”. A diversified mix of disciplines, divided almost equally between engineering and arts subjects, offer outstanding opportunities for interdisciplinary projects and cooperation schemes. In view of its multi-faceted, high-quality teaching range and

research spectrum, the University of Applied Sciences Cologne is a much sought-after contact internationally and has forged links of many different institutions of higher education both inside and outside Germany.

Hallmarks of the University of Applied Sciences Cologne include application-oriented and faculty-crossing education, research and development, dynamic advances in various fields of study, integrated internships and short duration of studies. Thanks to the close links between scholarship and industry, current developments can be input directly into the work of the University of Applied Sciences Cologne.

The Project: An Automatic Foosball Robot

Fun and science can definitely be combined. This was proven by the degree candidates at the Cologne University of Applied Sciences (FH Köln) with their project to automate a foosball table and thus demonstrate the capabilities of modern, freely programmable circuits – so-called FPGAs (Field Programmable Gate Arrays). Under the supervision of Prof. Dr. Jens-Onno Krahn, head of the Laboratory for Motion Control and Digital Signal Processing at FH Köln, students developed a foosball table on which people can play against a robot. The eye of the robot is a Pike digital camera from Allied Vision Technologies.

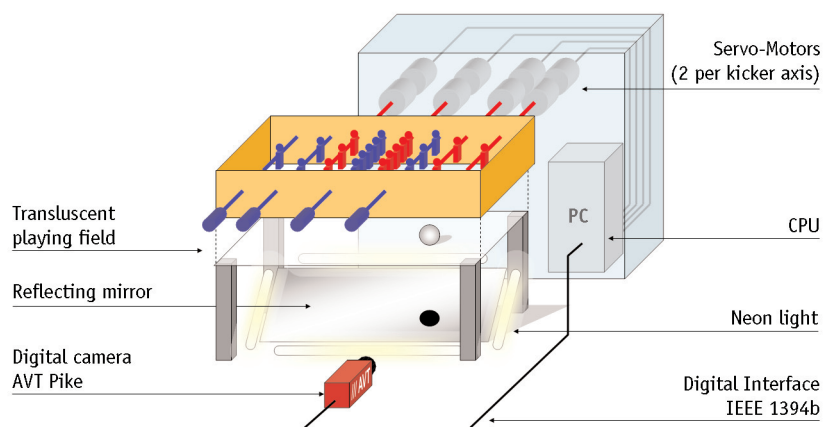
Here’s how the foosball robot works: The playing field is monitored by an AVT digital camera. It is located underneath the foosball table, where the green playing field has been replaced by translucent, impact-resistant, safety glass. Thanks to specially tuned lighting, the camera

recognizes the shadow of the foosball from underneath. The images are analyzed in the “brain” of the robot – a computer – using algorithms, which calculate the position and speed of the foosball and transmit corresponding commands to the four “arms” of the robot. These

“arms” consist of servo-motors, which are linked to the four handles on one side of the foosball table and operate the playing figures: For each handle one motor positions the players, while another is used to turn the figures, i.e. to kick.

Automatic Foosball Robot

University of Applied Sciences, Cologne (Germany)



The Requirements

Critical for the game experience is the reaction speed of the robot. This depends decisively on the speed of the camera, as

shown by the experience of the development team: "The first prototype of the foosball robot was equipped with an analog camera and a comparably slow image processing speed of 20 images per

second", explains Prof. Dr. Krahl. "So it was quite possible to win against the robot".

With AVT Pike Nearly Unbeatable By Humans

The analog camera has since been replaced by a Pike high-speed camera from Allied Vision Technologies. Via its IEEE 1394b FireWire interface, up to 120 images per second are recorded and analyzed in VGA resolution (0.3 megapixels). Furthermore, the use of the AVT FirePackage software optimized the speed of image processing.

This six times faster version of the foosball robot was presented on Allied Vision Technologies' booth at die Vision show in Stuttgart, Germany in November 2007 and was tested thoroughly by users. The result: With the Pike camera, only experienced foosball players have a chance to win against the robot. "The robot won over 90% of the games and was able to kick five goals even against the two best foosball players", says Prof. Dr. Krahl. "No one expected the robot to kick such fast and hard shots".



The AVT PIKE camera family is equipped with an IEEE 1394b (S800) interface, as well as high-quality CCD sensors and comes in a surprising variety of different versions for the most demanding applications. The PIKE offers a selection of five different high-quality sensors (b/w and color) with high sensitivity and true-to-life color reproduction. To meet the highest requirements in the industry, the PIKE comes optionally in a version with a copper daisy chain connection or 1 x copper combined with 1 x GOF connector (2 x optical fiber on LCLC). The high data rates of the PIKE (max. 62.5 MByte/s) and a huge number of smart features ensure an extraordinary performance in PC-based image processing.