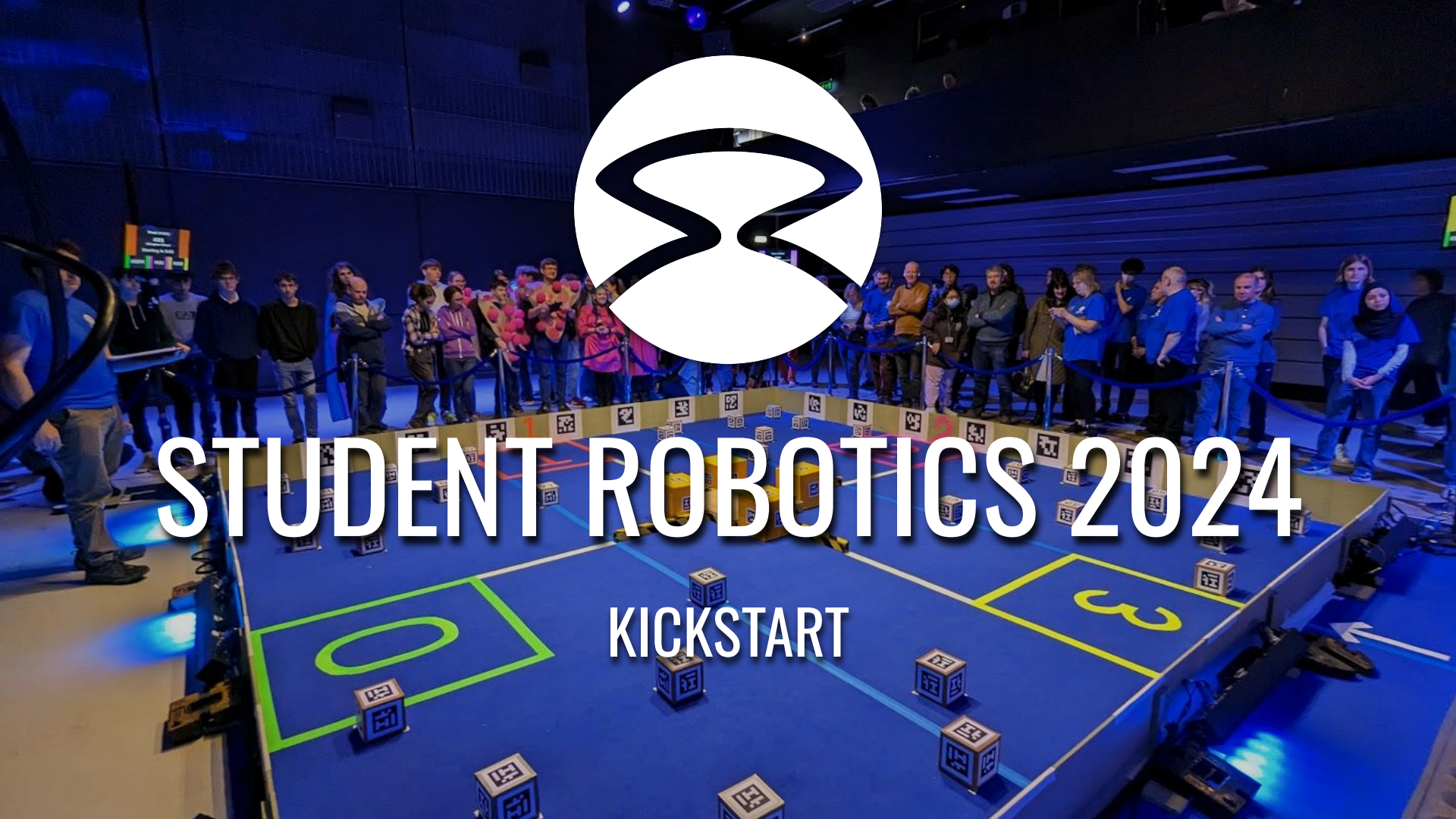




STUDENT ROBOTICS 2024

KICKSTART





KICKSTART 2024

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

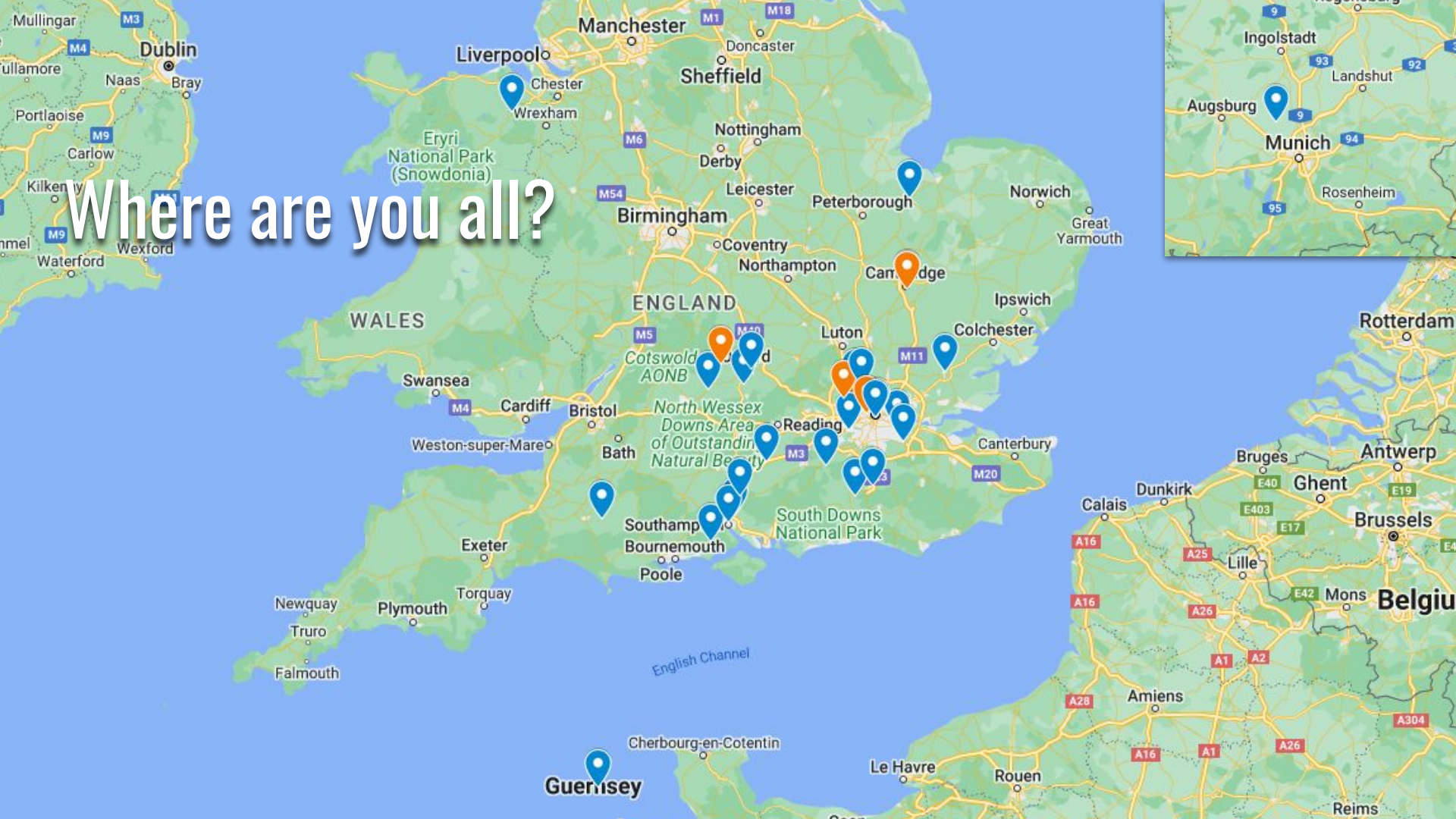
We're here to help!





The Teams

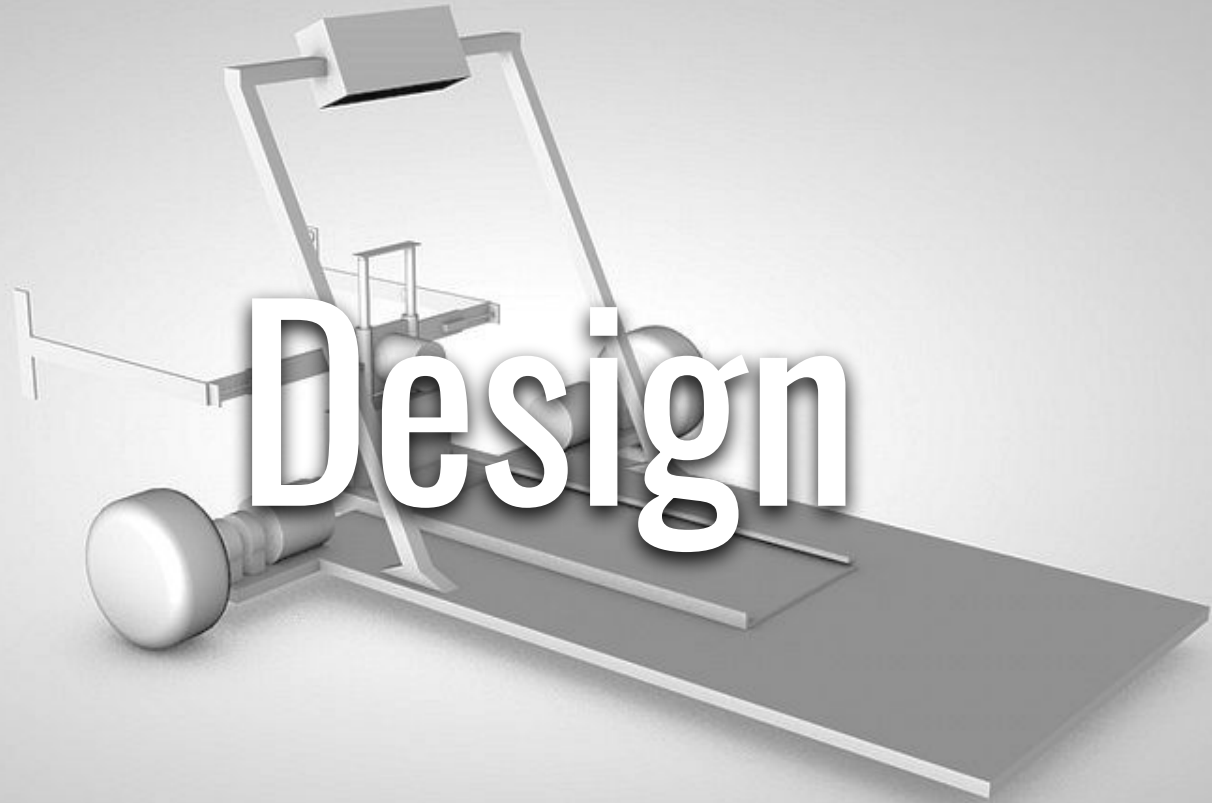
Where are you all?





5 MONTHS

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

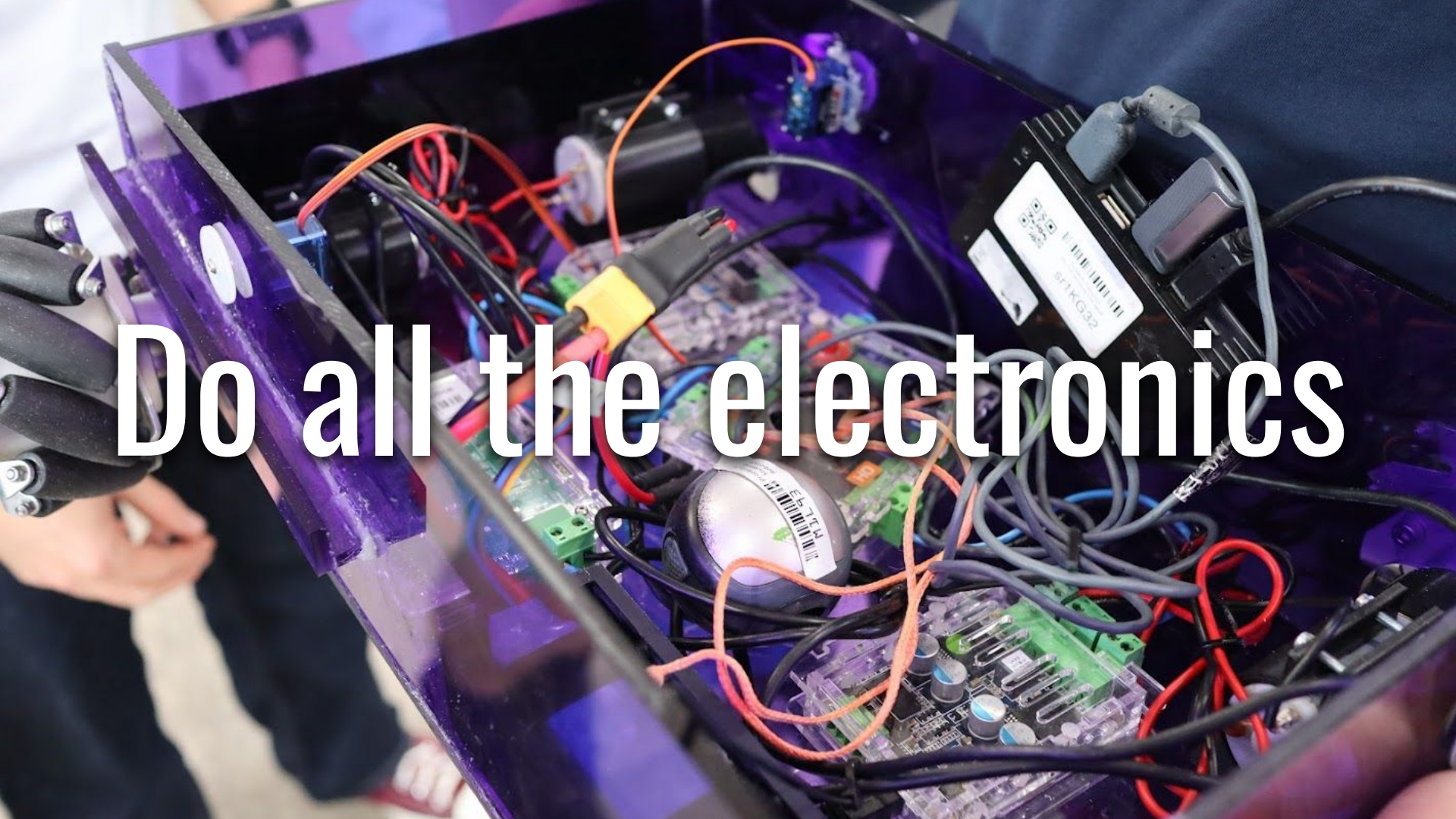


A photograph of a custom-built robot prototype on a wooden board. The robot features a red DC motor, a black servo motor, a blue battery pack, and various electronic components like a microcontroller and sensors. Wires connect the components, and two black wheels are visible. The word "Prototype" is overlaid in large white text.

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 a clear acrylic top panel. Inside the frame, there is a blue printed circuit board (PCB) with various electronic components, including a microcontroller, resistors, and a battery. A blue battery pack is also visible on the workbench. The background shows a typical workshop environment with a green table and various tools.

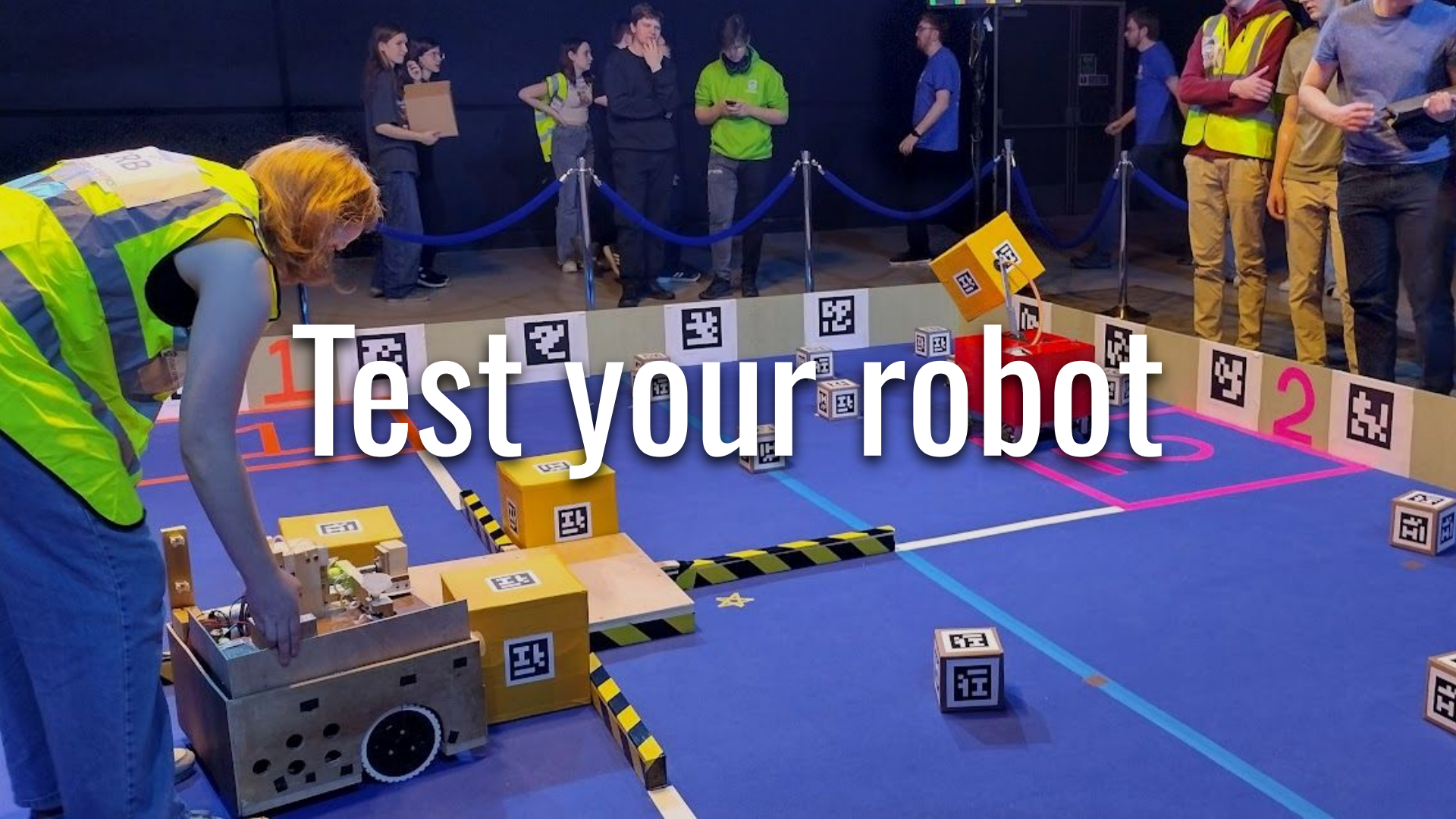
Build



Do all the electronics

A photograph of two young men sitting at a wooden table in a workshop or classroom, focused on their laptops. The student in the foreground is wearing a dark blue long-sleeved shirt and a blue wristband, with his hands on the keyboard. The student behind him is wearing a blue hoodie, glasses, and a white face mask, also typing. The table is cluttered with various items including a power strip, cables, a container of colorful pushpins, and a laptop. In the background, there are other tables, chairs, and equipment, suggesting a busy, hands-on 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



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 looking down at a piece of paper on the desk, holding a pen in his right hand. On the desk in front of him is a black Dell laptop displaying a code editor with lines of text. To the right of the laptop is a clear plastic water bottle and a black and white checkered patterned box. Behind the man is a large 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 font across the center of the image.

Work as a team

A group of students are gathered around a table in a classroom, working on a robot. One student is using a laptop, while others are looking at the robot or talking to each other. The robot is on a metal frame with various components attached. The text '* Work as a team' is overlaid on the image in a large, white, sans-serif font.

*** Work as a team**

A person wearing a red hoodie is kneeling on a green carpeted floor, focused on working on a robot housed within a cardboard box. The robot's internal components, including a motor and various wires, are visible. In the foreground, a wooden frame stands on the floor; a horizontal beam of the frame has a QR code and the text "CUBE OF JUDGEMENT" printed on it. Several other people are standing around, observing the work. The scene appears to be a workshop or a competition event.

Get your robot inspected

A young man in a yellow safety vest is crouching next to a robot in a competition arena. The arena is lit with blue and green lights, and there are several yellow and black blocks scattered around. In the background, a crowd of people is watching the event. A sign in the background reads "Road & Speed ABS Awarded Winning in 2017" and lists "MAM WMC CAT".

Compete,



STUDENT ROBOTICS



Compete some more,

A robot competition arena with a blue floor, yellow blocks, and various robots. The arena is enclosed by a white barrier with black and white patterns. The floor has yellow and green markings, including the number '2'. A red robot is in the upper left, a white robot is in the upper right, and a black robot is in the center. The text 'Compete even more!' is overlaid in the center.

Compete *even* more!

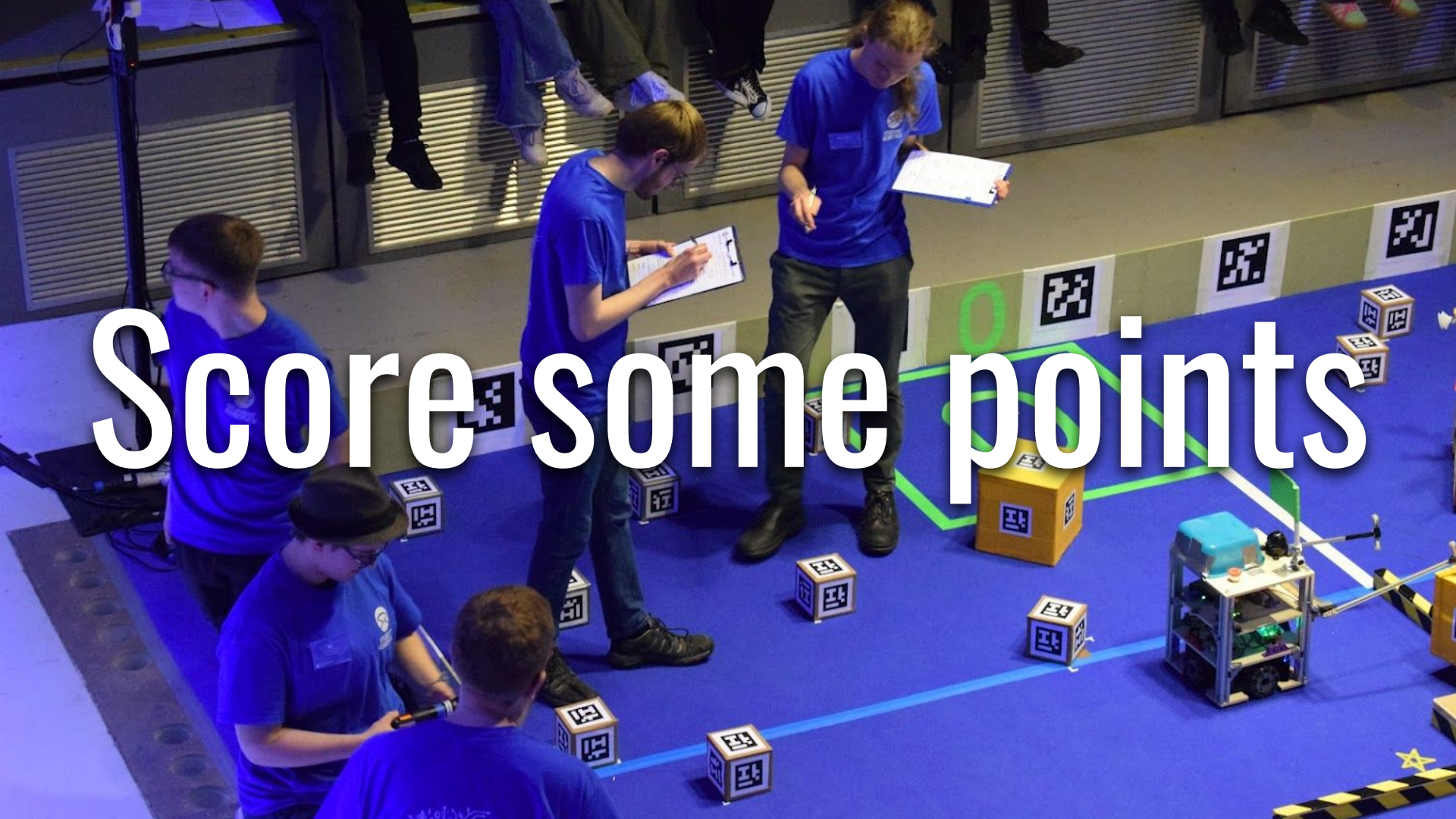


Meet other robots



Meet other people

Score some points



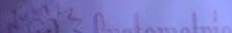
Win some prizes



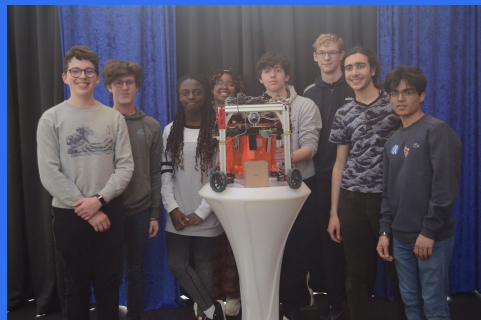
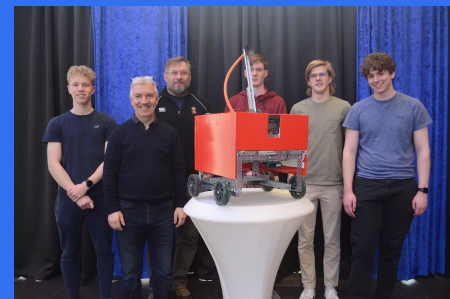
STUDENT ROBOTICS

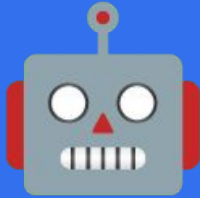


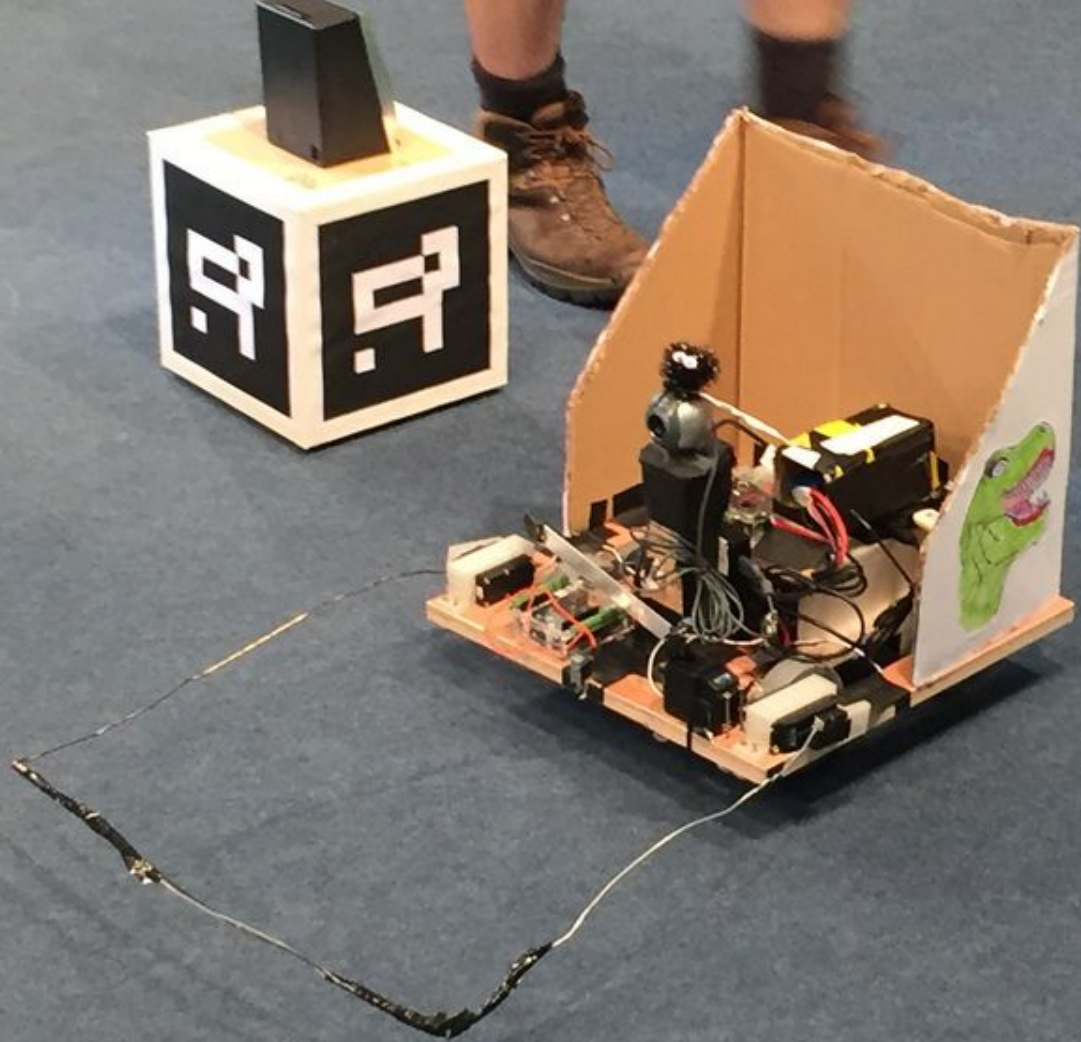
Innovation | Technology | Development



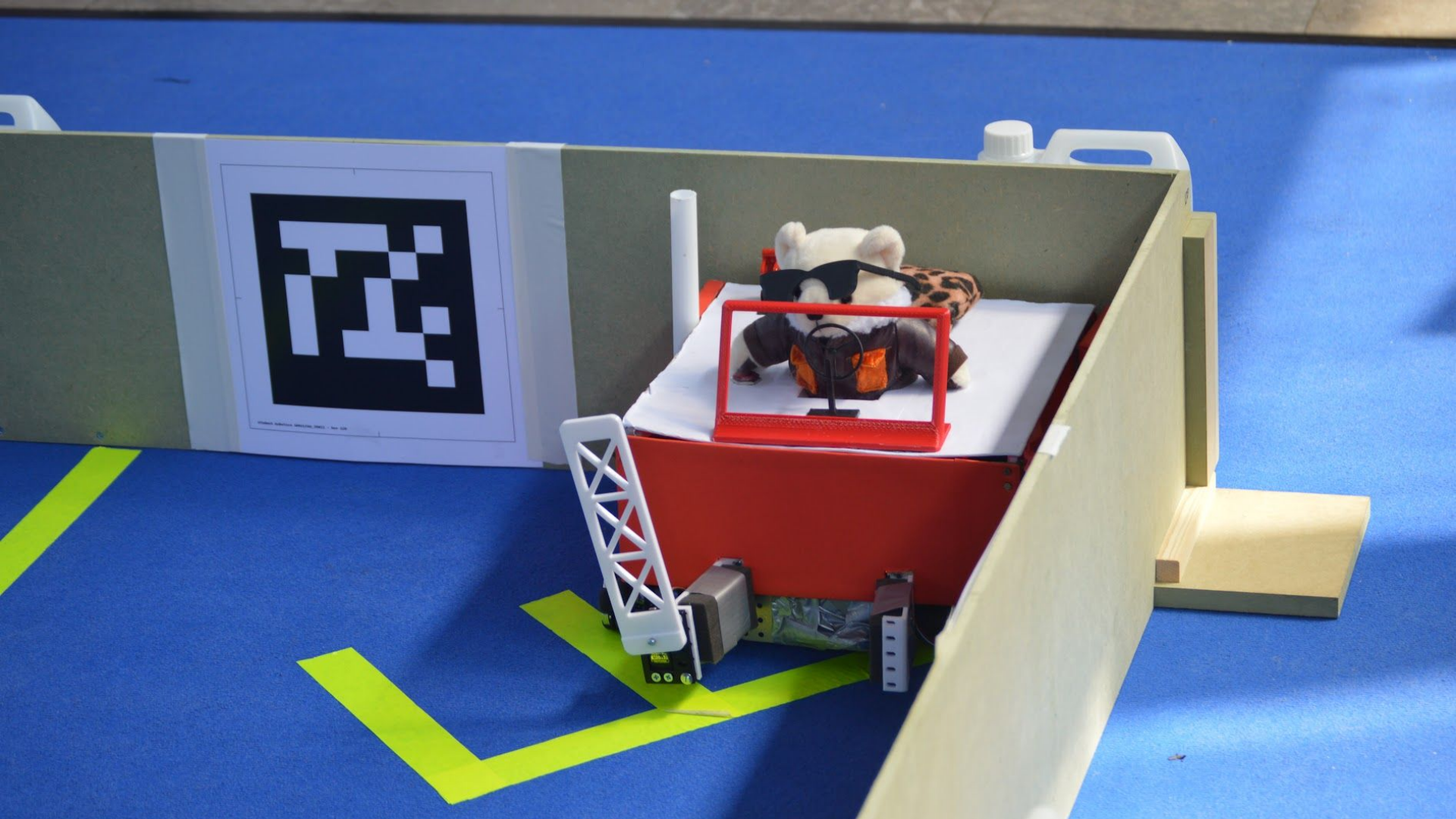
Have fun!

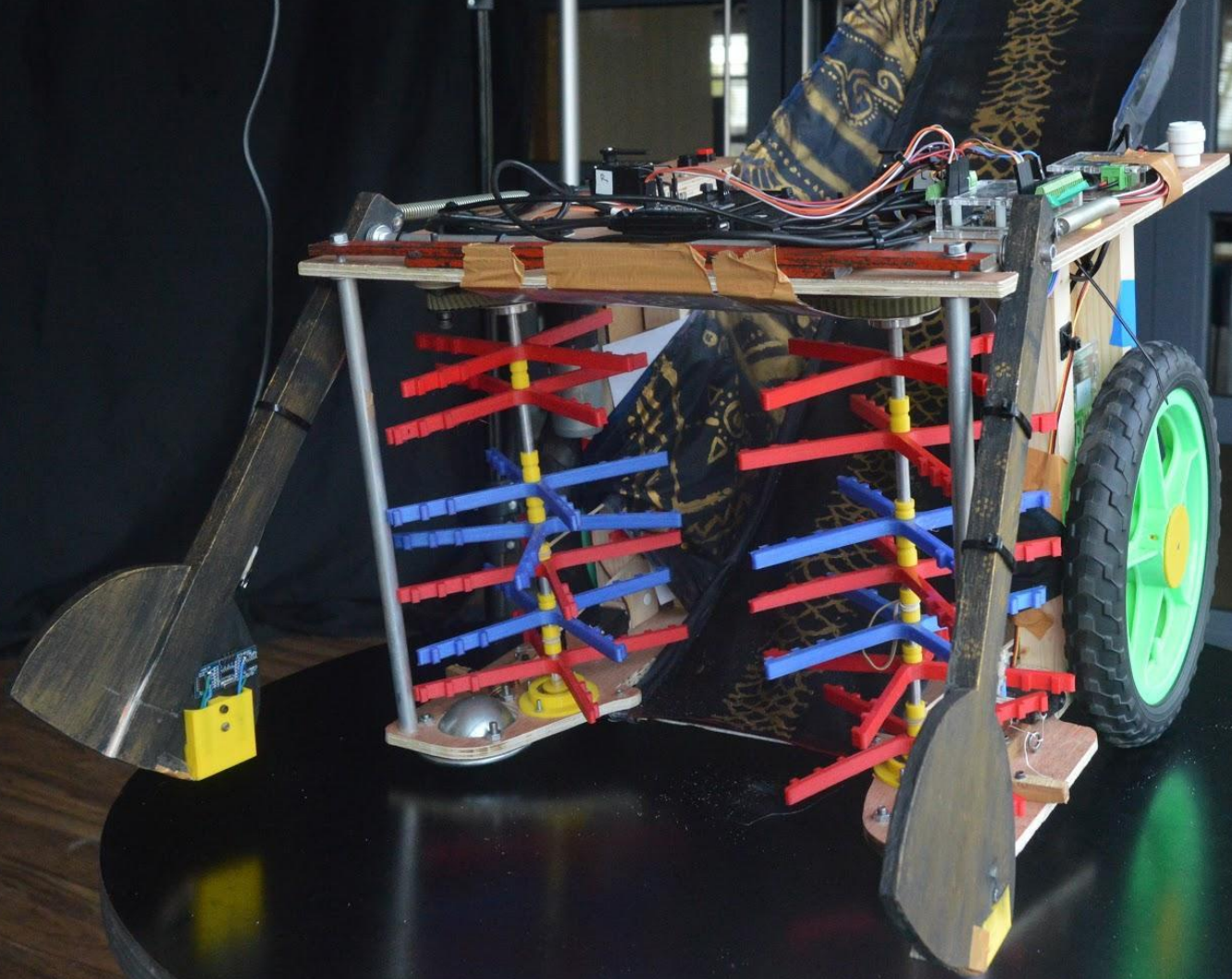


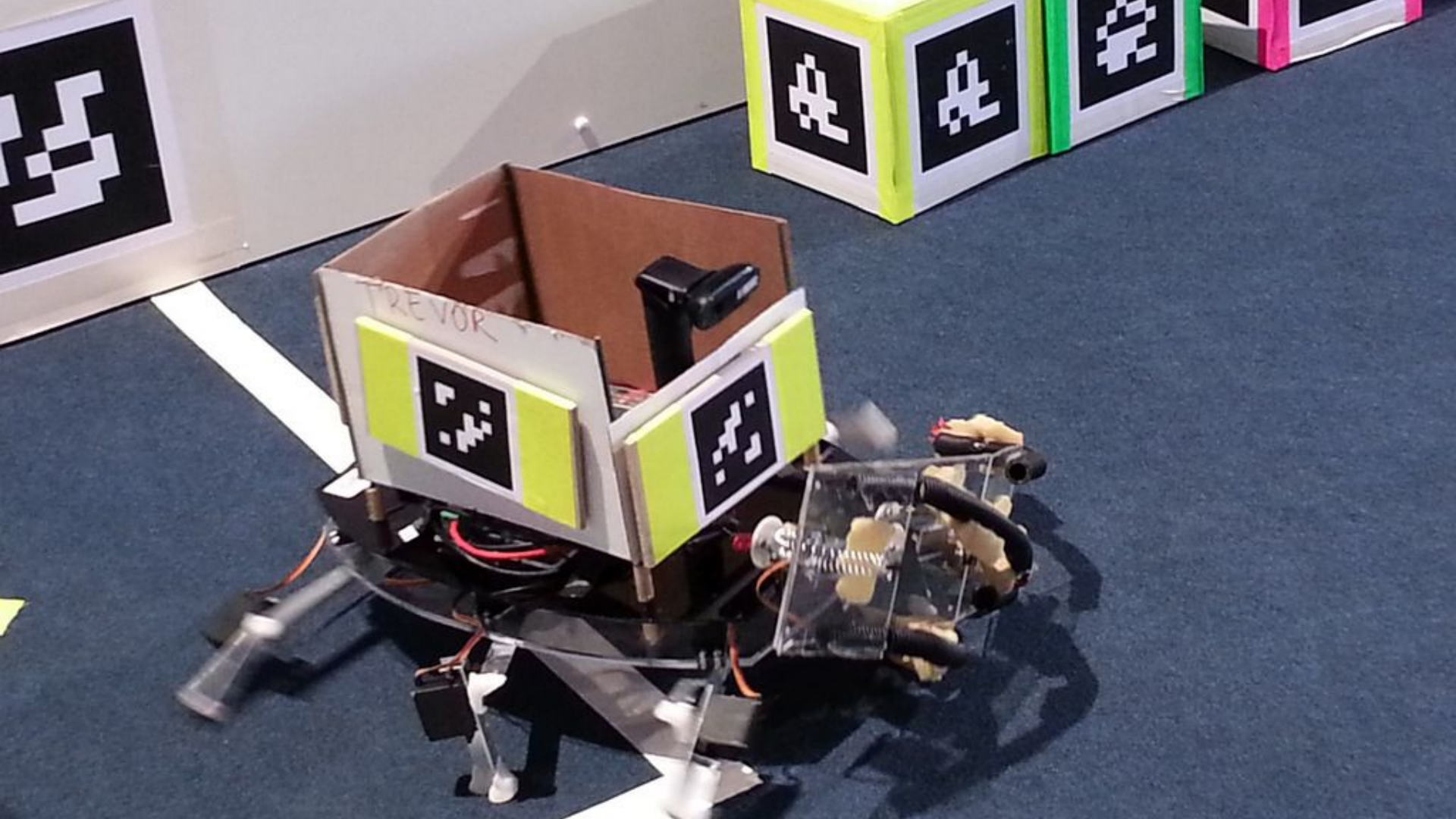
What does a  look like?

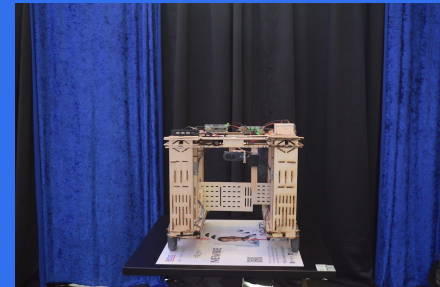
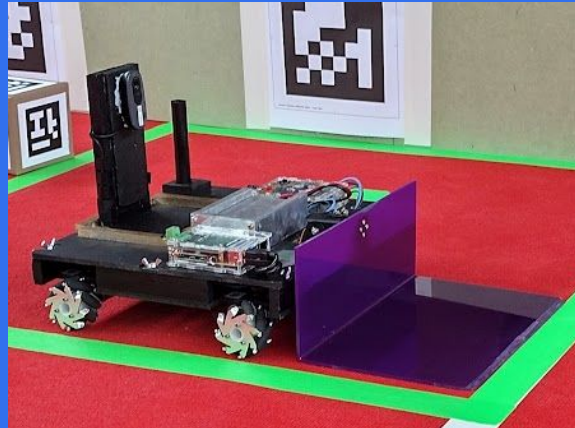
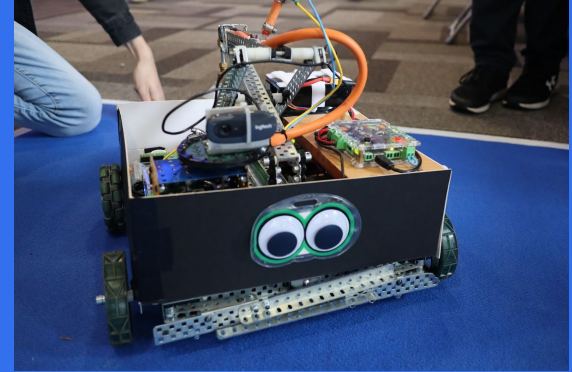
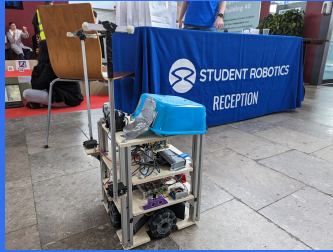
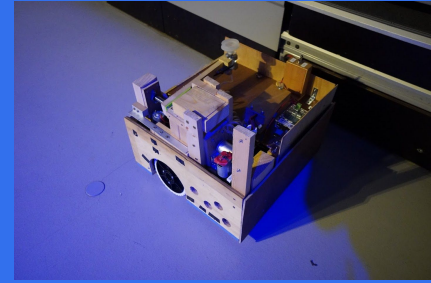
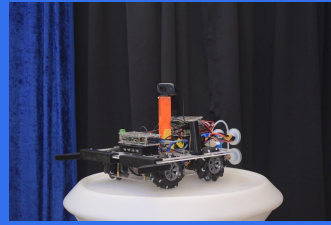
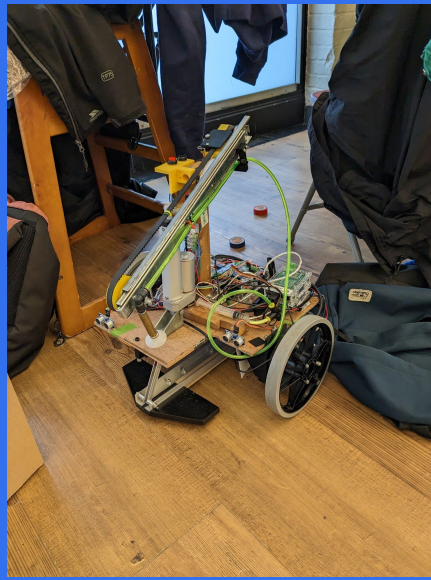










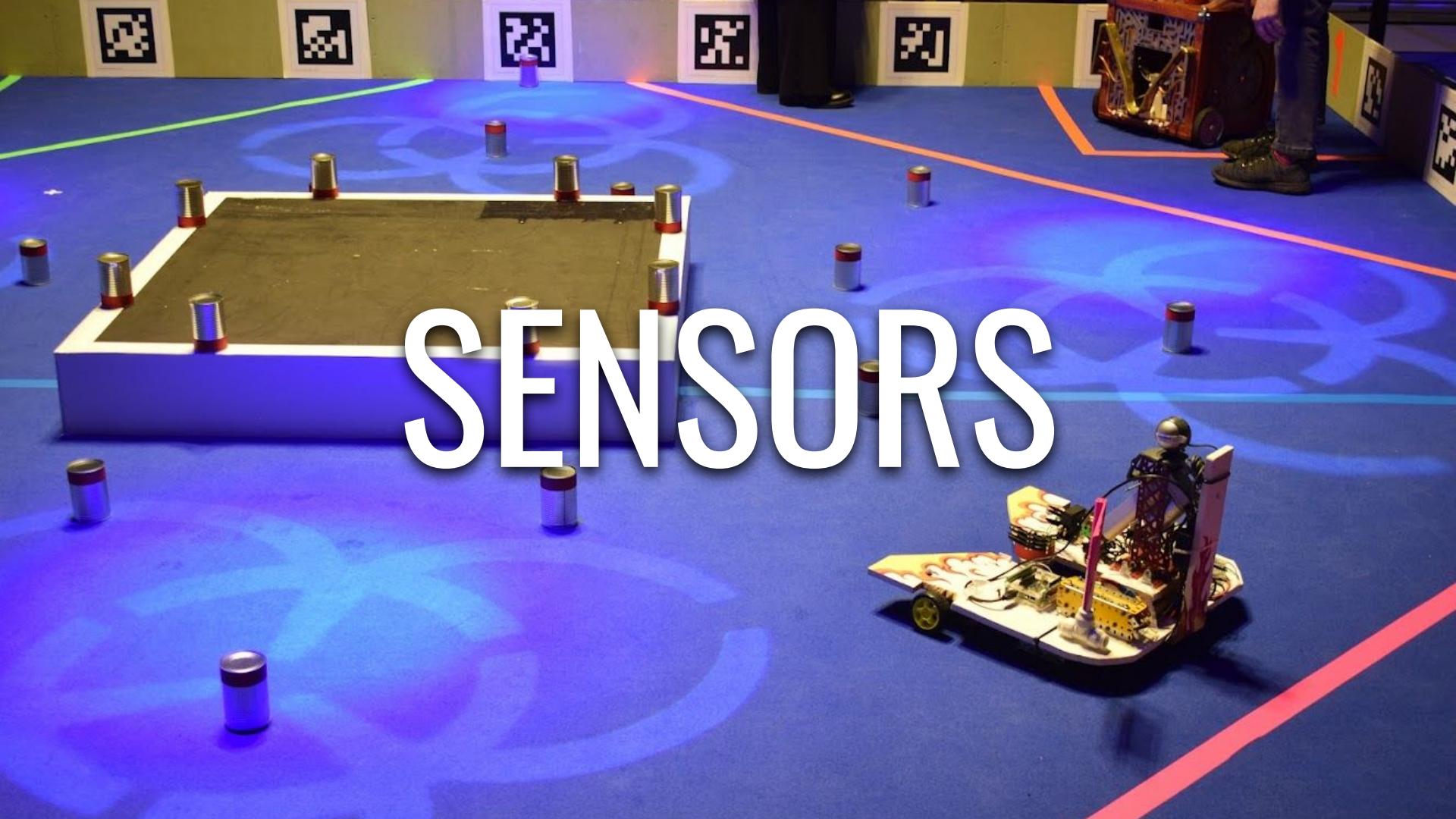


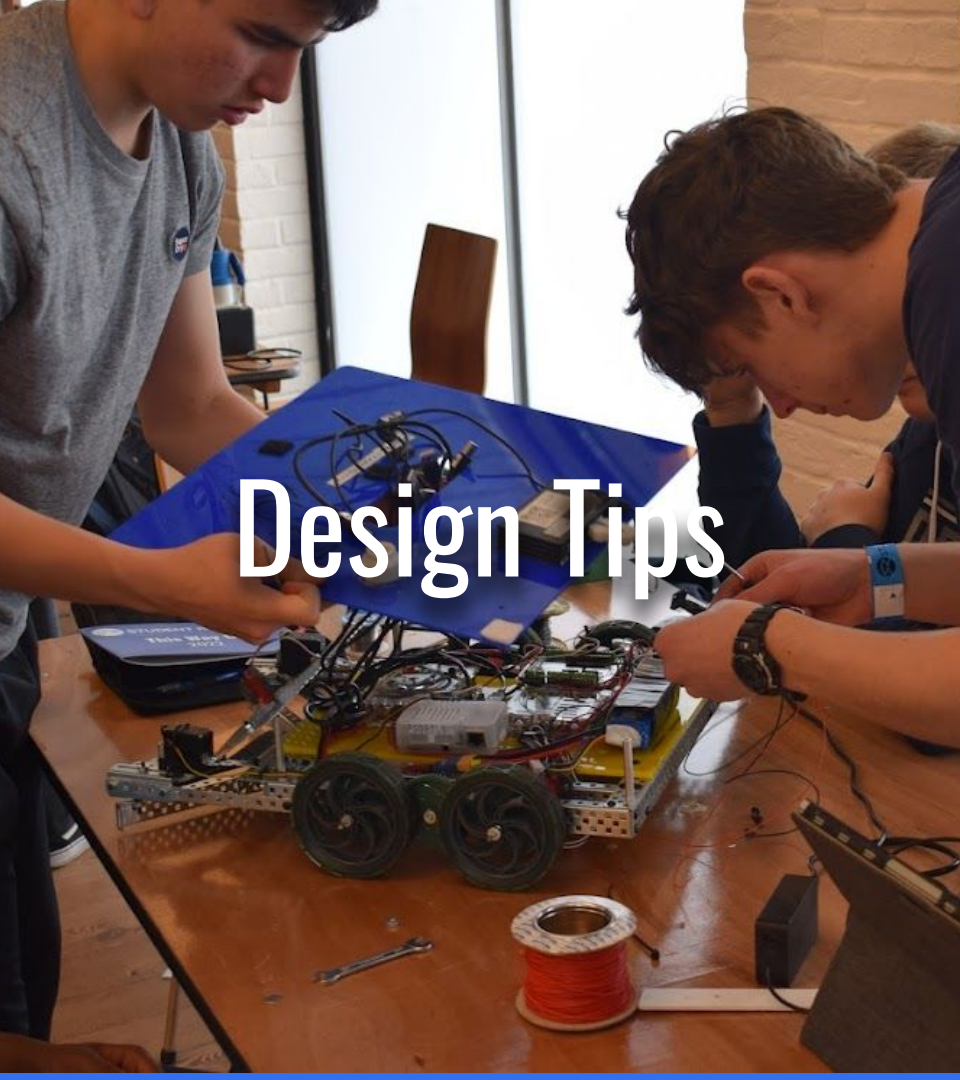


Design Tips

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

SENSORS



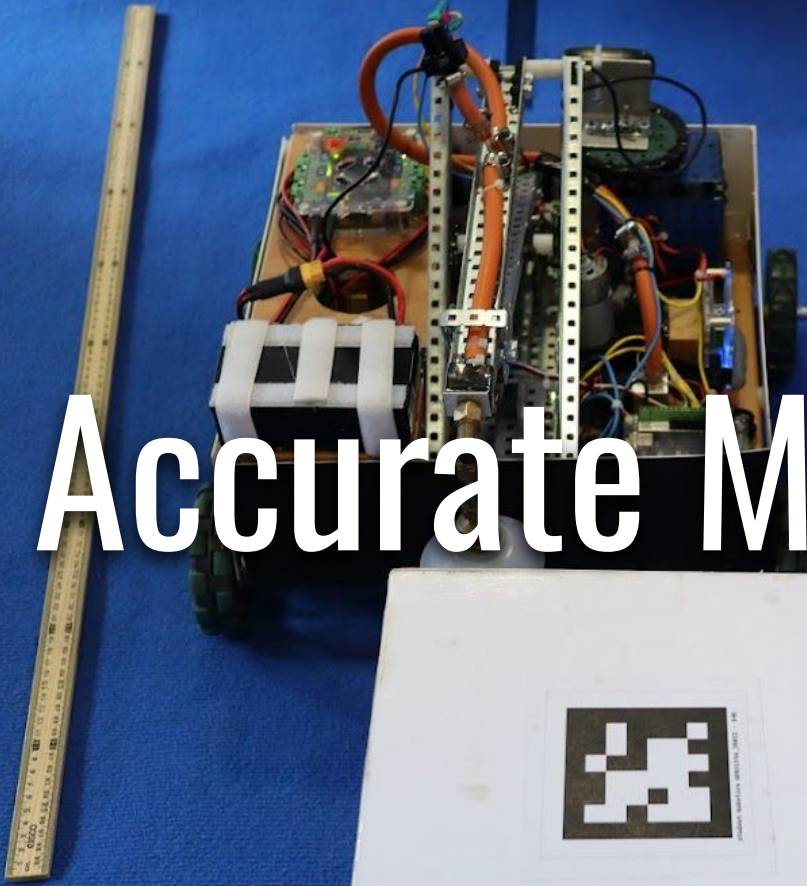


Design Tips

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

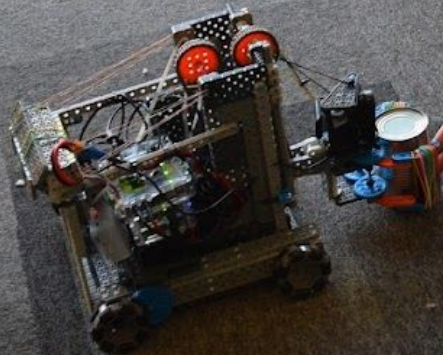
Accurate Movement



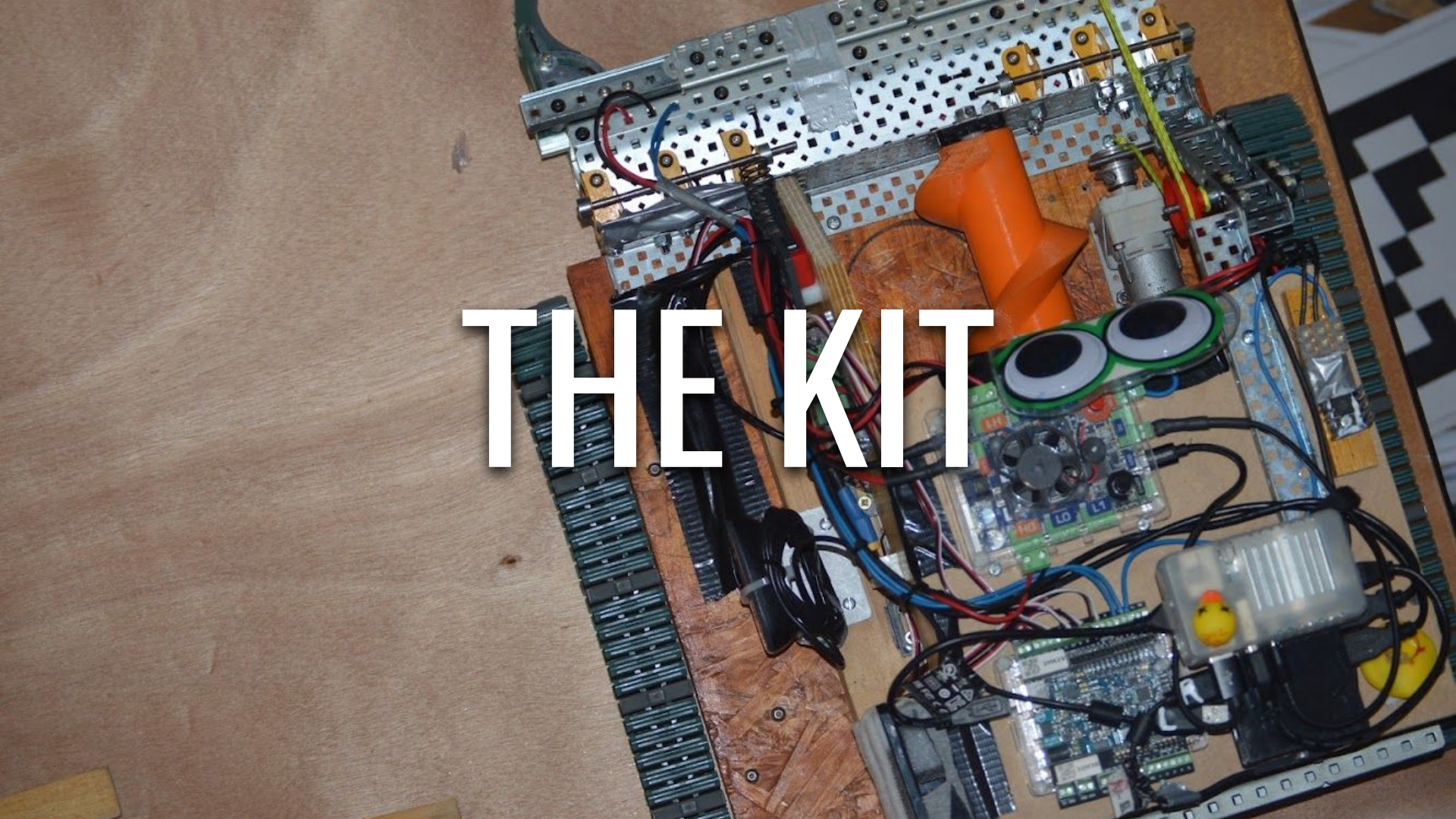
Recommended Procedure

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

TESTING



THE KIT



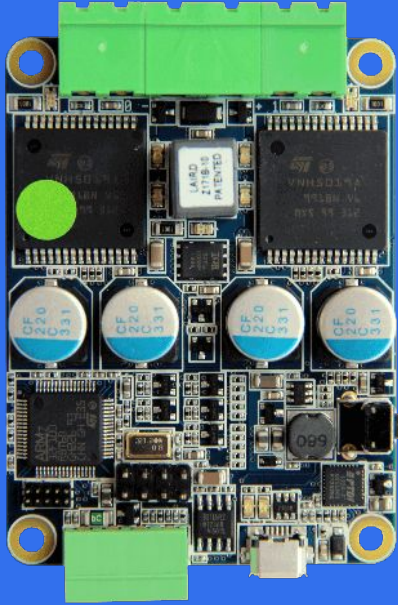
Brain Board



The brains of the operation

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

Motor Board



Controls motors

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

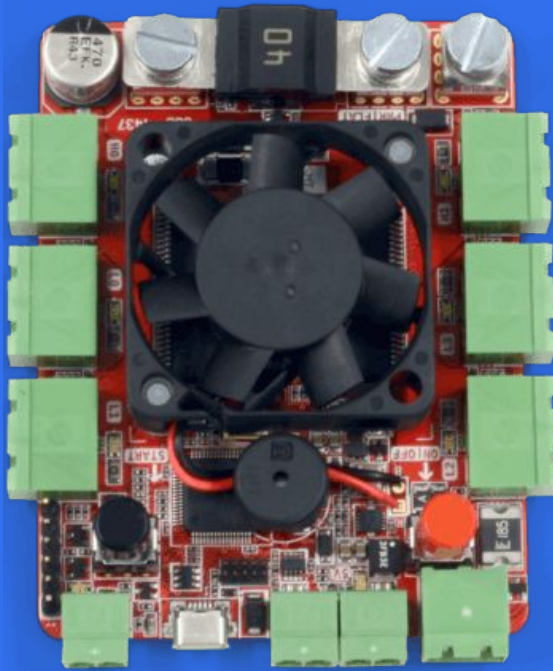
Servo Board



Controls servos

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

Power Board



POOOOWWWEEEEERRRR!

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

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!**

Arduino



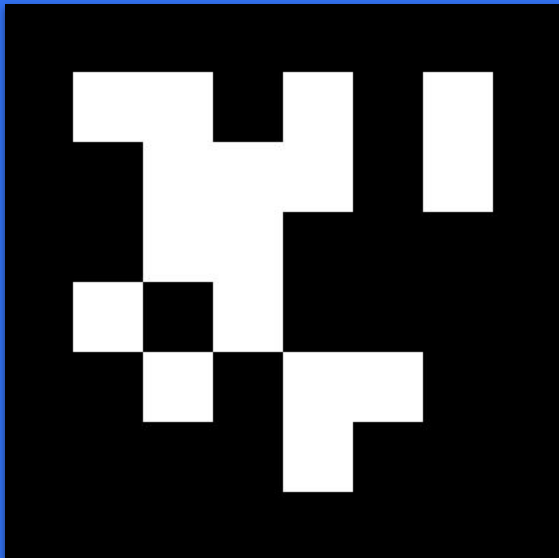
General Purpose IO

- 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



Vision

Fiducial Markers

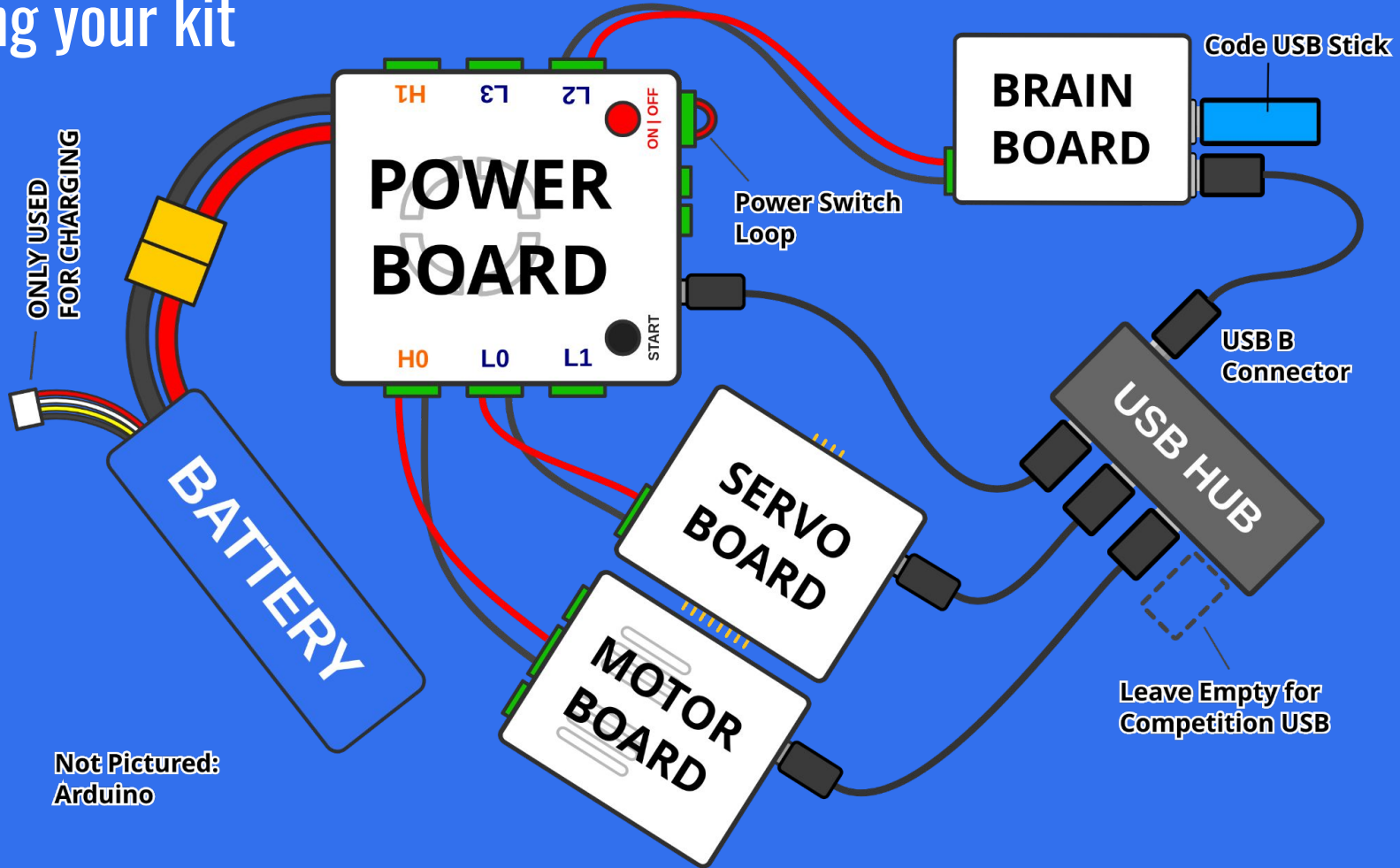


- On arena walls and props
- Properties:
 - Type
 - ID
 - Distance from webcam
 - Position relative to webcam
 - Orientation



Carpet

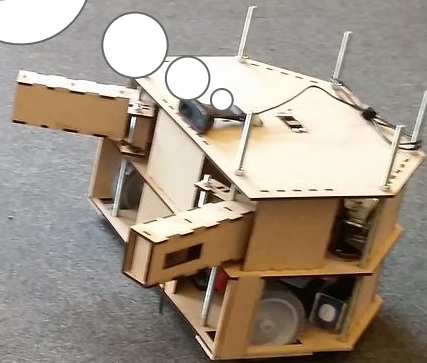
Connecting your kit





Mounting

- Screws ✓
- Velcro ✓
- Cable Ties ✓
- Screws (through the provided case holes) ✓
- Gravity ✗
- Hot Glue ✗
- Tape ✗
- PVA ✗
- Blu Tack ✗



YOUR CODE

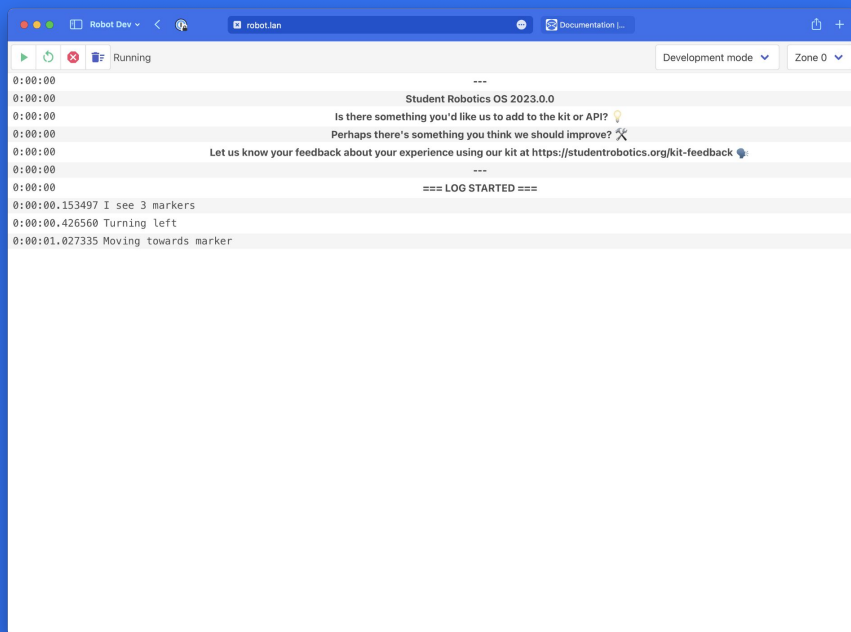
Your Code

- Python 3.11
- `from sr.robot3 import *`
- Local Development
 - Any editor you like
 - Backups!
 - Distributed team
- 1 big file? Or separate modules?
- Pre-installed libraries

Getting code onto the robot

1. Code in a `robot.py`
2. USB drive
3. Power on
4. Wait for the start button

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*

Kit Changes

- Simplified vision API
- Improved Error messages
- Connection issues *fixed*
- Support wider range of servos



DOCUMENTATION

Read The Docs!

srobo.org/docs

Introduction

Kit

Batteries

- HKE4 Charger
- IMAX B6 Charger

Brain Board

- Student Robotics OS
- Python Libraries
- Web Interface
- Advanced

Motor Board

- Power Board
- Servo Board
- Arduino

Programming

Robot API

- Competition Mode

Brain Board LED API

- Motor Board API
- Power Board API
- Servo Board API

Vision

- Markers
- Position
- Orientation

Arduino API

- SR Firmware
- Extended SR Firmware
- Custom Firmware

API Quick Reference

Rules

- Game Rules Archive

Tutorials

- Kit Assembly
- An intro to Python
- Getting Code on the Robot
- Basic Motor Control
- Code Editors
 - PyCharm
 - Visual Studio Code
- Updating your brain board
- How to use Discord

Simulator

- Simulator Programming

INTRODUCTION

This documentation explains how to use the kit and the robot's Python API. The information is spread across multiple sections:

- The [kit](#) section will give you an overview of the physical kit that is provided to your team, how to connect to each board and what features they have.
- The [programming](#) section talks through how to write code that interacts with all the boards.
- The [rules](#) section is important as it talks through the aim of this year's game and what task you are trying to achieve.
- [Tutorials](#) are a series of guides that will help you get started.

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

```
# code example
```

These are pieces of example code that you can run on your robot.

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

Never leave batteries unattended when they are in use or charging.

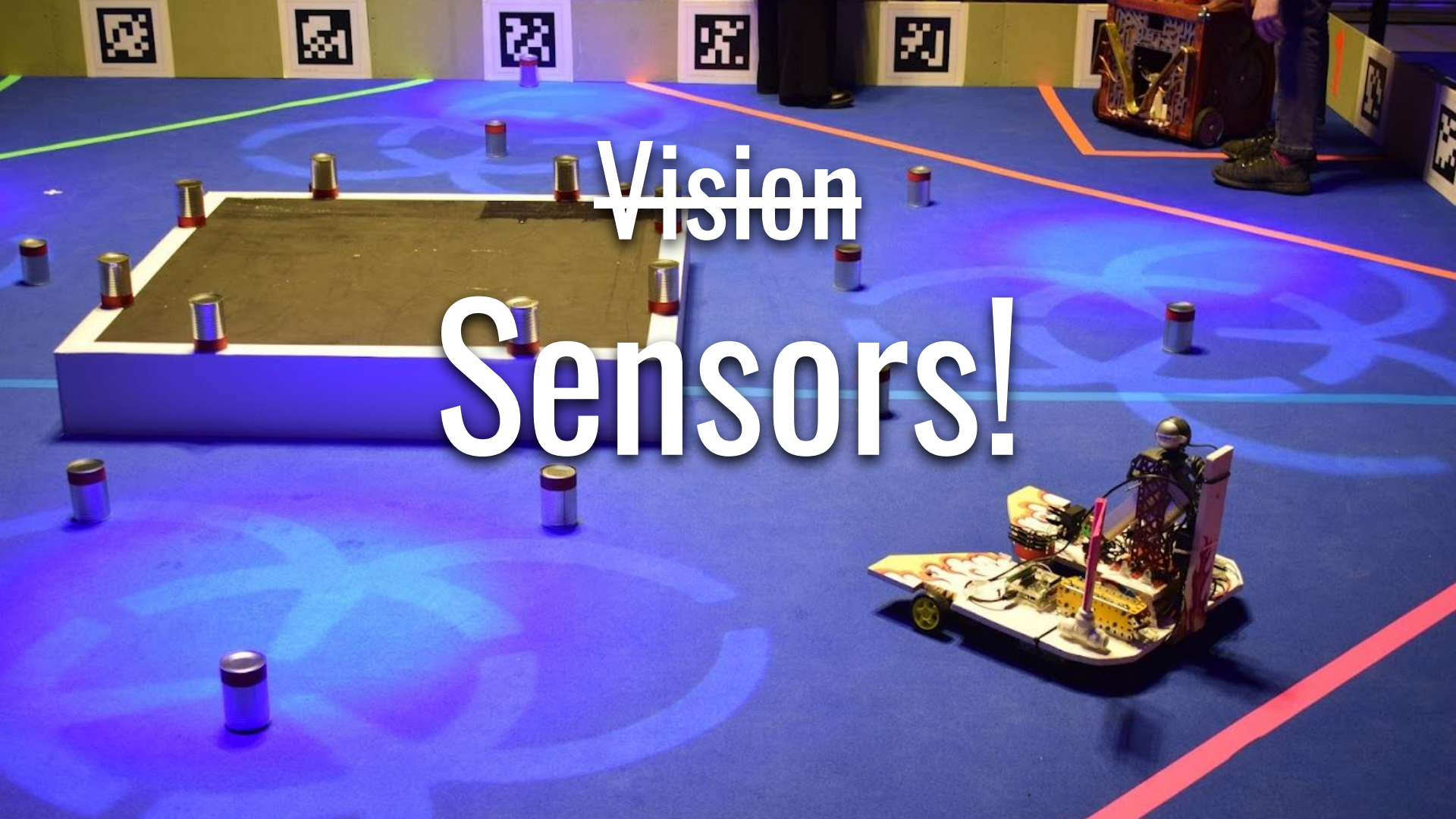
You should take note of these, they often contain important safety information.

You will also come across some blue boxes providing key bits of information, similar to the following:

Taking images while moving will cause them to be blurry, which will cause marker detection to fail. Try pausing movement while taking an image.

These contain useful tips that will help you when building your robot.

Vision Sensors!

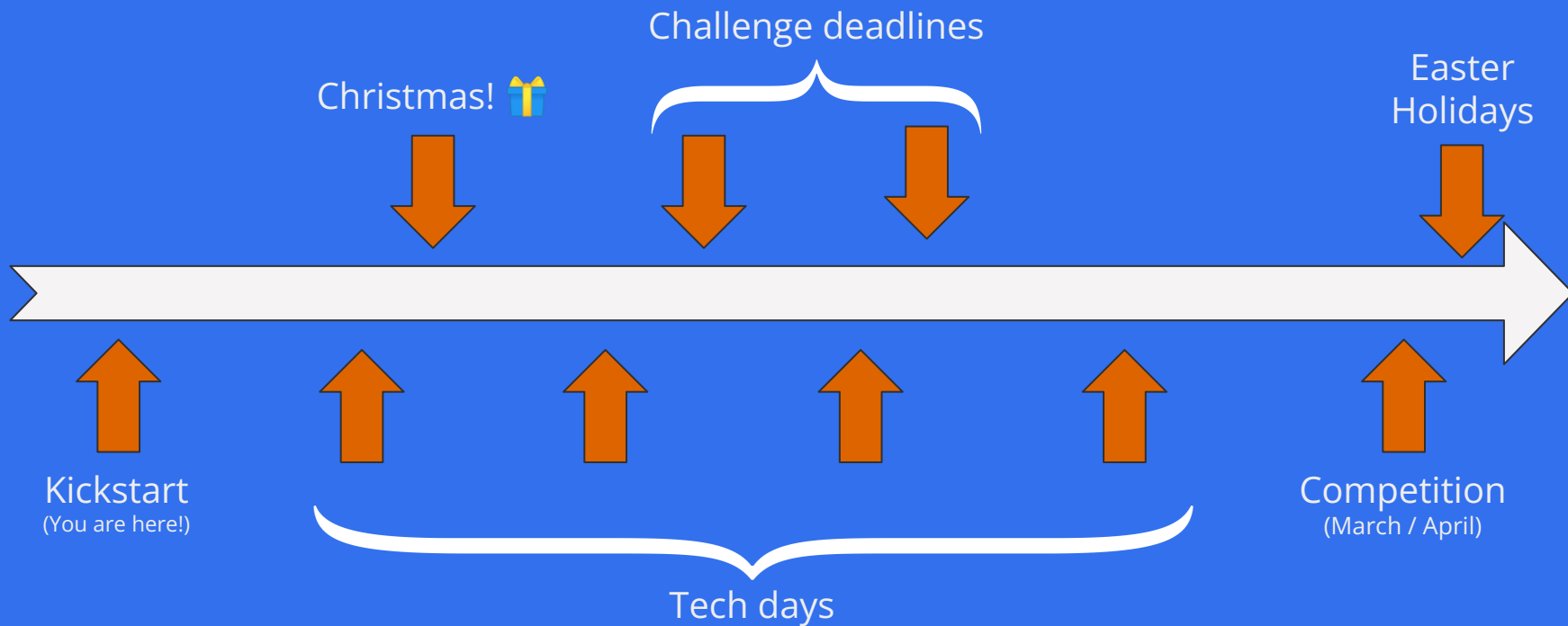




Robot Safety

- 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?

Schedule for the year



Tech Days

- 4th November in Horsham
- 9th December in Southampton
- 20th January in Horsham
- 2nd March in Cambridge



Support

Need some help?

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

Discord

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

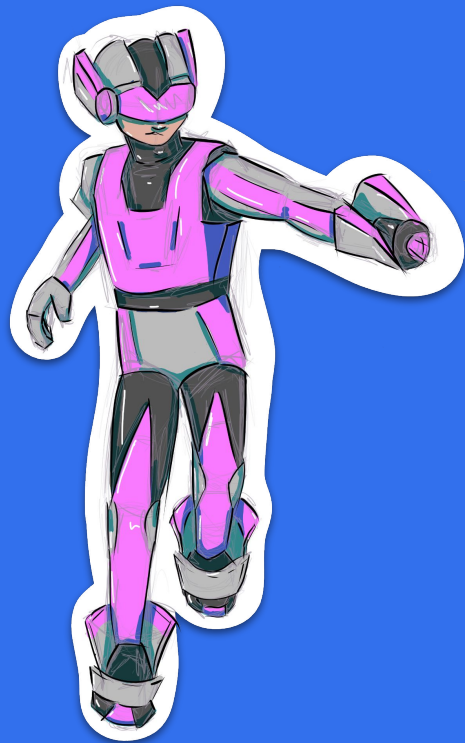
THE GAME?

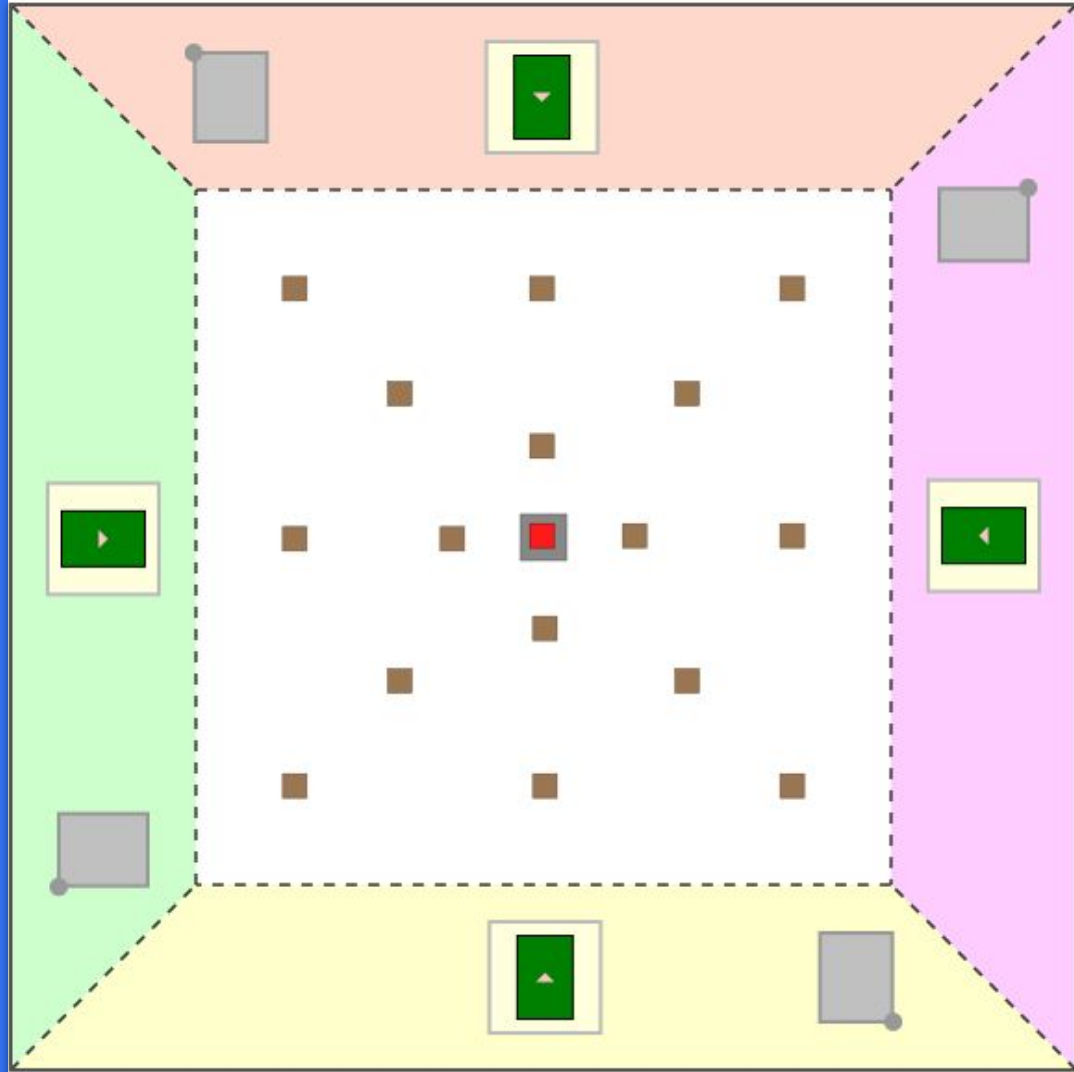
The moment you've all been waiting for!

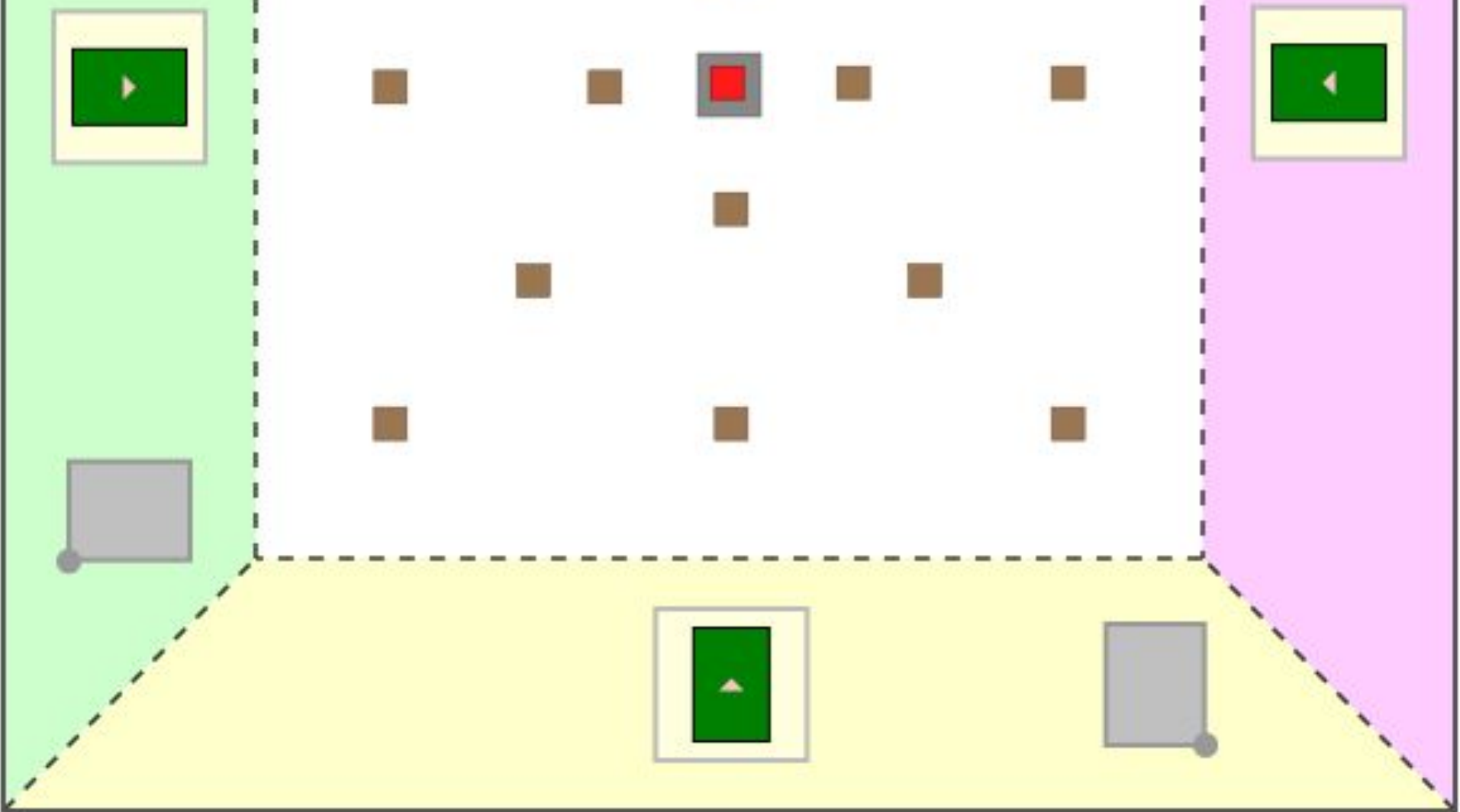


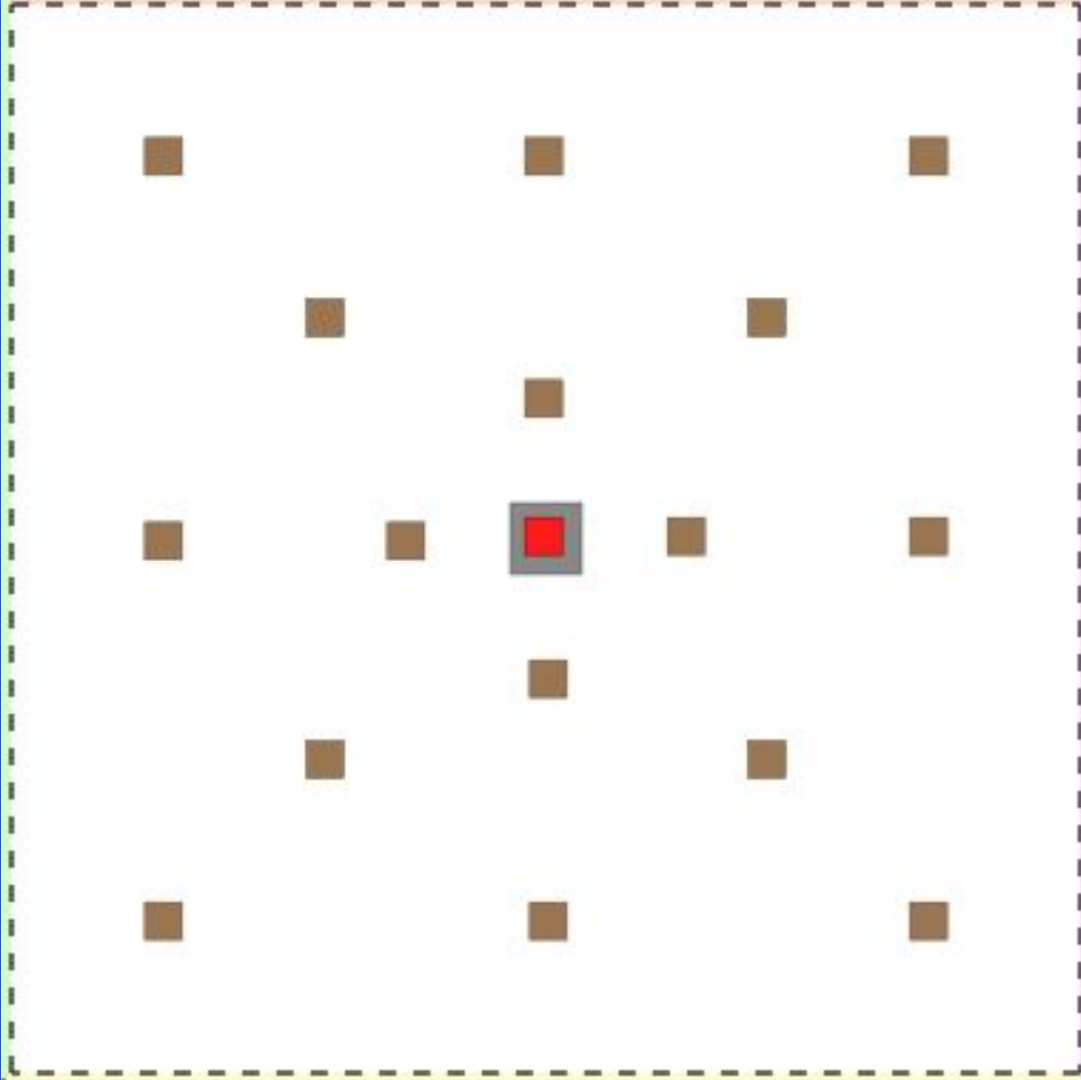
Final Frontier
SR2024

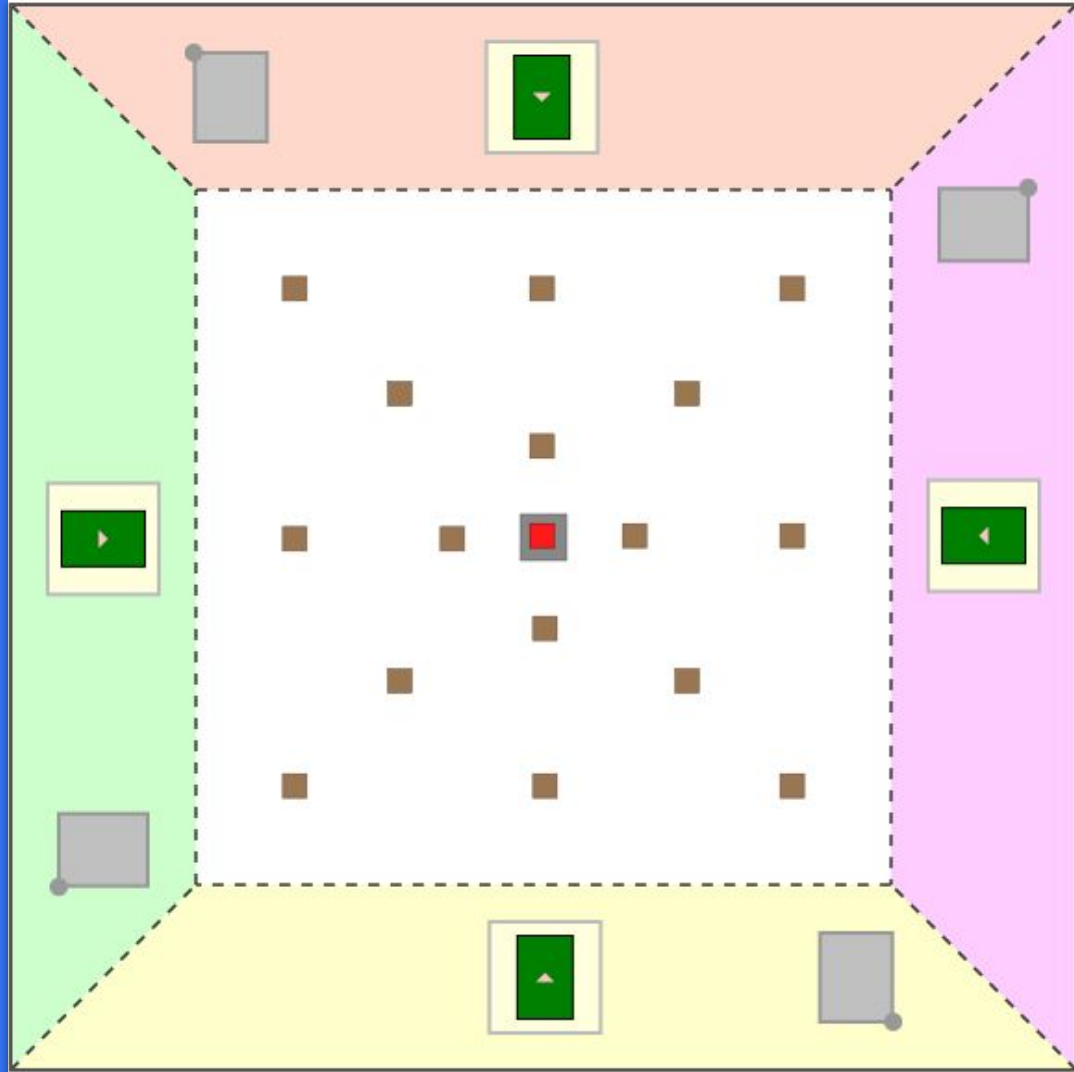
Backstory













Competition

1. Challenges
2. League
3. Knockouts

CHALLENGES





Challenges

- Movement
- Mechanics
- Vision



Challenge Submission Dates

- January 7th
- February 4th

PRIZES



STUDENT ROBOTICS



Intelligent Technology Development



ADVENTUROUS
MACHINES

UNIVERSITY OF
Southampton

First Place

Second Place

Third Place

Obviously!

Excellence in Engineering

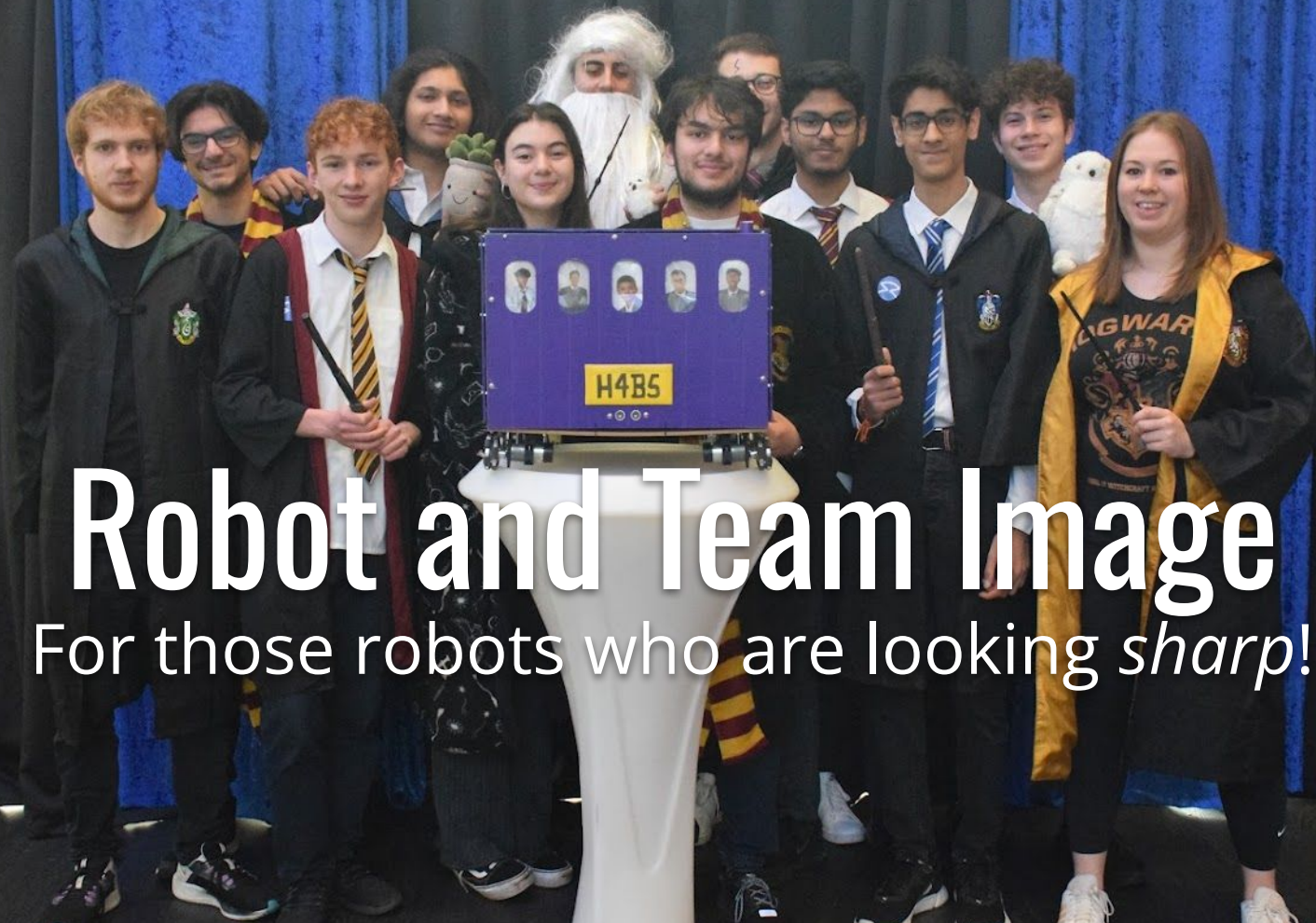
For ingenuity & elegance in robot design

Rookie Award

Highest placed rookie in the league

Challenges

Complete all challenges first



Robot and Team Image

For those robots who are looking *sharp!*

Online Presence

For those teams who are active online

#srobo2024

The Rules

Read them!

They're **very** helpful!

TABLE OF CONTENTS

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

BACKSTORY

You're working on behalf of one of four powerful civilizations, each itching to conquer the cosmos. The stars are within your grasp, and the asteroid field? That's your gold mine, teeming with precious resources. But it's never that simple: nestled deep within those asteroids is The Egg — a ticking time bomb of cosmic proportions. Disturb it, and you might just unleash chaos like you've never seen. Your mission? Haul those asteroids back to your home planet or, even better, direct to the intergalactic spaceship under construction. But be cautious, one wrong move and your civilization could pay the price, or perhaps another civilization could take the fall...

GAME RULES

1. The objective of the game, called **Final Frontier**, is to retrieve asteroids and return them to your home planet or intergalactic spaceship.
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

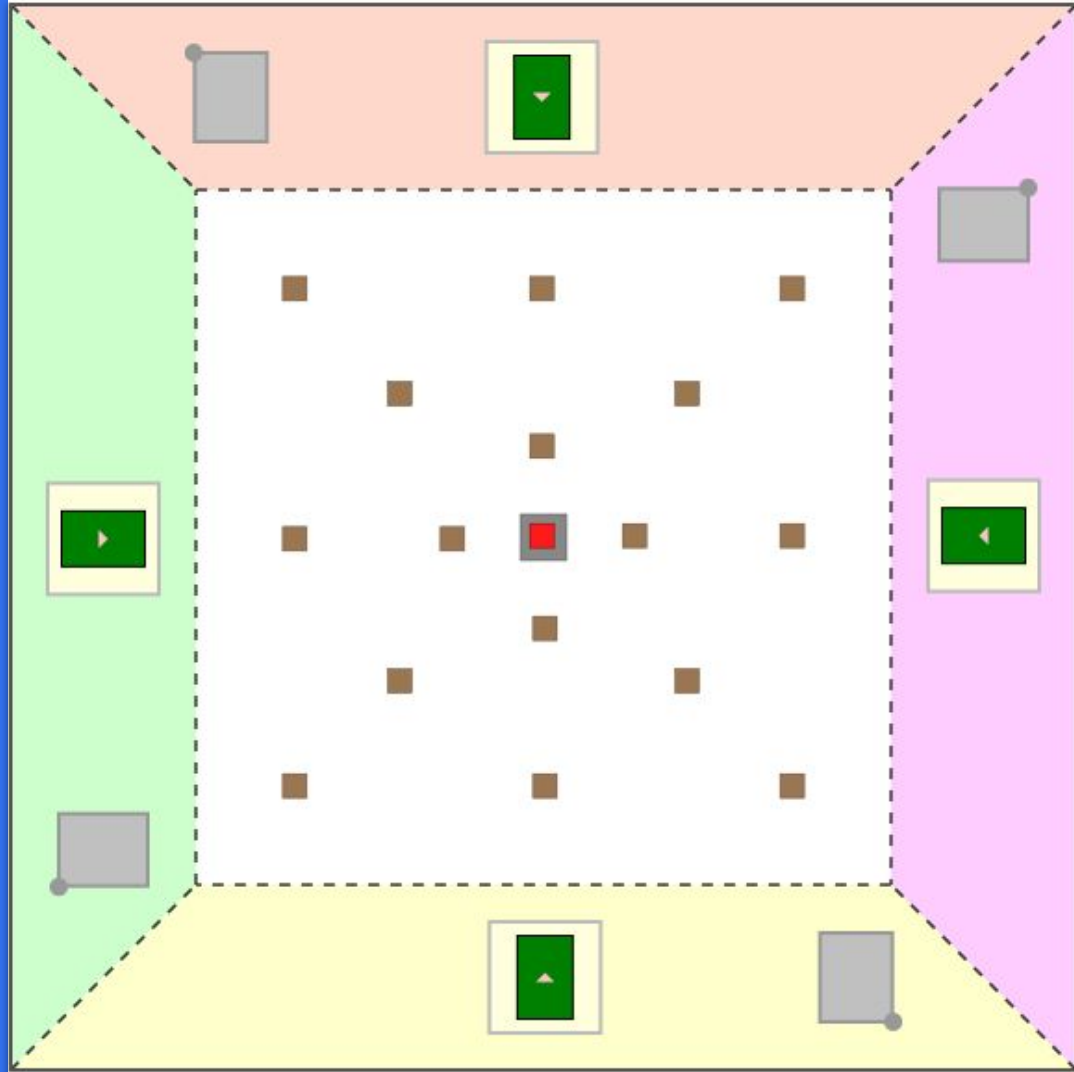
Microgames

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



Any Questions?







GOOD LUCK!



@studentrobotics



@student_robotics



@studentrobotics



@studentrobotics