RoboCupJunior Soccer League 2021

Team Description Paper

Gebruder Weiss CRO Team

Abstract

We are team Gebruder Weiss CRO Team from Croatia. In this TDP you can see our soccer robots with which we started working in September 2019. Through the last and this year, we have been improving it, to go to RoboCup competition. We are using MRMS technology, based on Arduino technology, because it is a low cost, it's easy to use, and it has a wide variety of libraries for sensors and other devices. Our robots have been improved with better tracking, adding a dribbler to the ball catching area and better positioning in final third.

Introduction

Team

Jerko Ćubić

- Team captain
- Hardware
- Experience:

  Robocup Japan (rescue line)

  Robocup Canada (rescue line)

  Robocup Australia (Soccer Open)

Fran Plevko

- Software
- Strategy
- Experience:

  Robocup Hannover

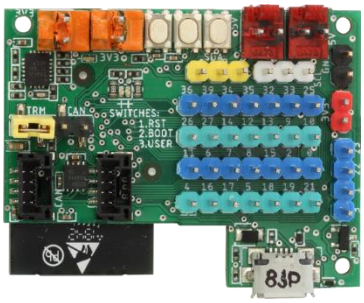
  Robocup Austria

Robots and Results

Hardware

Our robot contains power supply, distribution board, microcontroller, motors, motor drivers, line sensors, ball sensor and camera. Our robot consists of three circular layers which are made of aluminum. Each of these layers consists of parts that are crucial for robot's functionality. First layer consists mainly of motors and line sensors. Second layer holds all the other electronic parts. Lastly, third layer is elevated for better overview of the terrain. This purpose server our Infrared ballseeker to easily catch IR rays from the ball. Third layer also has camera. Since the first two layers chassis are made of aluminum, all the electronic parts are mounted on plastic spacers to prevent short circuit problem. We designed a mechanism by which only one engine controls the dribbler and kicker.

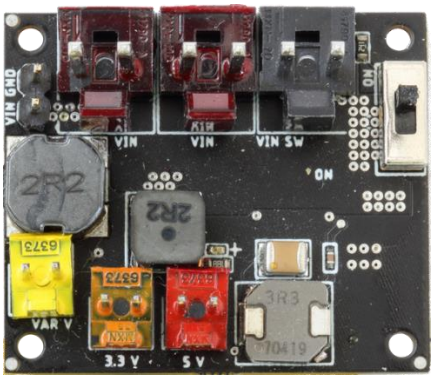
Microcontroller

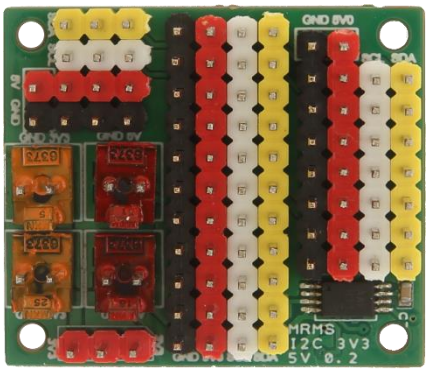


For the microcontroller we use MRMS ESP32 board with two 240 MHz cores. It is compatible with Arduino and has CAN BUS system installed.

Power Supply and Distribution Board

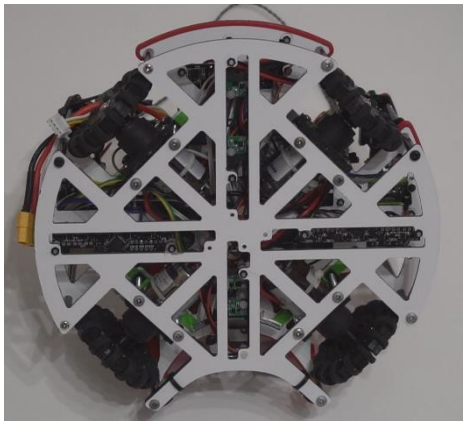
We use MRMS Power Supply 3x B and MRMS 12C 3v3 5v distribution board.





Line sensors

We use two types of line sensors. On the front and back side of the robot, we use four MRMS Reflectance sensors which are connected to analog pins on our microcontroller. On the right and left side of the robot we use MRMS reflectance sensors which are connected through CAN BUS system.

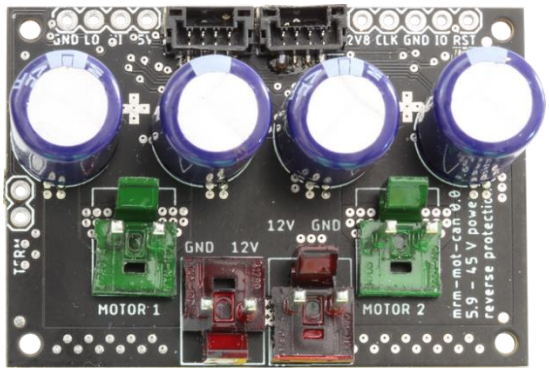


Motors

For the motors we ae using Joinmax Motor 3561. It's of standard 2-line connection, which connects to high-power motor control board. We are using 4 of them. We also use one UHP 1500 rpm DC motor for dribbler that communicates through CAN BUS system.

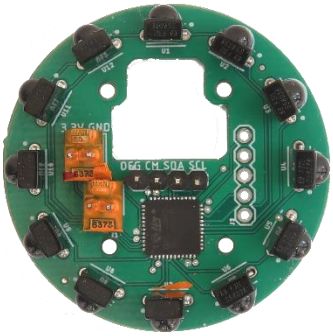
Motor drivers

We are using two MRMS BLDC Motor Driver 2x50A reverse protection motor drivers one for each pair of motors. For dribbler motor we use MRMS Motor Driver 4x3.6A CAN Bus. Both drivers are compatible with CAN BUS system communication.



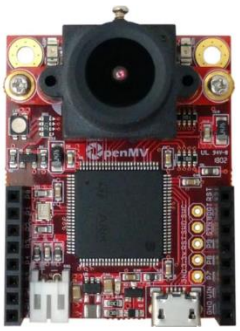
Ball Sensor

For the ball sensor we use MRMS IR ball finder 2, direction + distance. It returns values of 360 degrees ana it returns values of distance through two analog pins on our microcontroller.



Camera

We are using OpenMV Cam. The OpenMV Cam is a small, low power, microcontroller board which allows you to easily implement applications using machine vision in the real-world.

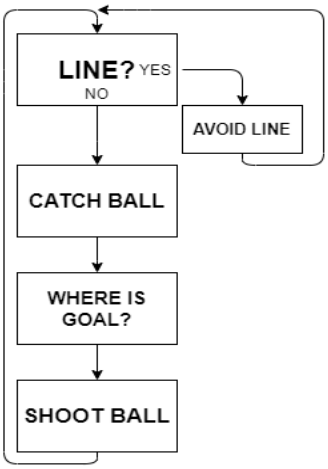


Software

We programmed our robots in the C++ language through the Arduino software. We also include many libraries for the proper use of the line sensors, the dribbler, motors, and ball sensor. We made functions for the motor's movement, sensor configuration and compass sensors. Each robot is programmed to advance towards the IR ball when it detects it.

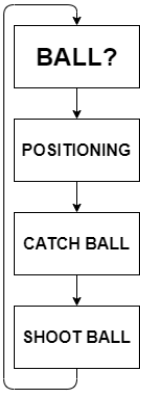
Attacker

Our attacker is trying to catch the ball with a dribbler and when the ball is into his dribbler, he is trying to score the goal. He is adjusting himself through Open MV camera programed in Open MV IDE software. Robot is always trying to avoid the line through his line sensors. if the opponent's robot is in front of the goal, the robot looks at which side of the goal has a larger surface and shoots the ball in that direction.



Defender

A defender always looks at his goal with his camera facing backwards and always tries to be in his half of the field to defend the goal. When he notices that the ball is approaching him, he positions himself exactly between the center of the goal and the ball. The dribbler works all the time and when the sensor detects that the robot has taken the ball, the robot rotates towards the opponent's goal and shoots the ball,



Results

Our robot had a lot of design and program changes during the creation process. At the very beginning we had neither dribbler nor kicker but we decided to put a dribbler so he could score a goal more easily. The kicker was created after we discovered that we could make it with a dribbler motor by running it in the opposite direction. We feel we have made a big step forward by designing our dribbler. We also had multiple wheel versions. Previous versions were worse because they had a worse grip on the field, but the wheels we have now have a very good grip, so the robot doesn't slip. Our robot used to have ultrasonic sensors for positioning in the field, but we found that it is not very efficient when there are more robots in the field, so we added the camera. In the program we improved tactic.

Conclusions and Future Work

In the process of creating the robot, we learned to work with the camera. How to program it to detect goal colors and how to connect it to Arduino software. In the future, we plan to work on tactics such as communication between robots. We have an idea to add a Bluetooth module and develop tactics of communication and cooperation in the field. We also need to work on reducing the weight which is very close to 1100g (1080g).

References

https://www.arduino.cc/

https://hobbyking.com/

https://openmv.io/