Eurobot 2010 „Feed the World“

Team LeoBots

::Leipzig, Germany ::

Our Team

Our team consists of 12 members from three departments of the university HTWK Leipzig: Department of Electronic and Information Technology, Mechanical and Energy Engineering and Department of Informatics.

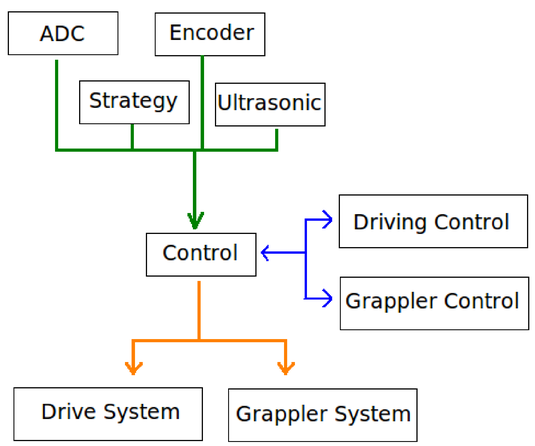
The picture shows from left to right:
Huy Vu Quang, Rico Steinitz, Steffen Bauch, Matthias Porzig, Sebastian Kühn, Christian Aurich, Andreas Schimmel, Hang Nguyen Thi, Norman, Schwarz, Marco Büchel

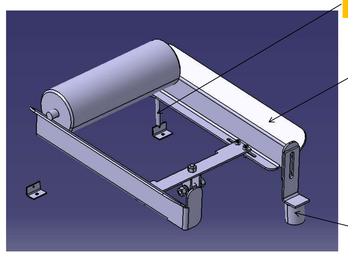
Members not in the picture are:
Michael Boy, Thomas Wendt

The brain

The main controller of the robot is implemented with an embedded, ARM-based processing board, the Foxboard G20. With 400 MHz of processing power and less than 5 Watt power consumption the board fits to the requirements of mobile robotics quite well. The large number of 80 GPIO or special function pins is well suited to the application. The main usage for those special integrated functions is Analog-Digital-Conversion (ADC) and pulse-width-modulated (PWM) signal generation in hardware. Auxiliary functions like the sampling of encoder data is done in an external ATMega2560 that is connected via USB. Considering the software side of the robot, the system is based on a Linux kernel 2.6.31.6 containing the real-time preemption patch. For the usage of PWM and ADC own kernel modules were programmed. The motion control and decision making of the robot is programmed in a combination of system programming in C and Matlab generated model based code.

Structural Overview



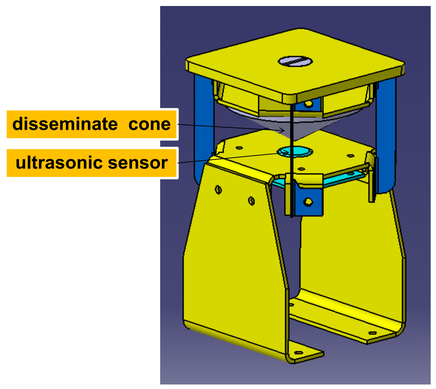


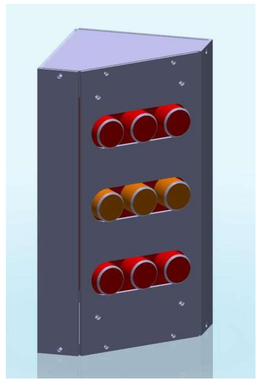
Tiltable Storage-System

The storage-system has a capacity to store four cylindrical elements. To dump the elements after the game we are activating the inductor and absorb the magnetic field of the permanent magnet. A spring pulls the storage-system into the deposition position.

1x Turn-off permanent magnet (IBS Magnet)

Typ SE3
Operating voltage for the inductor 24V
Magnet surface 35mm



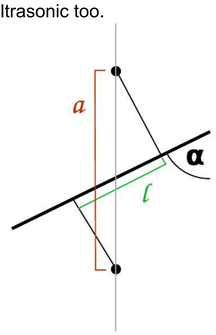


absolute-positioning-system:

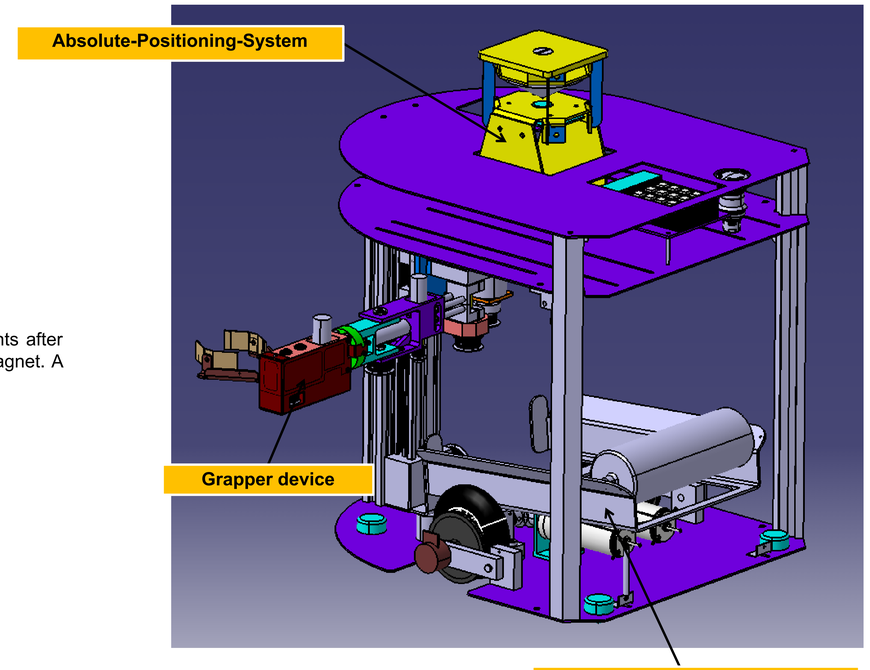
One ultrasonic sensor sends ultrasonic waves to identify the position and the other robot.

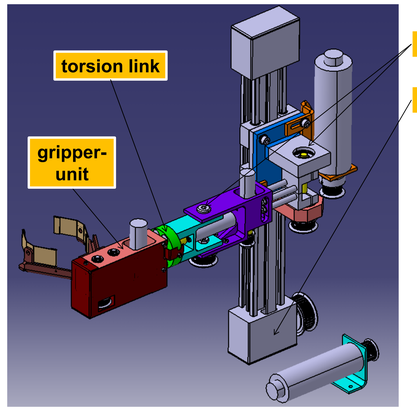
ultrasonic sensors
U: 5V protocol: I2C

The beacons are based on principle „angle of arrival“. Beacons based on robots are sending out an ultrasonic ping, which is received by the beacons located at the border of the field. Each of these three systems is detecting the angle of arrival, that is send back to our robot using ultrasonic too.



By using triangulation the robot could calculate its position from only 2 of these angles. The beacons at the border have a lot of ultrasonic sensors because we are using multiple frequencies. These minimizes influences of the commonly used 40kHz. An other principle to avoid errors due to frequency collision is to correlate the received signal with the expected signal that was measured without any other ultrasonic sources and saved into the µC.





Grappler device:

The grappler device grips the cylindrical elements and place it on the depositing rack.

5 DC-motors (Faulhaber)
Linear guide system of IGUS GmbH

Parameters of the used components

Anti Collision
4 ultrasonic sensors
U: 5V protocol: I2C

Control System
2 ATMEGA2560 micro controller
2 ATMEGA32 micro controller
U: 5V protocol: I2C

Visualisation
RN-Key LCD Keypad
protocol: I2C

Energy Supply
2 accumulator packs
2x 7.2V, 4000mAh
2 DC/DC-converters
output voltage: 5V/12V
output Power: 15W/60W