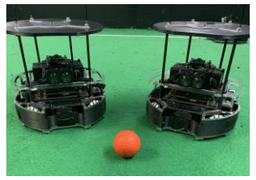
TEAM FAABS

TEAMMEMBERS

From left to right

1. Fabian Brune (Hardware Design)
2. Mark Krause (Software)
3. Jurij Lenz (Hardware)



Germany
2vs2 Open

Zwick / Roell

MULTIVAC

initiative. ulm.digital e.V.

wieland

LG PH

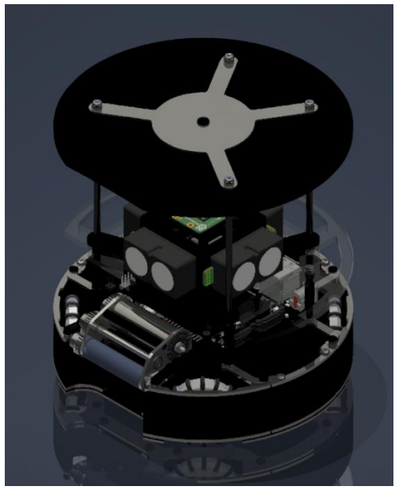
ABSTRACT

We are „Team Faabs“ consisting of three students from Germany. We are part of the „Robotik AG“ at our school (Lessing Gymnasium Neu-Ulm). We meet multible times a week to work on our robots. Due to the pandemic, this is our really second time competing in RoboCup Junior. Although we participated in several regional competitions aswell as at the European Championship 2022, where we were able to take second place in the LightWeight League.

CONTACT

TEAM_FAABS

HARDWARE

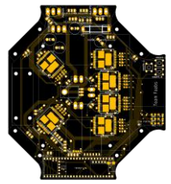


All our parts were designed using ’Autodesk Inventor 2023 Professional’ and ’Autodesk Eagle 9.6.2’. Most of our parts are printed with our Prusa MK3S+ and the metal parts are produced by our sponsor ”Blech und Technik”. Traveling with high speeds, while being strong is also a huge challenge. To achieve this, we use high quality Maxon DC Motors in combination with the VNH3SP30 driver chip. Also the whole design is trying to keep the center of mass as low as possible. To put the force on the ground, we designed new omnidirectional wheels. To protect this whole construction from the opponent robot, everything is moved into the robot with metal protectors covering the whole inner side of the robot. The hardest challenge althought was fitting a Jetson Nano as our single board computer aswell as 4 LIDAR Sensors without making compromises in the FOV on the robot.

BLECH & TECHNIK FUNKTION IN FORM

maxon

ELECTRONICS



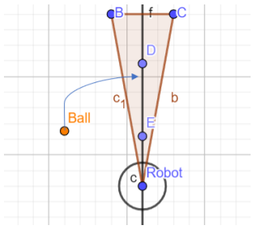
To detect various elements and control the whole robot we use a Teensy 4.1 microcontroller and a Jetson Nano for ball detection. It runs a ROS for exactly this type of task. All electronic parts are soldered to self designed circuit boards (except the developer board of the nano).

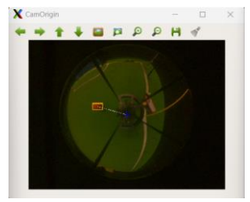
DEVELOPMENT & TESTING

Since this is our first season in the Open League we had to figure out how to locate the ball without a high latency. We did many testing but figured out that the Jetson seems to be the best option for our use and stuck with it. On the mechanical side the main construction side was to construct an dribbler that is able to catch the ball and maintaining it aswell as fitting the most optimal kicking device between the motors which we achieved by 3d-prining the housing an self winding the coil to fullfill our needs.

SOFTWARE

The most important part ist the object detection. This is done with the opensource computer vision library ”OpenCv” (v4.1.1) on our Jetson Nano. We also do multithreading to achieve this three detection processes parallel with the lowest latency possible. Our resolution is 816 on 616 pixels in one frame. The software is written so it gets the most out of the abilities the robot has. The main objective ist to approach the ball as quickly as possible and shooting at the goal while the ball is secured in the ball capturing zone due to the dribbler. All these fast movements happen while the robot should stay inside the playing field very consistently. To achieve this we have written an own line detection algorithm and are using the information the LIDAR sensors provide us with.





CHALLENGES

The main challenges were to realize everything we had in mind on the robot due to the small diameter. This includes, that we had to design smaller wheels and find the battery packs which are able to consistently power the robot the whole halftime. Of course the whole object detection was really time consuming and challenging aswell because we wanted to locate three seperate objects as close to realtime as possible.