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LNX ROBOTS

Bratislava, Slovakia

RoboCup Junior Soccer
Open 2024

Abstract

We are LNX Robots, a team of 3 high school students from *Gymnázium Grösslingová 18* and *Gymnázium Bilíkova* high schools in Bratislava, Slovakia.

On-board Raspberry Pi 5 handles object detection, logging and main playing logic.

Two STM32 microcontrollers act as additional IO processing units.

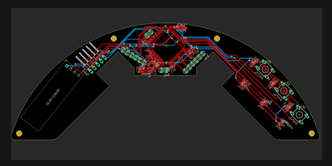
Processing

Raspberry Pi 5 8 GB

Communicates with STMs and processes all data.

Inputs:

- Front camera
- Mirror camera



PCB for main STM

Bottom STM (STM32G474)

Controls:

- 5x ESCON Module 24/2
  - 4 drive motors (Maxon EC45 flat 70W, brushless, direct drive)
  - 1 dribbler motor (Maxon EC-max 22 25W)
- Kicker (solenoid, Tremba HMF-2620, 48V)

Inputs:

- 7 light-sensors
- Dribbler light gate

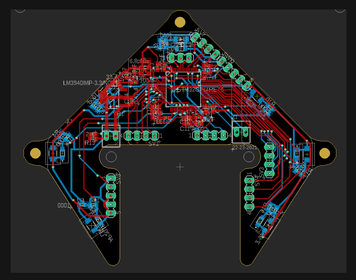
Main STM (STM32F427)

Controls:

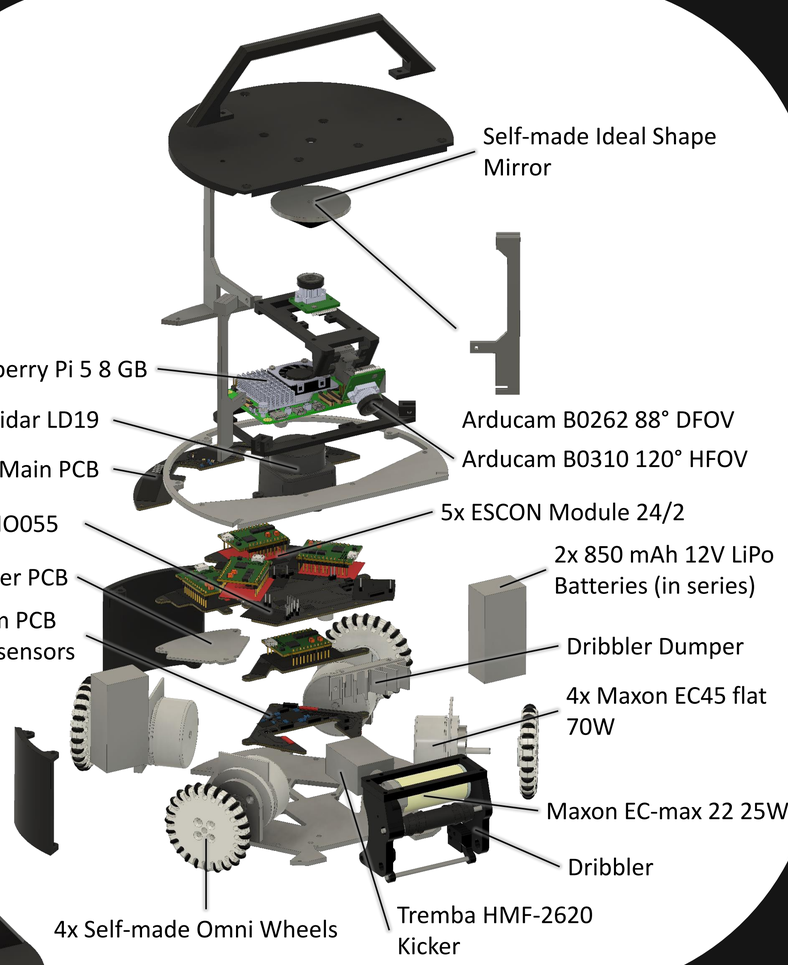
- OLED display
- Buzzer

Inputs:

- IMU BNO055
- Buttons
- 360° Lidar
- SuperTeam communication module

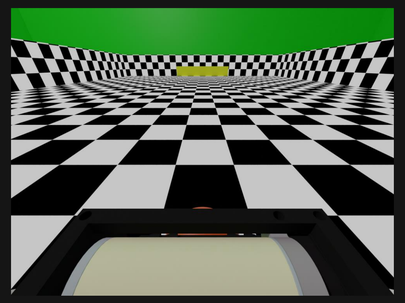


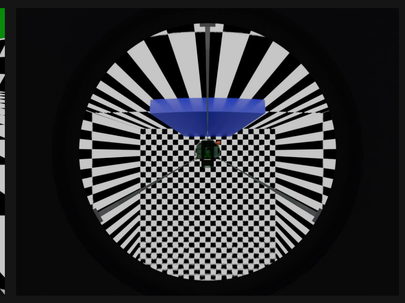
PCB for bottom STM



Simulation

To test the mirror and find the optimal positions for cameras, we simulated the playing field in Blender and imported the robot model from Fusion 360.

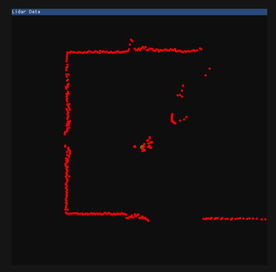




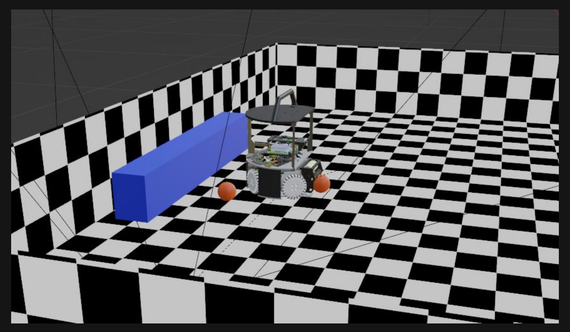
Views from both cameras rendered in Blender

Positioning

Robot uses a 360° lidar to measure the distances from the walls. It then finds the lines that represent walls in the point cloud to tell the exact position on the field.



Point cloud of the lidar



Chassis

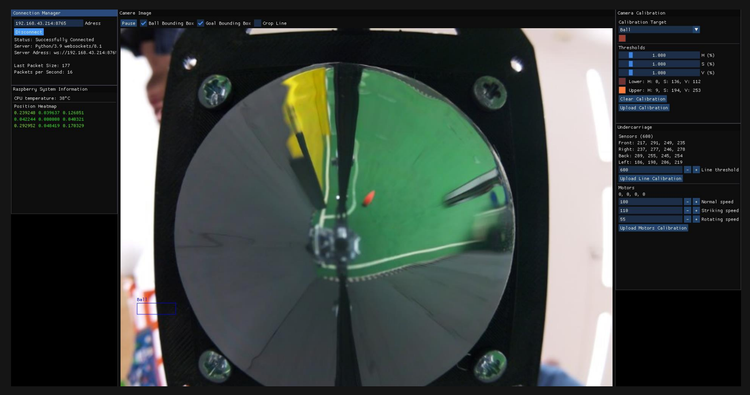
Chassis consists of plastic 3D-printed and aluminum parts.
Pillars for supporting mirror are made of aluminum for structural integrity and were chosen to be three in number to minimize interference with image of the mirror and measurements of the lidar.
All parts were designed in Fusion 360.

Vision

Robot processes images from two cameras:

- **Front wide-angle camera** (Arducam B0310, IMX708) for detection in the front and farther away from the robot
- **Mirror camera** (Arducam B0262, IMX477P) for detection in all directions from the robot

Mirror is made by vacuum forming of laminated polystyrene. The shape is calculated as a differential equation such that things on the plane of field appears in the same distance from each other in the virtual image of the mirror.



SIEMENS
Alanata