2024

RCJA 2024 Rescue Line, Rescue Maze and Soccer
Technical Description Paper

Team Information:

Challenge/Division: Lightweight soccer

Team Name: Hyperion

School: Brisbane Boys' College

State/Territory: Queensland - Brisbane

Team Member Names:

If any team member had a specific role, please include this below.

Member 1: Matthew Adams (Electrical)

Member 2: Luke Atherton (Hardware)

Member 3: Sam Garg (Software)

Robot Properties: (200 words recommended maximum, plus components list (if applicable))

Please describe the software (e.g. EV3 Block Code, Python) and hardware (e.g. Spike Prime, EV3, Raspberry Pi) you have used for your robot.

For each piece of software/hardware used, please give it a star rating out of 5 (1=very bad, would not recommend to other teams, 5=very good, would strongly recommend to other teams).

If you have used custom electronics for your robot, please include specific model/part numbers or web links, and a star rating for each.

Software

- The main language used for our robot is C++, however, python was used to communicate to a camera (in a library that is not used yet). An Arduino programming style was chosen to do this. A compiler was used so that the Arduino language can be understood by the robot. This compiler is named 'platformio' and is a commonly based system that is used for various programs.
  C++ = 5
  Arduino programming style = 4
  Platformio = 5

Hardware

- Within the hardware process, Fusion 360 was used to design our full robot design, various individuals 3d printed components (such as the battery holder) and PCBs (such as the Light Sensor Board). Fusion also allowed for parts which weren't printed to be factored into the visual design (such as various stand-offs between plates and components). Our robot mainly consists of a Base plate, Mid plate, Top plate, motor holders and TSSP holder made from PLA 3D print filament. With other smaller 3d printed parts to support other components, such as the battery holder, and 3d printed plates to support the power supply and Audino. There are 4 motors positioned in an X shape because of our omni wheels which allows the robot to have smooth omni-directional movement, being able to move in all directions with minimal issues, ensuring precision when positioning the robot on the field for optimal play. The central positioning of the power supply allowed for wires to connect easily to both the Audino and motor controllers.

Electrical

- The Electronic components consist of a power supply board, Light sensor Board and TSSP board. The Power Supply Board is a 60Lx40W(mm) board consisting of a JT60 connector that is connected to a 12V 1.3Amp Battery that is tucked in the robot securely, also there are multiple connections for power output on top of the board. The TSSP ring board is a circular ring with a hole in the centre to save space. The diameter of the board is 80mm the which is the exact size of the holder that we made. The TSSP ring is consisted of jumper wire pins and 12 TSSP58038 components in a circular patten pointed outwards. The Light sensor board is made of 16 Red LED's and sensors in a circular patten.

Components List

- 3D Printed Custom Parts
- Custom made PCB's (Light Sensor ring Board, Power Supply Board and TSSP ring board)

- Wheel rollers = 3
- Polulu 9.7:1 Metal Gearmotor 25Dx48L mm HP 12V https://www.pololu.com/product/3202 = 3
- Electrical Wiring
- Hot Glue
- Screws
- Nuts
- Bolts
- Standoffs = 5
- TSSP58038 TSSP58038 Vishay Semiconductor Opto Division | Sensors, Transducers | DigiKey = 4
- Arduino Jumper wires https://www.jaycar.com.au/150mm-plug-to-socket-jumper-leads-40-pieces/p/WC6028?srsltid=AfmBOopgDxb-hmfL54Dmbgx1oXoj9W4-LfwZQesS1pVKn8Ql9D3ob-JT = 3
- MPU 9250 https://www.phippselectronics.com/product/mpu9250-9-axis-motion-sensor-module-accelerometer-gyroscope-compass-motion/?gad_source=1&gclid=Cj0KCQjw05i4BhDiARIsAB_2wfBOFaP0WOj4Ha27kosREb9WdAGm1mfnMDne_QJGDlFk6Il2v1vbV1QaArwVEALw_wcB = 3
- Arduino Mega 2560 = 4
- Multiplexer (for LSB) https://octopart.com/adg1206yruz-reel7-analog+devices-46514718?gad_source=1&gclid=Cj0KCQjw05i4BhDiARIsAB_2wfB77KxgrLVmsC4tUQnJemb6yaQMXKa-Yp3CZd5BwY6o57VVmDWJBOUaAnRuEALw_wcB = 3

Collaboration: (100 words recommended maximum)

Please describe if your team has used any methodologies, software or systems to aid collaboration (working together). This could be related to the design, construction or programming of the robot(s).

It is the overall desire of RoboCup Junior events that any technological and curricular developments will be shared with other participants after the event. Any developments including new technology and software examples, may be published on the RoboCup Junior website after the event, furthering the mission of RoboCup Junior as an educational initiative.

To collaborate we use Microsoft Teams, in the BBC Robotics Team (Organization)- we have our own designated channel. As well as this, we chat to each other using the teams group chat feature. (Also, by phone if teams are not available)

In addition to this; we use Fusion 360 to communicate our changes within our robot's design. This allowed for all to make changes and access the full design, various components, and PCBs.

Not only this; but we use GitHub to communicate the changes made within our code, and so that all could access an updated version and previous versions of the code.

Key Achievement & Area for Improvement: (300 words recommended maximum)

Please describe one aspect of your robot your team is particularly proud of, and one aspect you would like to further improve.

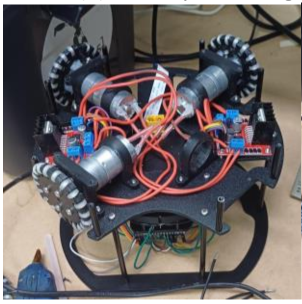
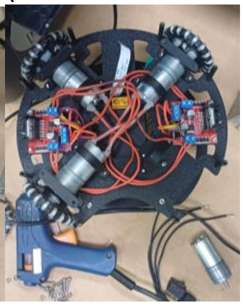
We are particularly proud of the way our TSSPs are designed- it can be seen that we use a PCB that links to the Arduino and power supply. Since we are a new team this year, PCBs are not regularly given- however- this was an exception, and we did not fail to deliver.

Another aspect that is particularly well done- is the overall design of the base & mid-plate. It is extremely organised and allows for a tight & compact robot, with components attaching both above and below the board. The various gaps in the board allows for reduced weight and allows for wires to connects to various components both above and below the mid-plate, such as between the motor controllers and the power supply. The mid-plate is compact as it has both components and standoffs above and below it; being attached to the motor brackets, motor controllers, standoffs to the baseplate, standoffs to the top-plate, standoffs to the power supply, and standoffs to the TSSP ring. Not only this- but our capture zone is the perfect size, allowing us to capture the ball within the rules- but also be able to dribble it.

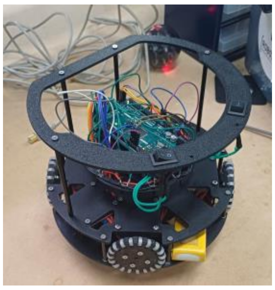
In addition to this, we could introduce goal tracking to ensure that our robot faces the goal when we accelerate, to allow for more accurate goals, with more consistency.

Photos and Design Documentation: **(100 words recommended maximum, plus images)**
If there is a design drawing of the robot or if you have photos or notes of the development process, please provide these as proof of your team's learning.

These two images display the robot being assembled, with the wires from the motor controllers to the motors being soldered and hot glue gunned on to ensure they do not detach and cause the motor(s) to stop running (which was an issue we faced in earlier testing of the robot)

This image shows the assembled 1st robot. It consists of a top-plate, with 2 switches (one for motors and 1 for logic). It also has an Audino with wires to and from various components including the TSSPs on the TSSP ring and the power supply (located on a small plate just above the mid-plate). On the mid plate, above there are standoffs to the TSSP ring and top plate, and below there are the 2 motor controllers, motor brackets, and standoffs to the baseplate.



This image shows the robot with the battery holder attached (which stops the battery from falling out of the robot). The battery holder attaches to the standoffs as seen in the image, and it is also one of the later 3d printed components that were made. Previously, only tape was used but this was decided on as it would be more reliable and allowed for easier access the removal and reapplication of tape.