



# STUDENT ROBOTICS 2023

KICKSTART

Housekeeping



# STUDENT ROBOTICS 2023

KICKSTART





# KICKSTART 2023

1. What is Student Robotics
2. Schedule for the year
3. Designing your robot
4. Building your robot
5. Developing your robot
6. Health and safety
7. The game
8. The microgames





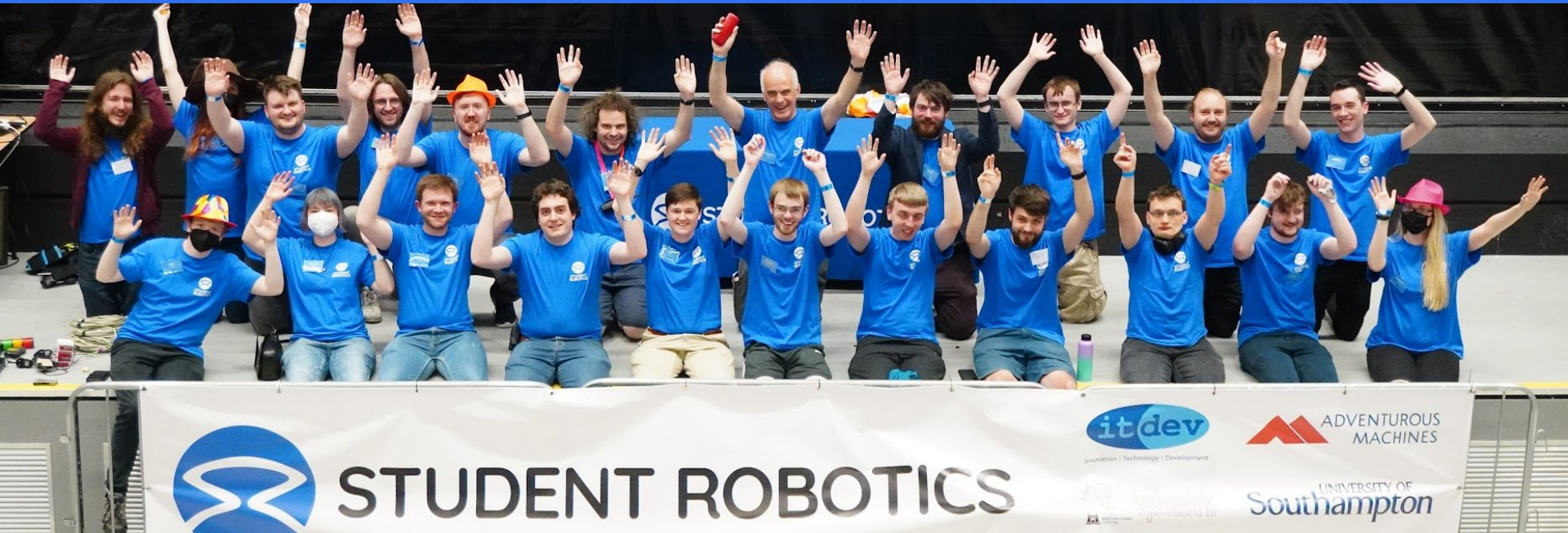
QUESTIONS

**WHAT IS STUDENT  
ROBOTICS?**



# The Volunteers

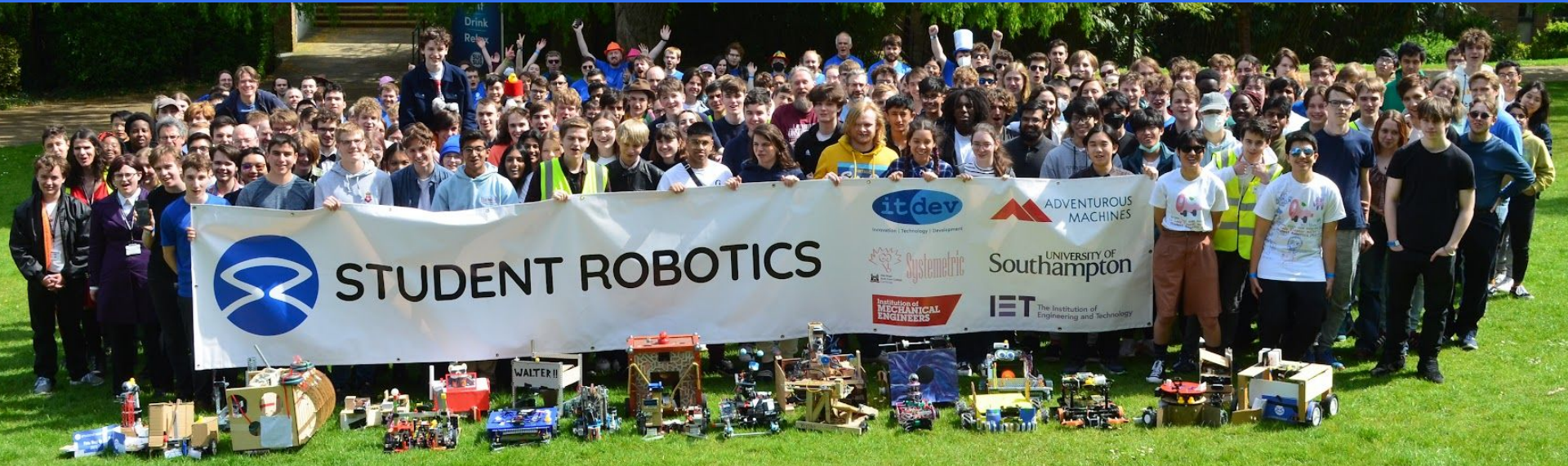
We're here to help!





# The Teams

There's 34 of you!



# Where are you all?

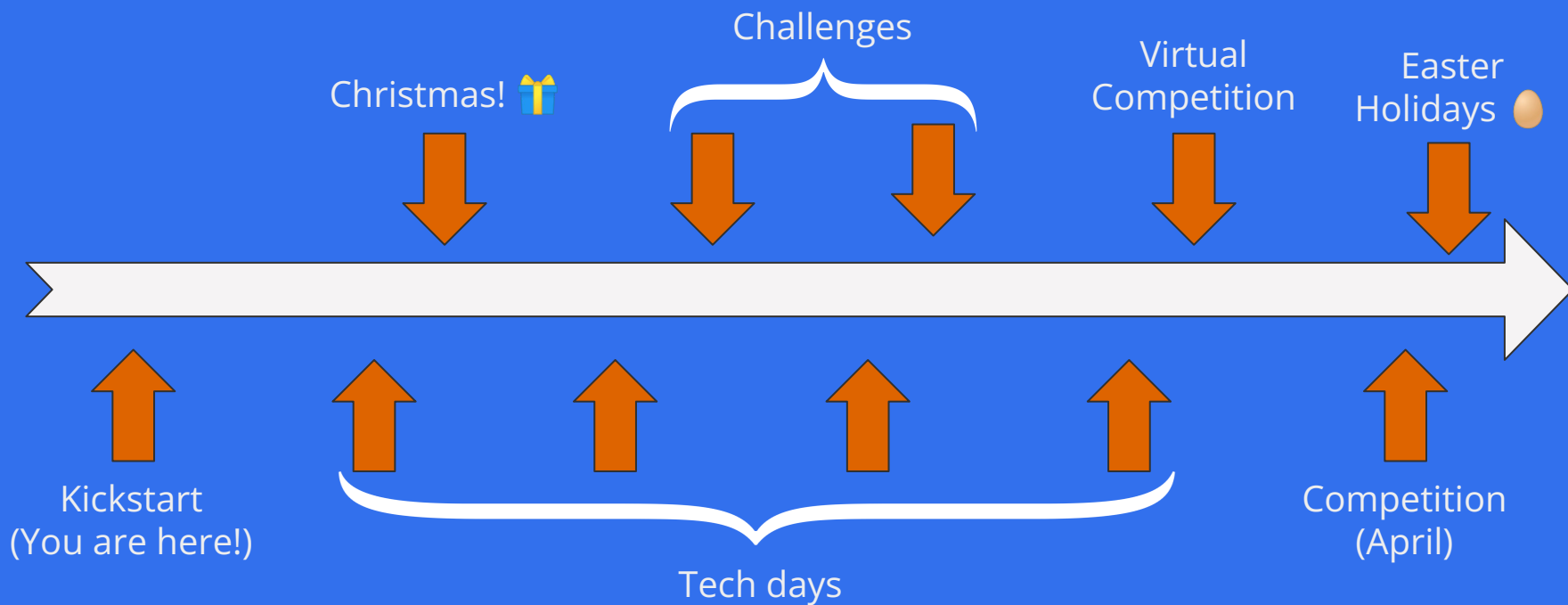








# Schedule for the year



# Tech Days

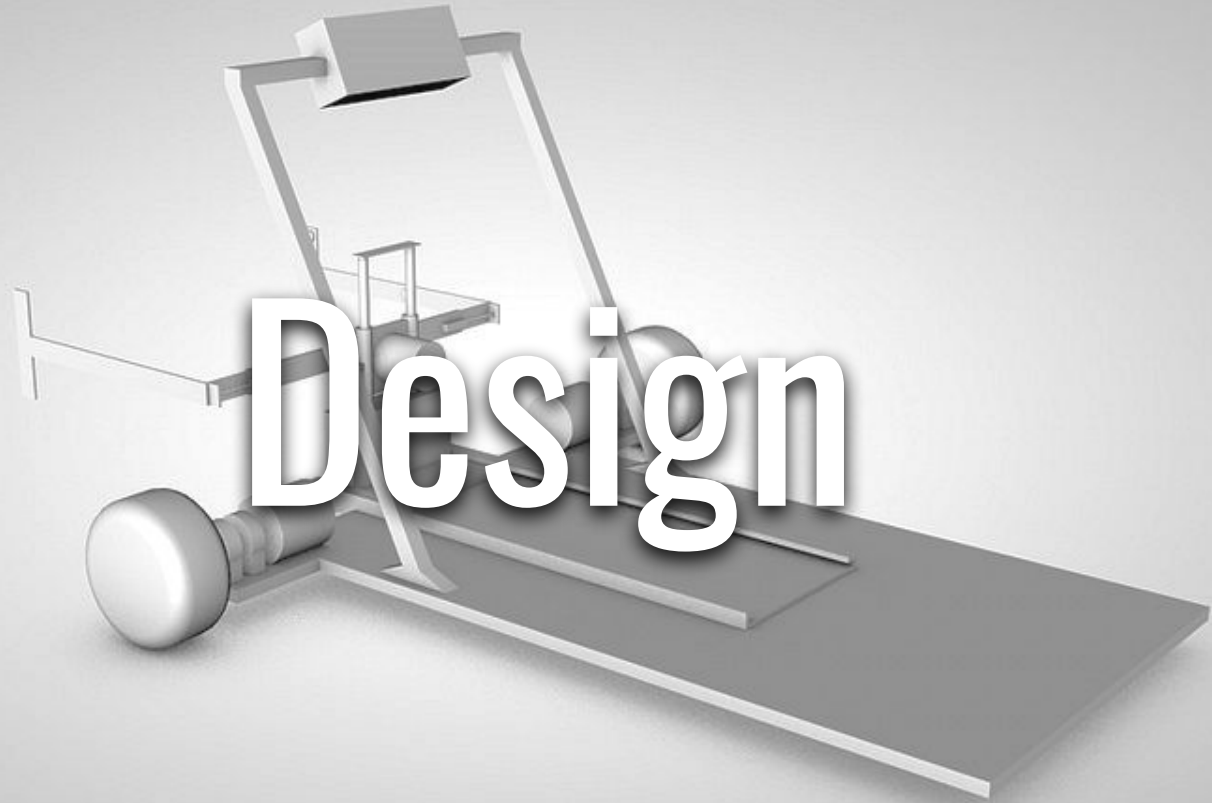
Locations TBC

- 3rd December
- 7th January
- 4th February
- 11th March

# 5 MONTHS

You have **ONLY** 5 months to...





A photograph of a custom-built robot prototype on a wooden board. The robot features a red DC motor, a black servo motor, a blue battery pack, and various electronic components like a microcontroller and sensors. It has two black wheels. The word "Prototype" is overlaid in large white text. The robot is on a light-colored wooden desk with a black bag and a mouse visible in the background.

Prototype

A person wearing a grey t-shirt with a 'Imagine Dragons' graphic is working on a project in a workshop. They are using a power drill on a wooden workbench. The project involves a white metal frame with various electronic components, including a blue battery pack and a blue PCB. A blue screwdriver is visible on the workbench. The word 'Build' is overlaid in large white text in the center of the image.

# Build



A photograph of an open wooden case containing a Raspberry Pi and various electronic components. A breadboard is mounted on top, connected to the Pi and other parts. The wiring is messy and tangled. A blue USB hub is connected to the Pi. A black keyboard is visible on the left and right sides of the case. The text "Do all the electronics (Hopefully better than this)" is overlaid on the image.

**Do all the electronics**  
(Hopefully better than this)

A photograph of two young men sitting at a wooden table in a workshop or classroom, focused on their laptops. The man in the foreground is wearing a dark blue long-sleeved shirt and a blue wristband, with his hands on the keyboard. The man behind him is wearing a blue hoodie, glasses, and a white face mask, also typing. The table is cluttered with various items including a container of colorful pushpins, a power strip, and a coffee cup. In the background, there are other tables, chairs, and equipment, suggesting a busy, collaborative learning environment. The text 'Write lots of code' is overlaid in large white font across the center of the image.

Write lots of code



Test your robot





League scores


1. ...	...
2. ...	...
3. ...	...
4. ...	...
5. ...	...
6. ...	...
7. ...	...
8. ...	...
9. ...	...
10. ...	...

# STUDENT ROBOTICS

## Game Rules

When in a team's scoring zone, correctly oriented cans are worth 3 points, upside down cans are worth one point, and cans lying on their sides are worth nothing. Tin cans on the arena floor start upside down, but those on the raised platform in the centre are already the right way up. Robots can detect a can's orientation by the coloured insulating banding the bottom.

Matches resume at 13:31



# Test it some more





Test it a *bajillion* times



A young man with short, light brown hair, wearing a dark blue hoodie, is seated at a wooden desk in a workshop or classroom. He is leaning forward, focused on writing on a piece of paper with a pen. On the desk in front of him is a black Dell laptop displaying a code editor with syntax-highlighted text. To the right of the laptop is a clear plastic water bottle and a small clear plastic cup. Behind the man is a large, empty blue plastic crate. The background shows other people sitting at desks, suggesting a collaborative learning environment. The text "Work as a team" is overlaid in large, white, sans-serif font across the center of the image.

Work as a team

A group of students are gathered around a table, working on a project. One student is using a laptop, while others are looking at a small robot or device on the table. The scene is brightly lit, suggesting an outdoor or well-lit indoor environment. The text '\* Work as a team' is overlaid in large white font across the center of the image.

**\* Work as a team**



A photograph of a grey tabby cat standing on a carpeted floor, looking at a custom-built robot. The robot is constructed from cardboard and wood, featuring a black top deck with various electronic components like a battery pack and sensors. The cat is leaning in, appearing to inspect the robot. The background shows a wooden table leg and a plain wall.

**Get your robot inspected**



Compete,



An aerial view of a robot competition arena. The arena floor is blue with yellow and red boundary lines. In the center is a white square platform with a black top surface, surrounded by 12 red and white cylindrical markers. Two robots are present: one is positioned at the top center, and another is at the bottom left. The arena is enclosed by a white wall with black and white pixelated patterns. A person's feet are visible at the top edge. A computer monitor is partially visible in the bottom foreground.

Compete some more,



Compete *even* more!





Meet other robots



# Meet other people





A blue carpeted arena with white and red lines. A robot is visible on the right side, and a yellow cube is in the bottom left corner. The text "Score some points" is overlaid in the center.

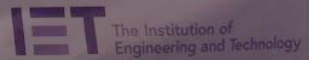
Score some points



# Win some prizes

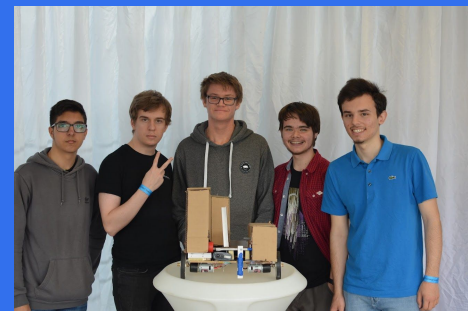
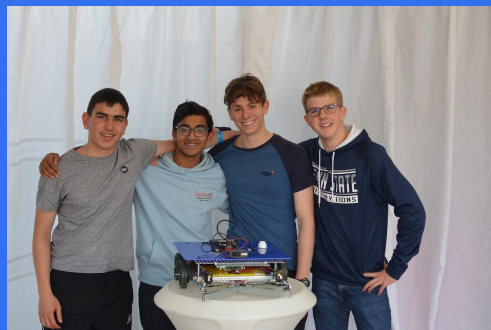
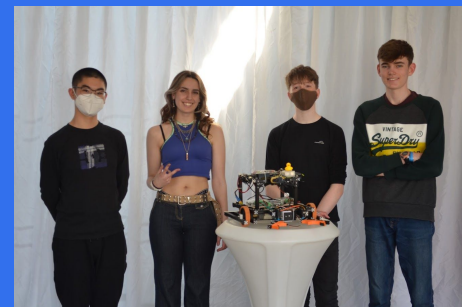


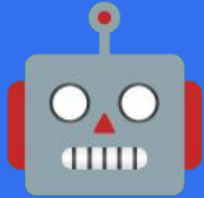
## STUDENT ROBOTICS



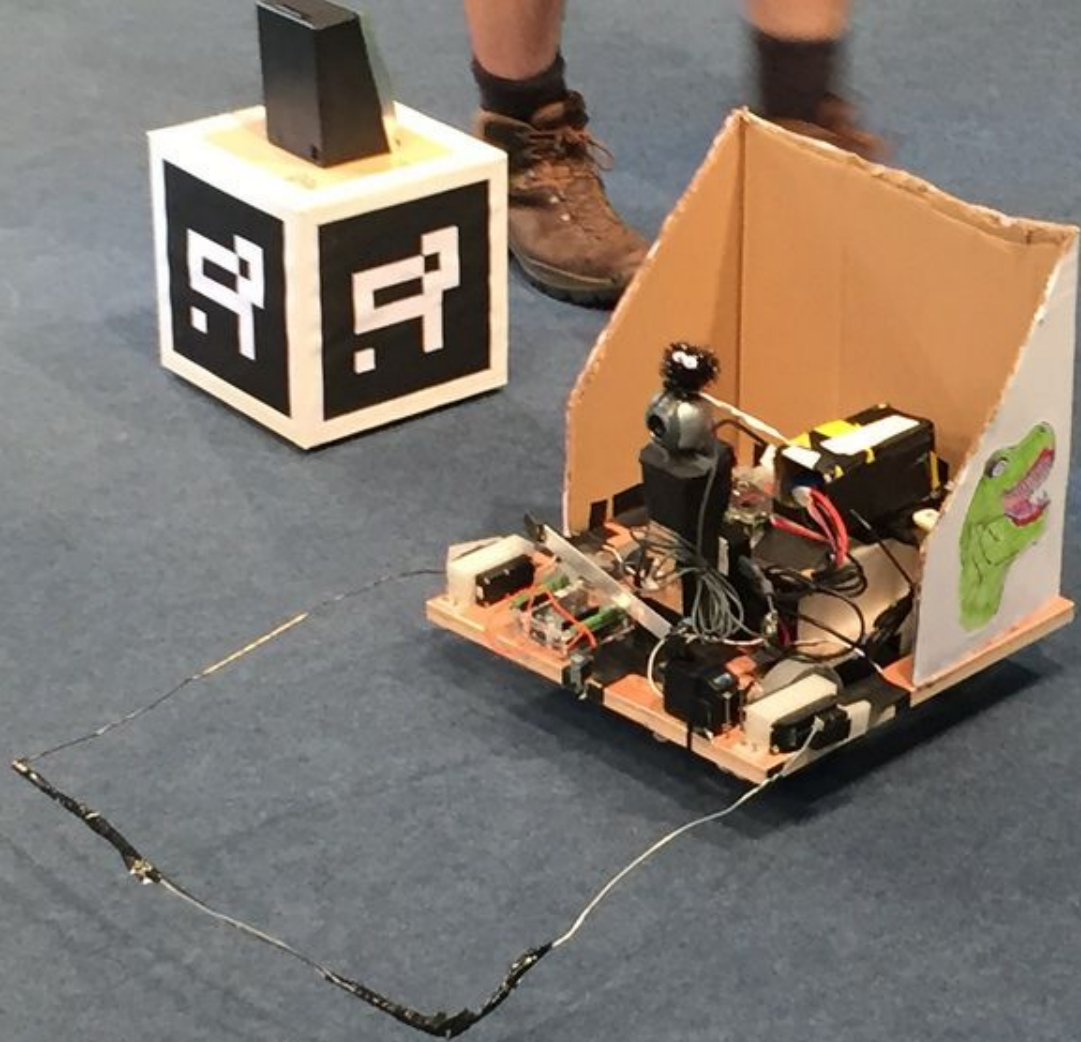


# Have fun!



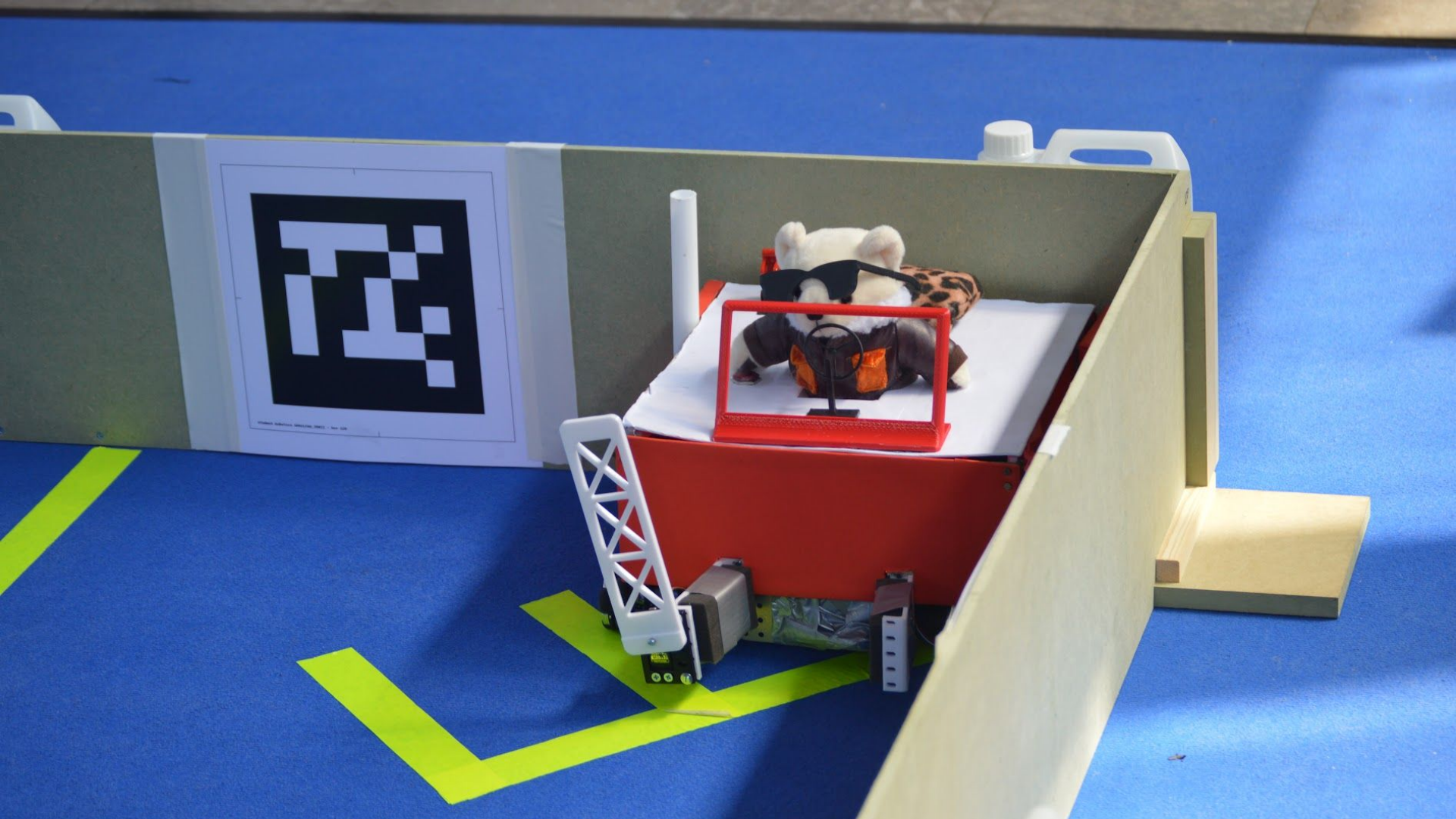
What does a  look like?

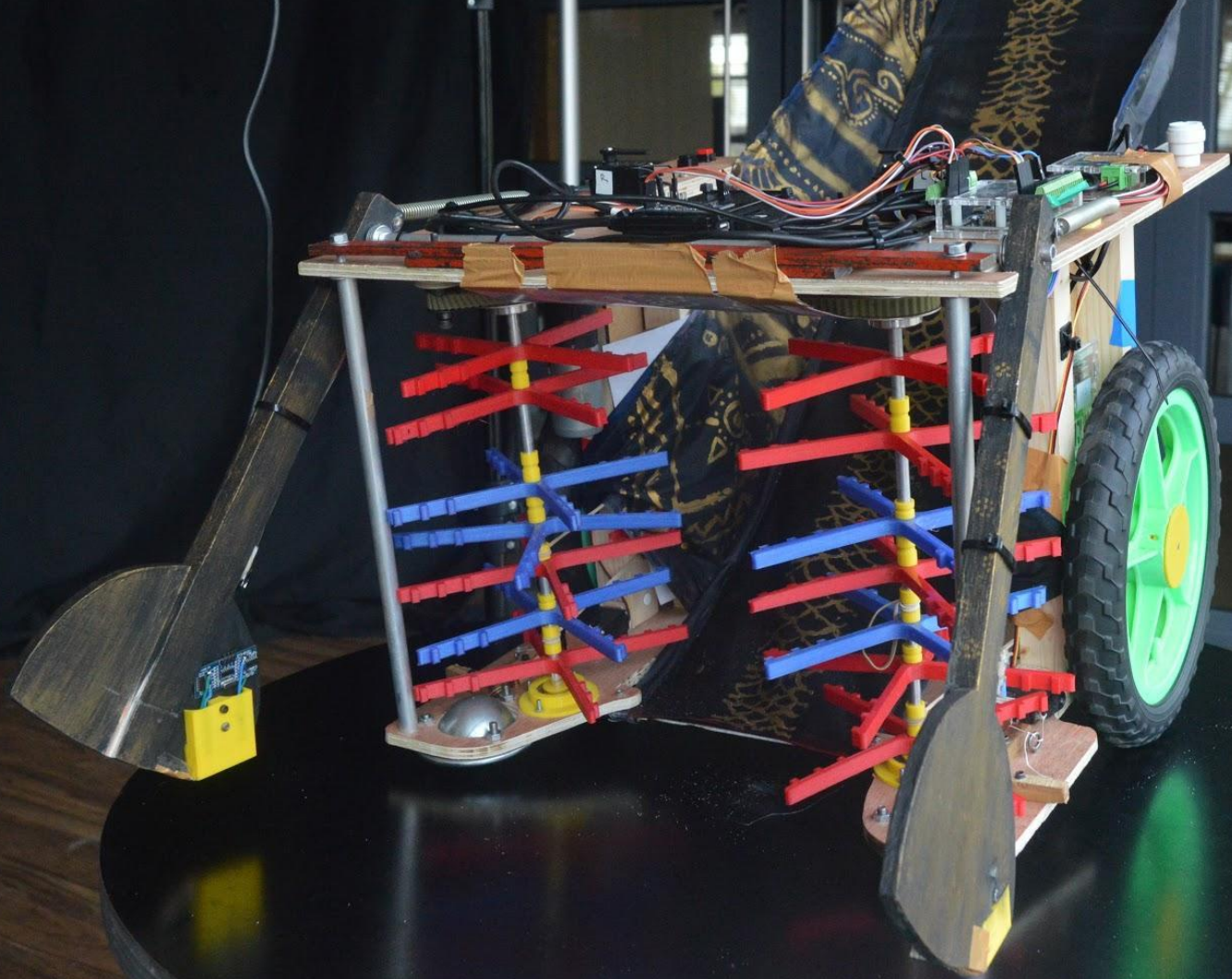




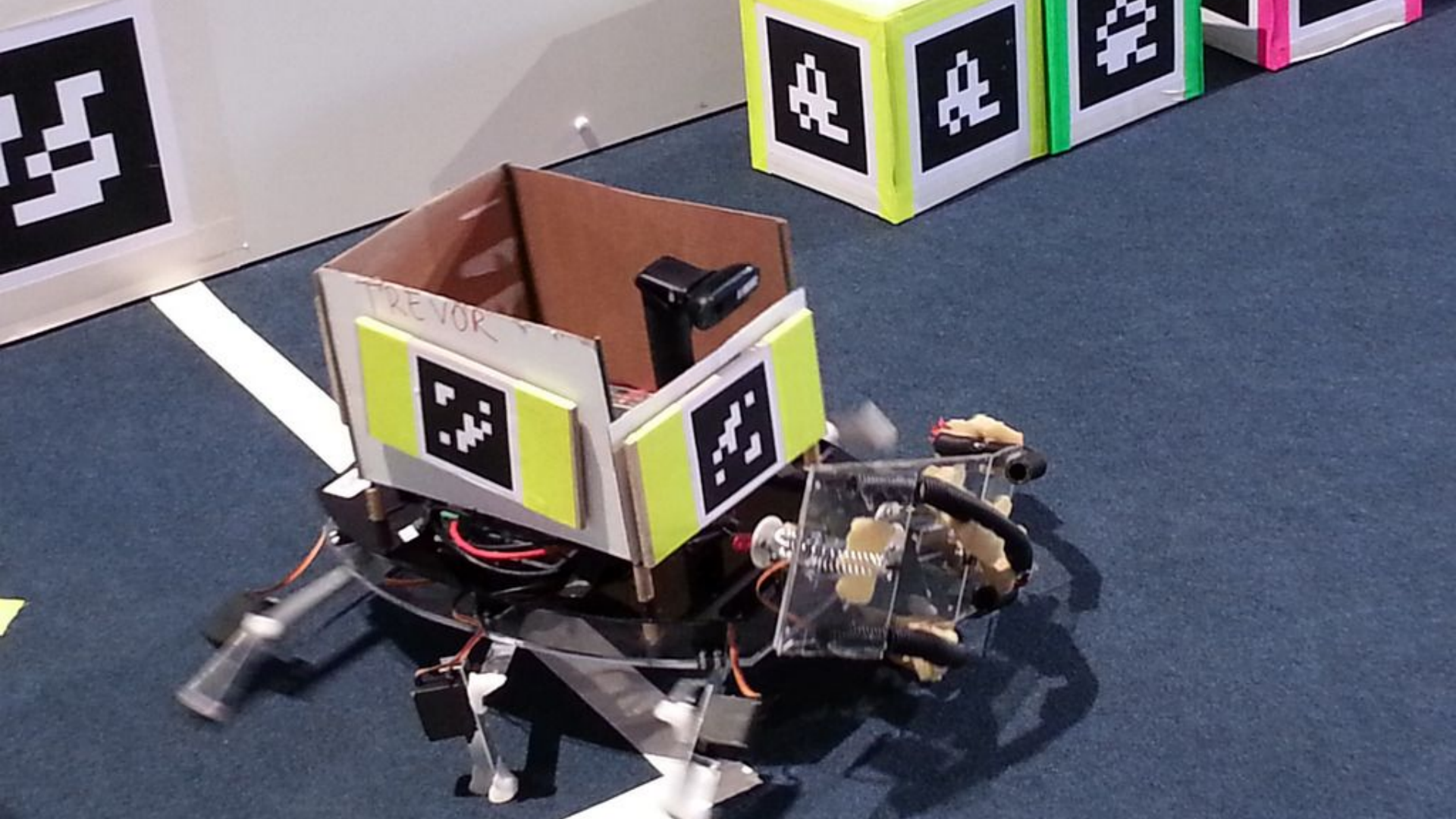




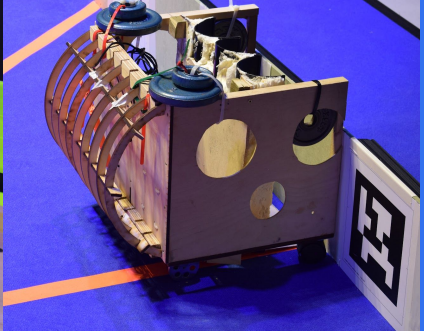
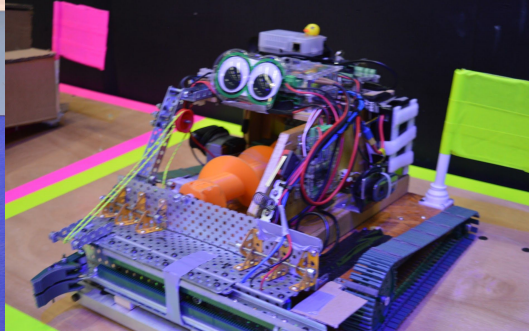
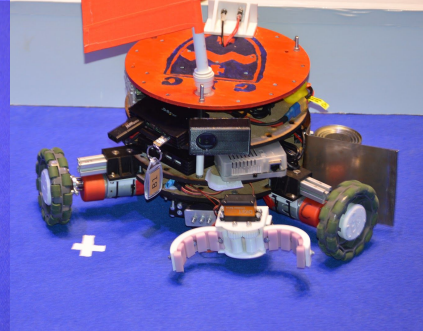
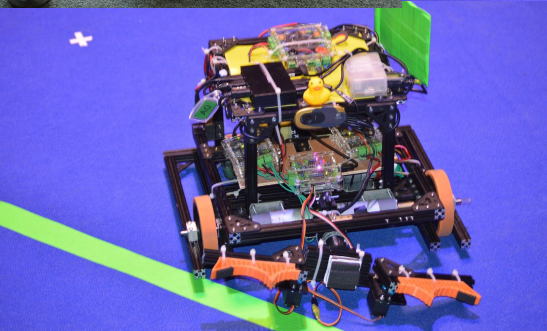
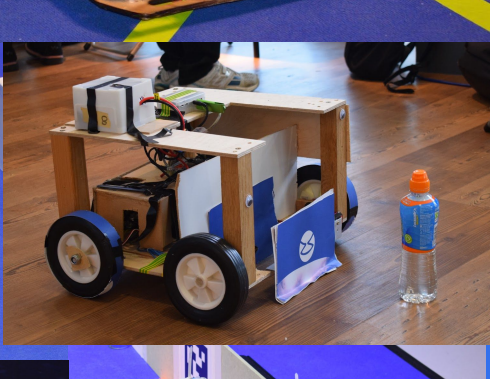
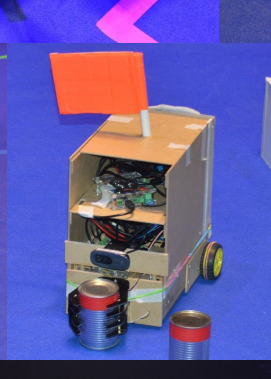
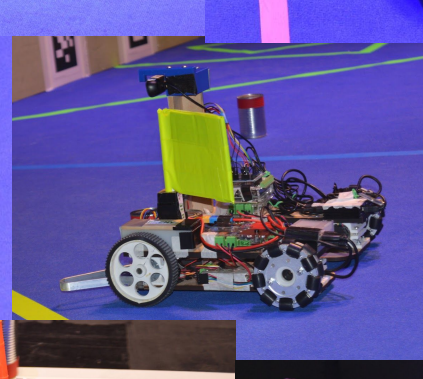
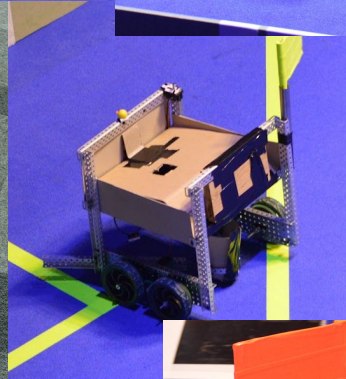
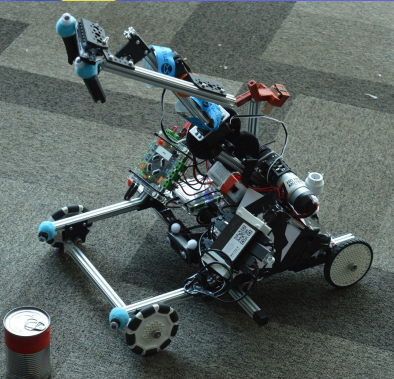
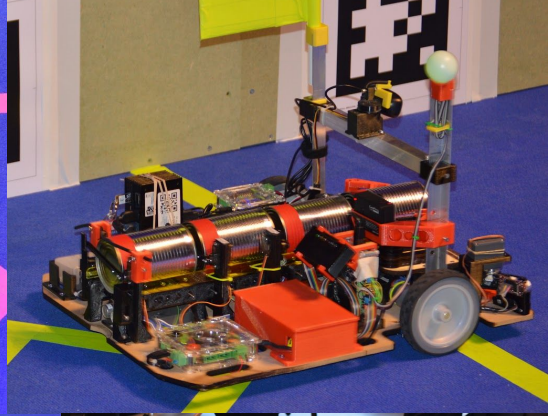
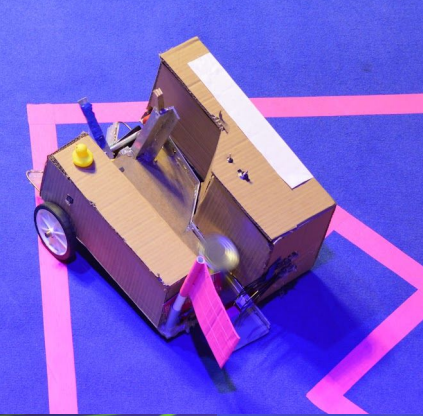
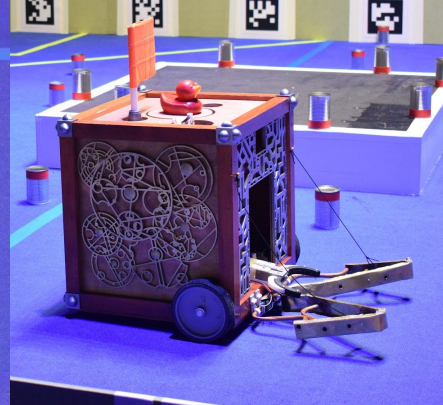
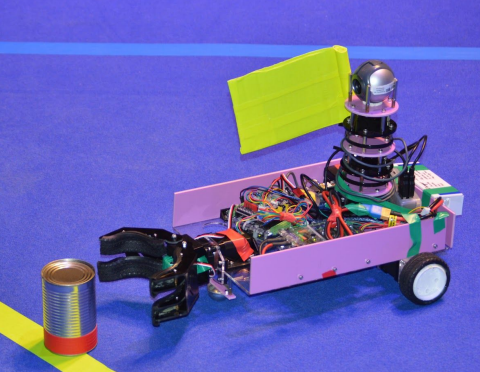












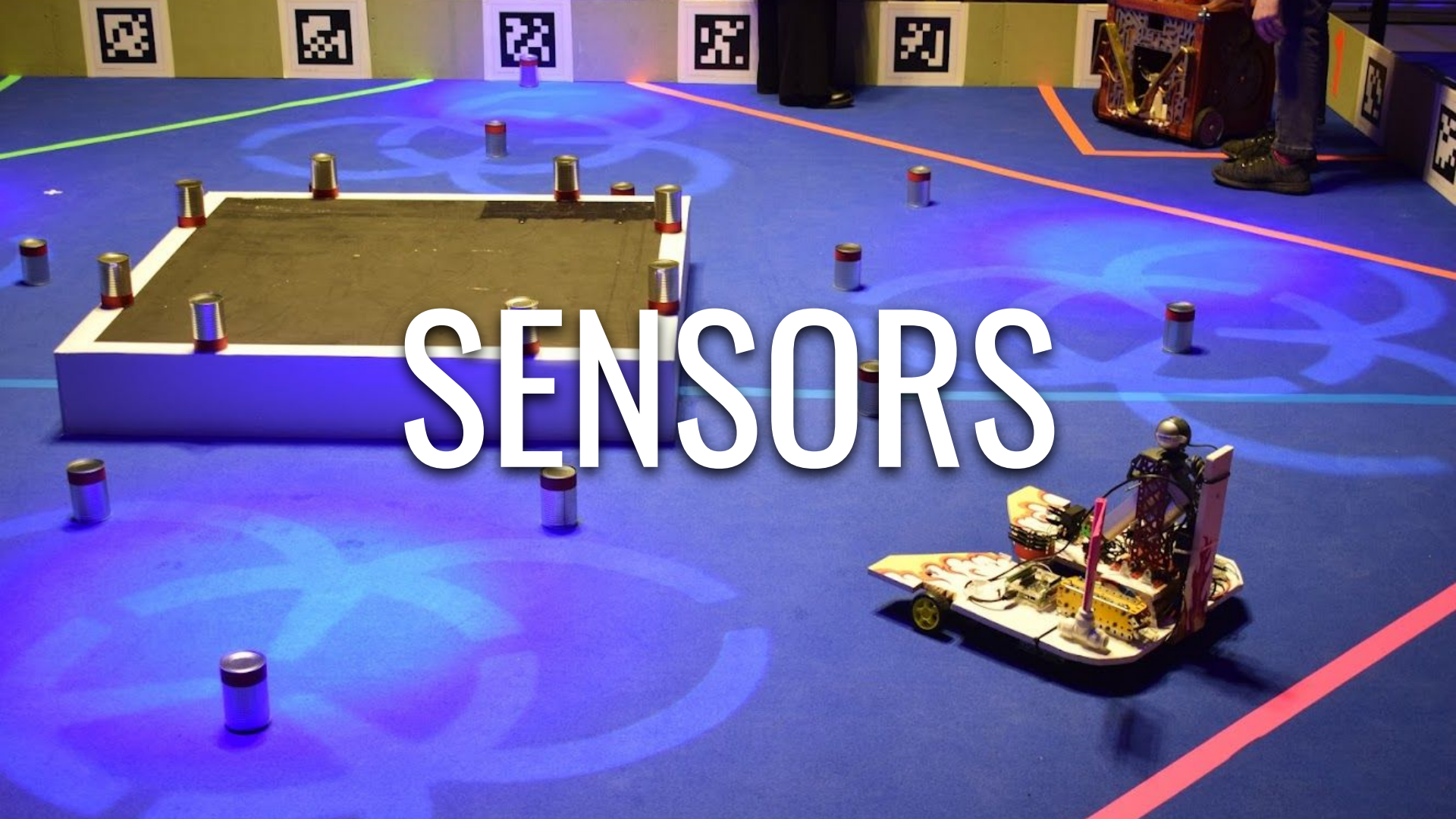




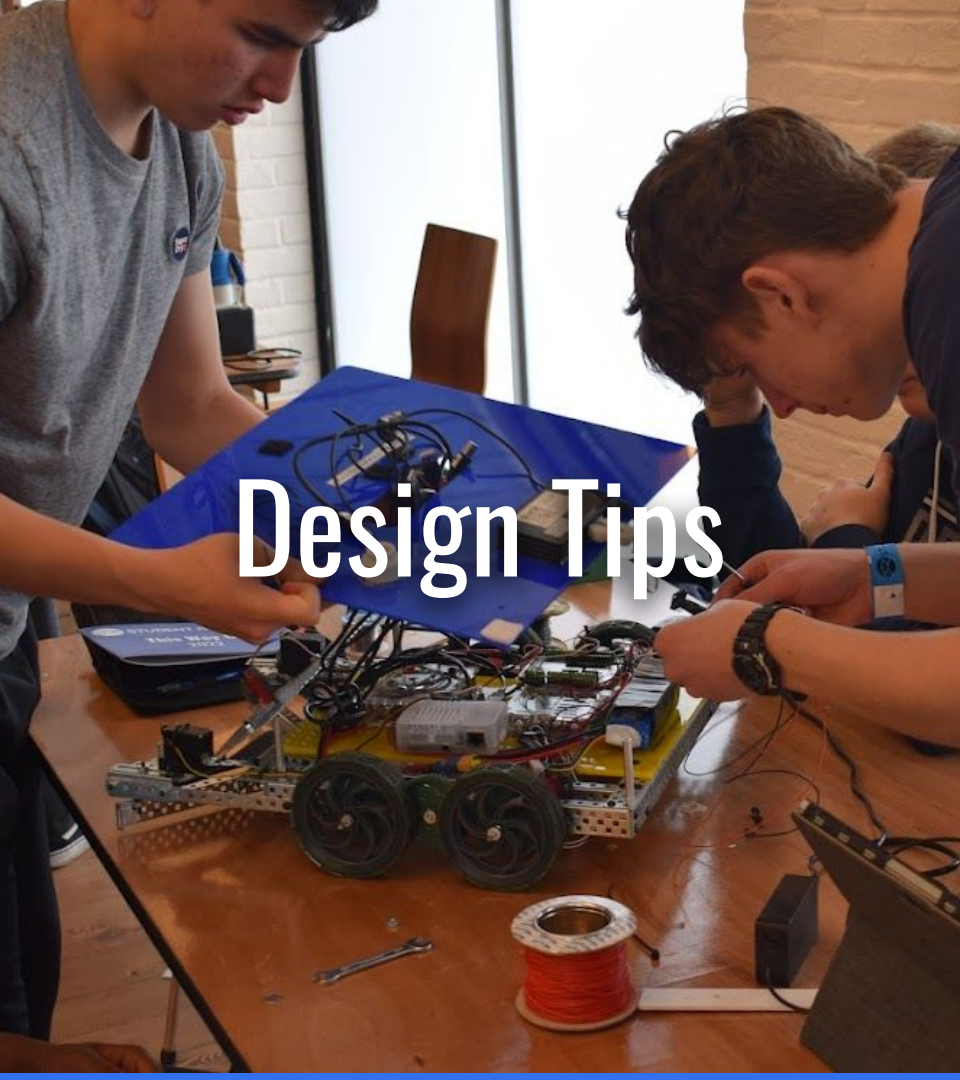
# Design Tips

- **Read the rules!**
- Movement
- Exposed Mechanisms
- Servos
- Couplings
- Size
- Tooling
- Sensors

# SENSORS







# Design Tips

## Electronics

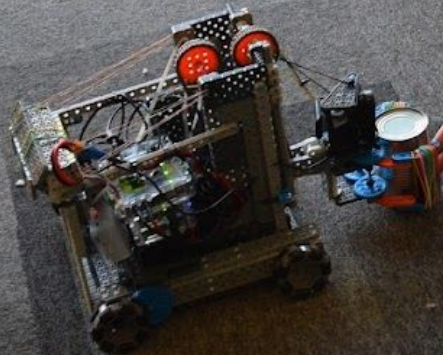
- Where do your electronics go?
- How long should the wires be?
- Start/Stop button needs to be accessible
- USB stick(s) needs to be accessible
- Battery needs protecting

# Recommended Steps

1. Make a test base ASAP
2. Think about
  - Mechanics
  - Sensors
  - Game strategy
3. Iterate
  - Small improvements
  - Keep it working
4. Testing, lots and lots of testing



# TESTING





# THE KIT





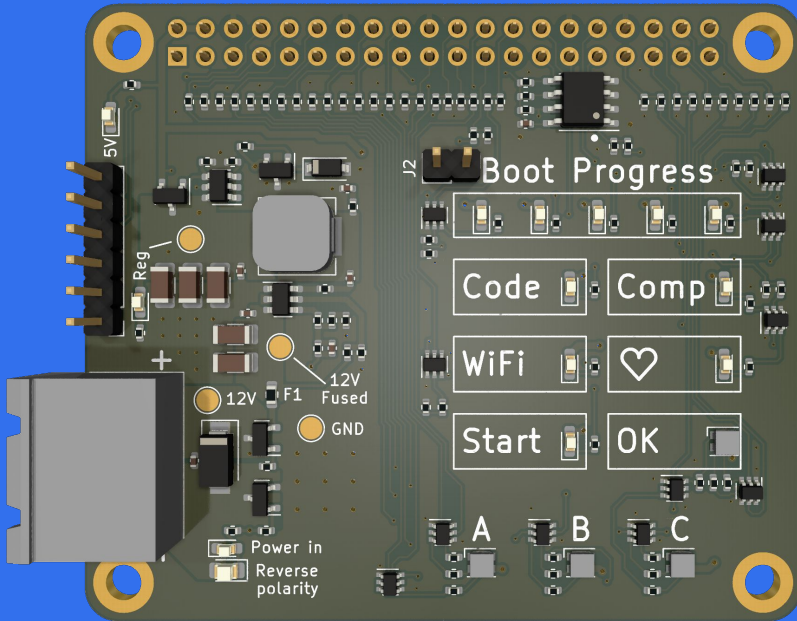
# Brain Board



*The brains of the operation*

- Controls boards
- Code runs here
- Raspberry Pi 4 with a KCH

# KCH

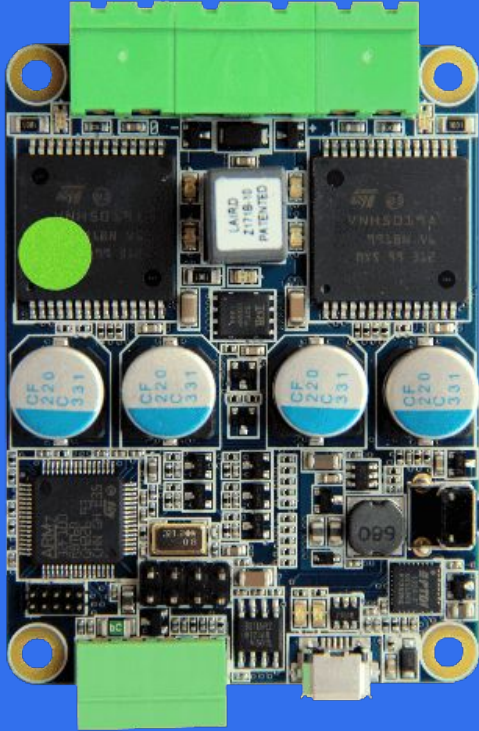


## *Custom Raspberry Pi Hat*

- Powers the Pi
- Status LEDs
- Controllable RGB LEDs



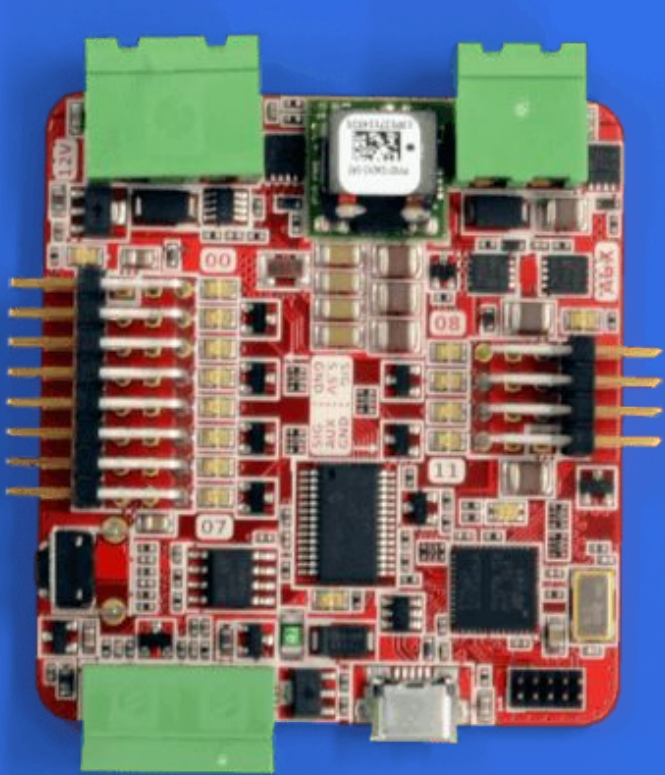
# Motor Board



*Controls motors*

- **12V DC** motors, up to **10A**
- \* motors not included

# Servo Board

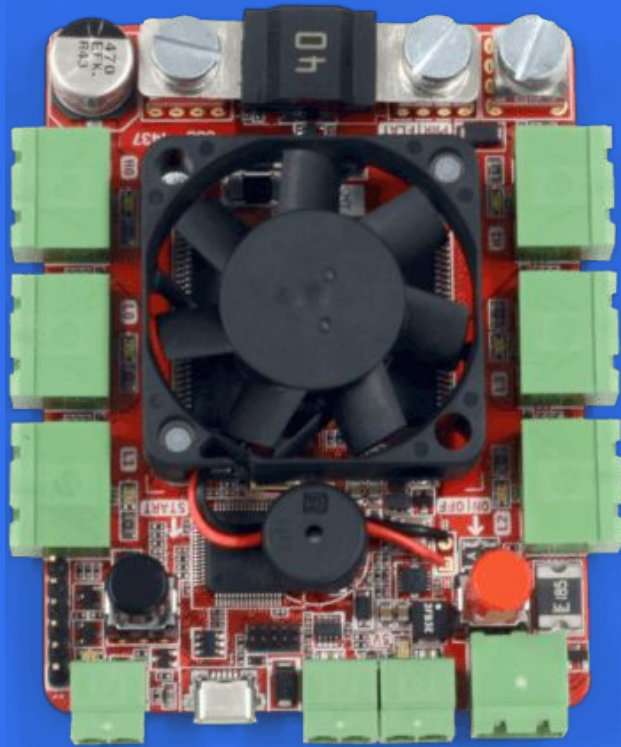


*Controls servos*

- Up to 12 RC servo motors
- Careful how you load them, though!
- \*servos not included



# Power Board



*POOOWWWWEEEEERRRR!*

- Power distribution
  - High-current 12V
  - Low-current 12V
  - 5V
- On | Off button
- Start button
- Buzzer

# Ruggeduino



## *General Purpose IO*

- Bump switches (Have I hit something?)
- Pressure sensors (How hard have I hit it?)
- Light gates (Have I captured something?)
- Ultrasound (How far away is something?)
- \* sensors not included

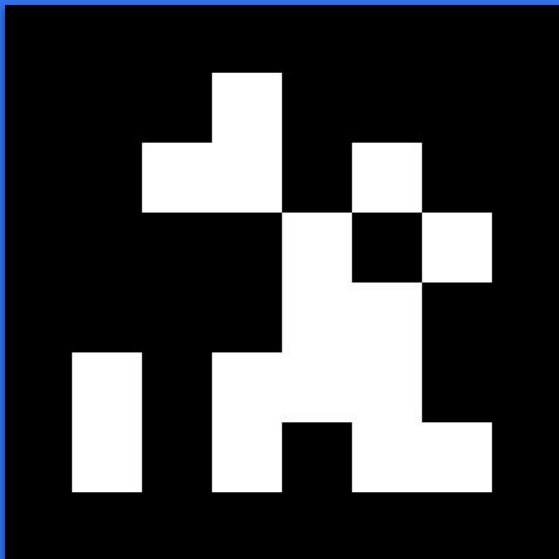


# Batteries



- Should be respected
- Follow battery charging procedure to the letter, every time (one of the microgames)
- Only ever connect to:
  - power board
  - supplied battery charger
- Protect it from mechanical damage
- Do not over-discharge
- If you're unsure, **read the docs!**

# Vision



- On Arena walls and props
- Properties:
  - Type
  - ID
  - Distance from webcam
  - Position relative to webcam
  - Orientation

OVERLOADING THIS BOX MAY BE A HEALTH & SAFETY HAZARD  
BOX WEIGHT MUST NOT EXCEED 15kg

WARNING!  
THIS BOX IS HEAVY  
WHEN FULL

WATERCOOLERS

PLAYROOM

# YOUR CODE





# Your Code

- Python 3.10
- `from sr.robot3 import *`
- Local Development
  - Backups!
  - Distributed team
- `robot.py`

# Web Interface

```
0:00:00 ---
0:00:00 Student Robotics OS 2023.0.0
0:00:00 Is there something you'd like us to add to the kit or API? 💡
0:00:00 Perhaps there's something you think we should improve? 🛠️
0:00:00 Let us know your feedback about your experience using our kit at https://studentrobotics.org/kit-feedback 🗨️
0:00:00 ---
0:00:00 === LOG STARTED ===
0:00:00.153497 I see 3 markers
0:00:00.426560 Turning left
0:00:01.027335 Moving towards marker
```

- WiFi
- Live logs
- 1-click start
- 1-click *restart*

# DOCUMENTATION

## Introduction

### Kits

- Assembly
- Batteries
  - HKE4 Charger
  - IMAX B6 Charger
- Brain Board
  - Updates
- Motor Board
- Power Board
- Ruggedulino
- Servo Board
- Safety Regulations

### Programming

- Getting Code on the Robot
- Python
  - Functions
  - Libraries
- sr
  - API Quick Reference
  - LEDs
  - Motors
  - Power
  - Ruggedulinos
    - Custom Firmware
  - Servos
  - Vision
    - Markers
- Code Editors
  - PyCharm
  - Visual Studio Code

### Rules

- Game Rules Archive

### Simulator

- Programming

### Troubleshooting

- Python
- Interactive Troubleshooter

### Tutorials

- Basic Motor Control
- Microgames
- Python

### Team Admin

- Discord Server

## INTRODUCTION

There are a number of sections in the documentation, offering help for the [kit](#) and [programming](#). Under the [tutorials](#) section, a number of these things are combined to help you understand what you can, or need, to do. Navigation of the documentation can be done using the column to the left, where everything is arranged alphabetically in the aforementioned sub-sections.

Within this documentation, you will come across a number of boxes like this:

```
# code example
```

These are code examples provided to help you.

From time to time, you may come across some warnings such as the following:

**Charge Your Batteries!**

It would be advisable to take note of these, especially that one! You will also come across some blue boxes providing information, similar to the following:

Some useful information... like the information given in the information box above.

# Read The Docs!

[srobo.org/docs](https://srobo.org/docs)



# Discord

- Communicate with us and your fellow teams
- Get support
- Share tricks
- Brag about how good your team is!



# Health and Safety

- How easy is it to turn off
- If we pick it up, can it hurt us?
- Is the wiring messy or loose?
  - Colour code your wiring!
- Is the kit loose?
- Is the battery protected?
- Is the power button accessible?



# Support

Need some help?

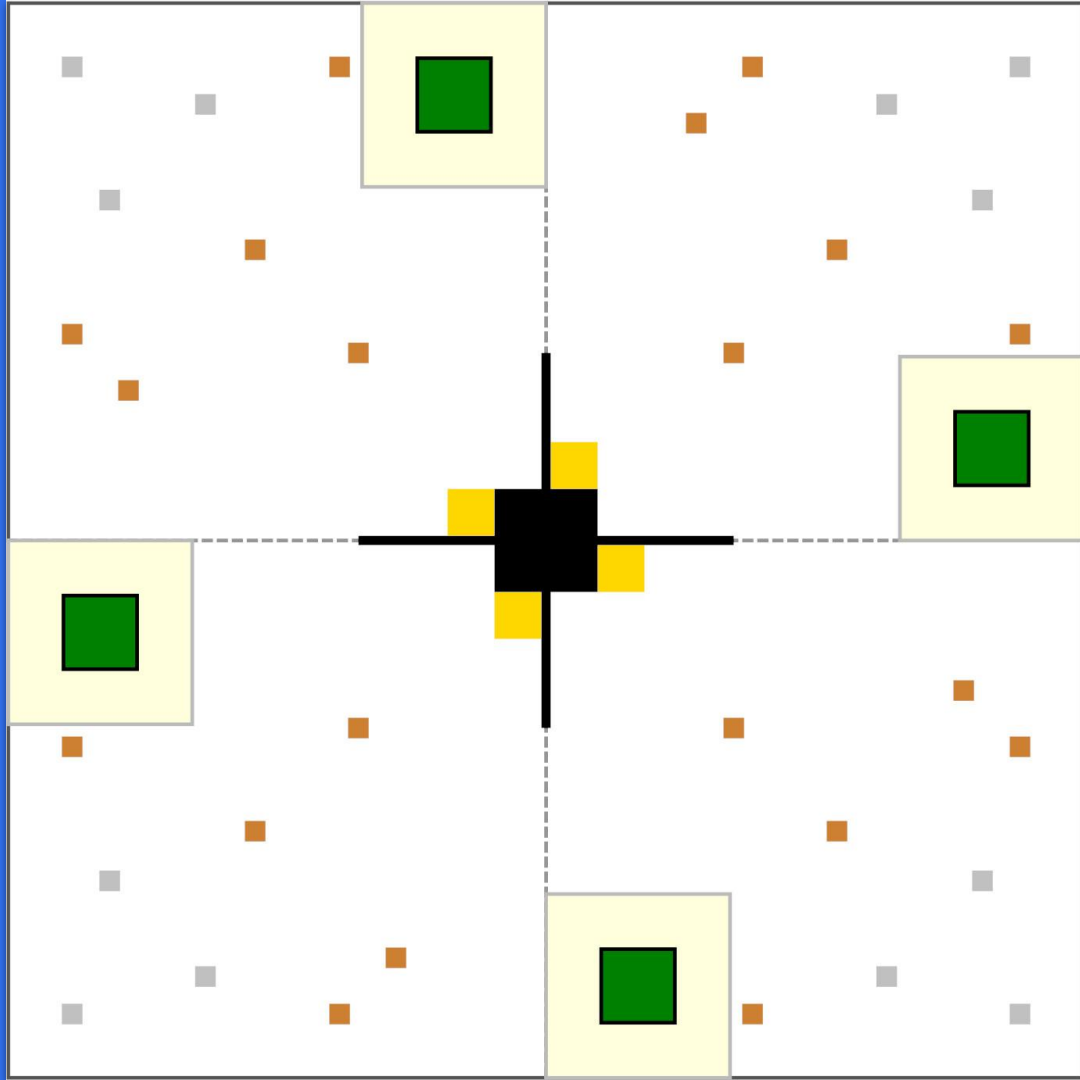
- Volunteers
- Tech Days
- Discord
- Team Supervisors
- Sharing knowledge
- Keep it simple
- Prototype early, and often



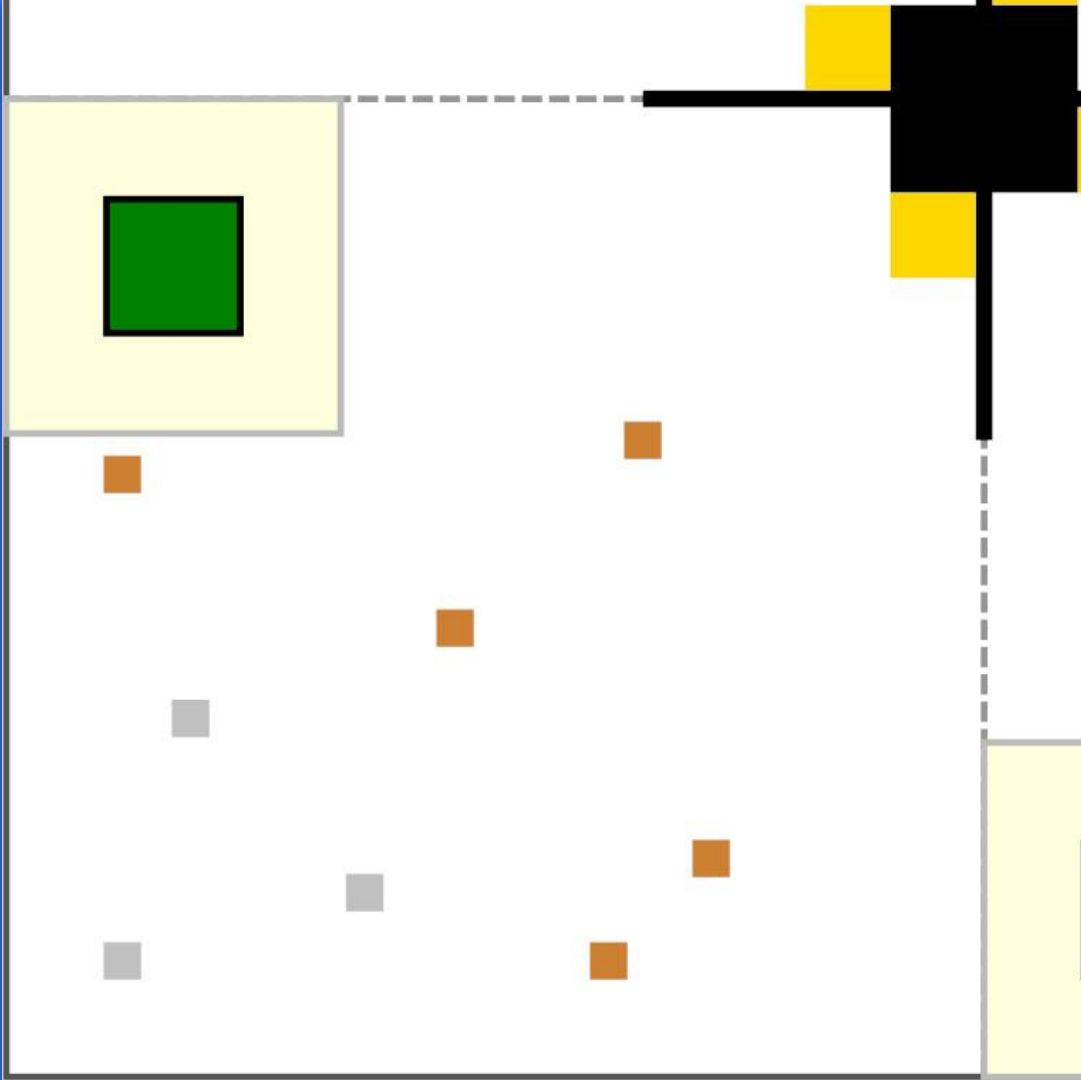
# THE GAME?

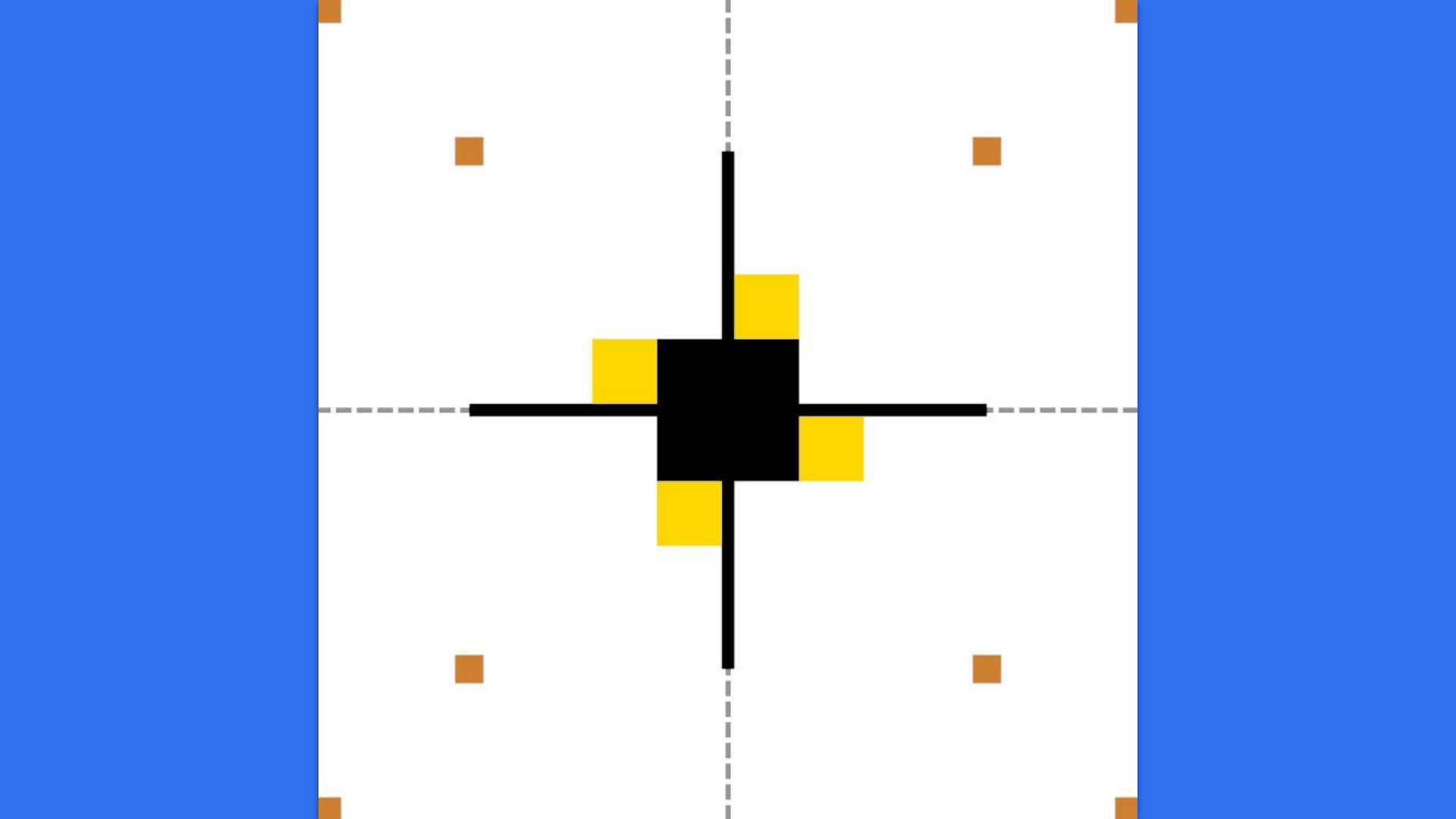
The moment you've all been waiting for!

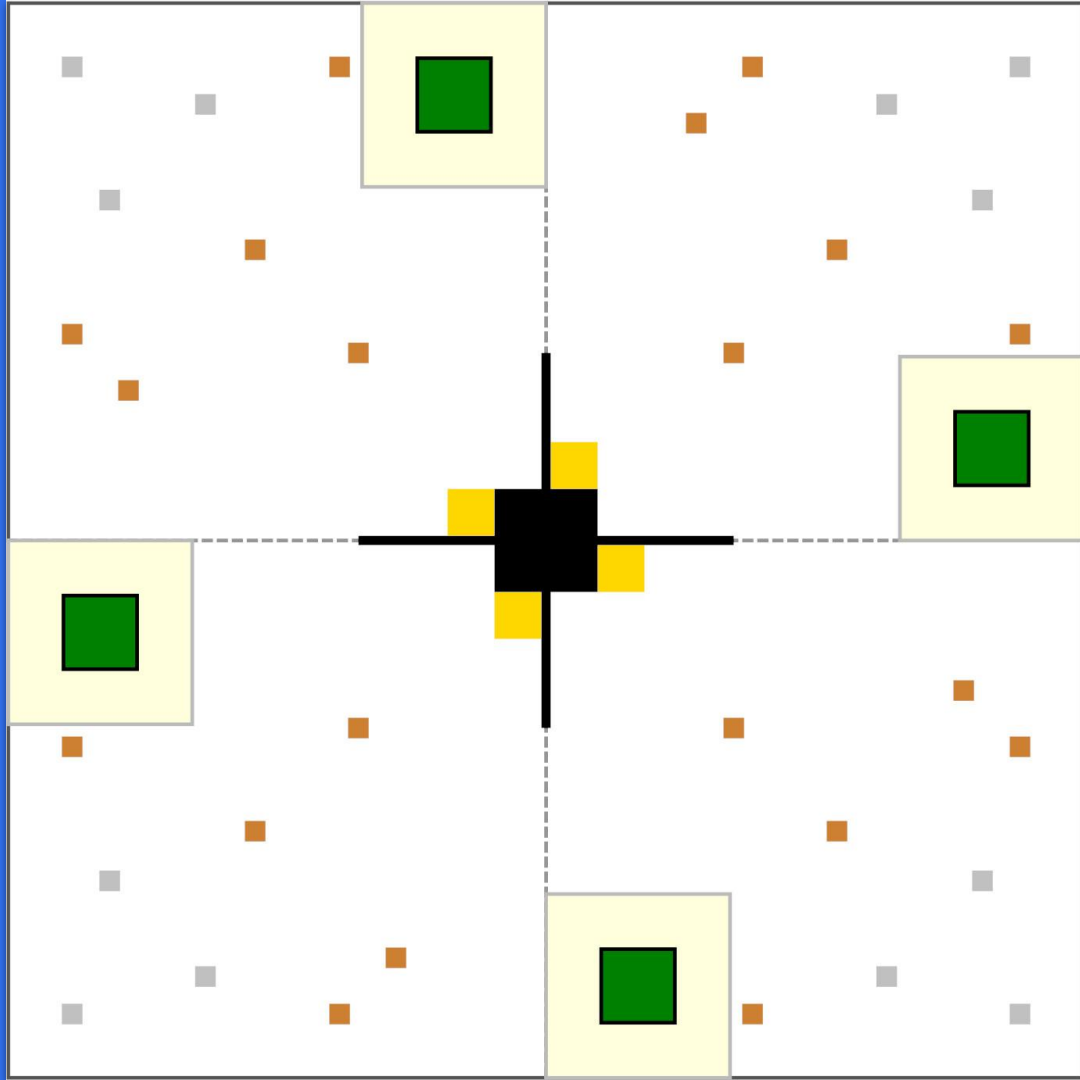
Greed









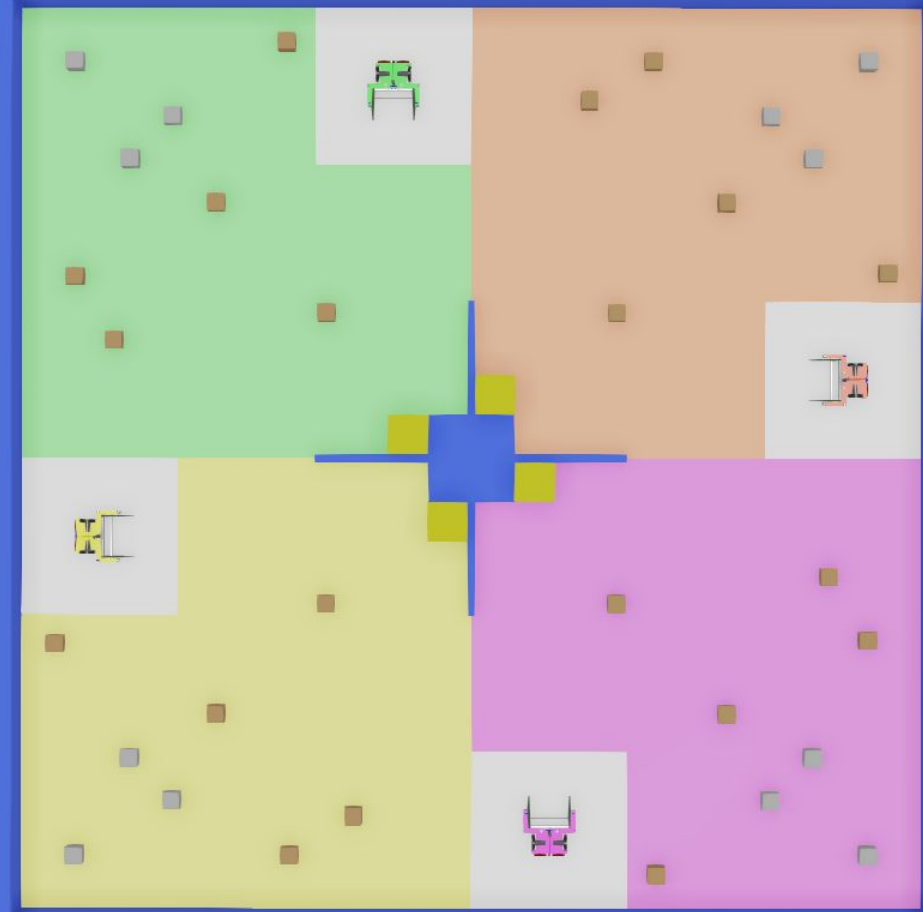




# Competition

1. Challenges
2. Virtual League
3. League
4. Knockouts

# Virtual Competition



# CHALLENGES

A large indoor arena, possibly a convention hall, is illuminated with blue and purple light. The floor is marked with green and red laser lines forming a complex pattern. A small robot is visible in the center of the arena. Spectators are seated on a raised platform around the arena, and staff members in high-visibility vests are present. The word "CHALLENGES" is overlaid in large white letters across the center of the image.





# Challenges

- Movement
- Sensor
- Vision



# Challenge Submission Dates

- January 7th
- February 4th

# PRIZES



STUDENT ROBOTICS



**First** Place

Second Place

**Third** Place

Obviously!

# Rookie Award

Highest placed rookie in the league

# Robot and Team Image

For those robots who are looking *sharp*!



# Online Presence

For those teams who are active online

#srobo2023

# Committee Award

For ingenuity & elegance in robot design

# Challenges

Complete all challenges first



# The Rules

Read them!

They're **very** helpful!

## THIS WAY UP

### TABLE OF CONTENTS

1. [Game Rules](#)
2. [Regulations](#)
3. [Specifications](#)
4. [Competition Structure](#)
5. [Awards](#)
6. [Revisions](#)

### GAME RULES

1. The objective of the game, called **This Way Up**, is to capture the most correctly-oriented cans.
2. Before a match begins, participating teams must:
  - Present their robot in the staging area, adjacent to the arena, before the scheduled close of staging time. The staging area will be clearly marked on the day.
  - Attach a **robot flag**. Robot flags will be provided by Student Robotics officials in the staging area.
  - Place their robot in the starting area that they are assigned. The robot must be placed such that it is entirely within this starting area, with no parts overhanging its boundary. Its orientation does not matter.
  - Vacate the arena 40 seconds before the scheduled start time. During the 40 second period prior to the start of the match there must be no interaction with the robot.
  - Follow the directions of the match officials.Teams that fail to comply with these rules—such as by arriving late—may forfeit the match, at the discretion of the judge.
3. The game is played between **four** robots.
4. Each match lasts for **150** seconds.
5. Robots will be started by, or at the direction of, match officials.
6. There are 28 cans in the arena at the start of each match.
7. Cans on the arena floor start upside-down. Cans on the raised platform start in the correct orientation.
8. Each can in a teams' scoring zone is worth:
  - 0 game points if it is on its rolling edge,
  - 1 game point if it is upside down,
  - 3 game points if it is the correct way up.
9. A can is "in" a scoring zone if either:
  - any part of it is in contact with the floor in the zone,
  - the can is in contact only with other cans which are in the zone.
10. There is a bonus point available for a robot fully leaving its scoring zone for the first time in a game.
11. Robots start inside their scoring zone.
12. At the end of the match the robot with the most points wins.
13. The arena is a square of the design specified in [the specifications section](#).
14. A match may be terminated prematurely if all teams participating in that match state to the match officials that they are happy for the game to end.

# Microgames

- Get familiar with your kit through a series of challenges
- Kit part (for those with kits)
- Simulator part
- Found in the docs
- Team supervisors have the answers
  - As do we on Discord

# THE REST OF TODAY

NOW	Kickstart Presentation
NEXT	Kit handout
THEN	Micro Games
12:30 - 13:00	Lunch + Robot Brainstorming
13:00 - 17:00	Micro Games (Continued)





Any Questions?





**GOOD LUCK!**



**@studentrobotics**



**@student\_robotics**



**@studentrobotics**



**@studentrobotics**