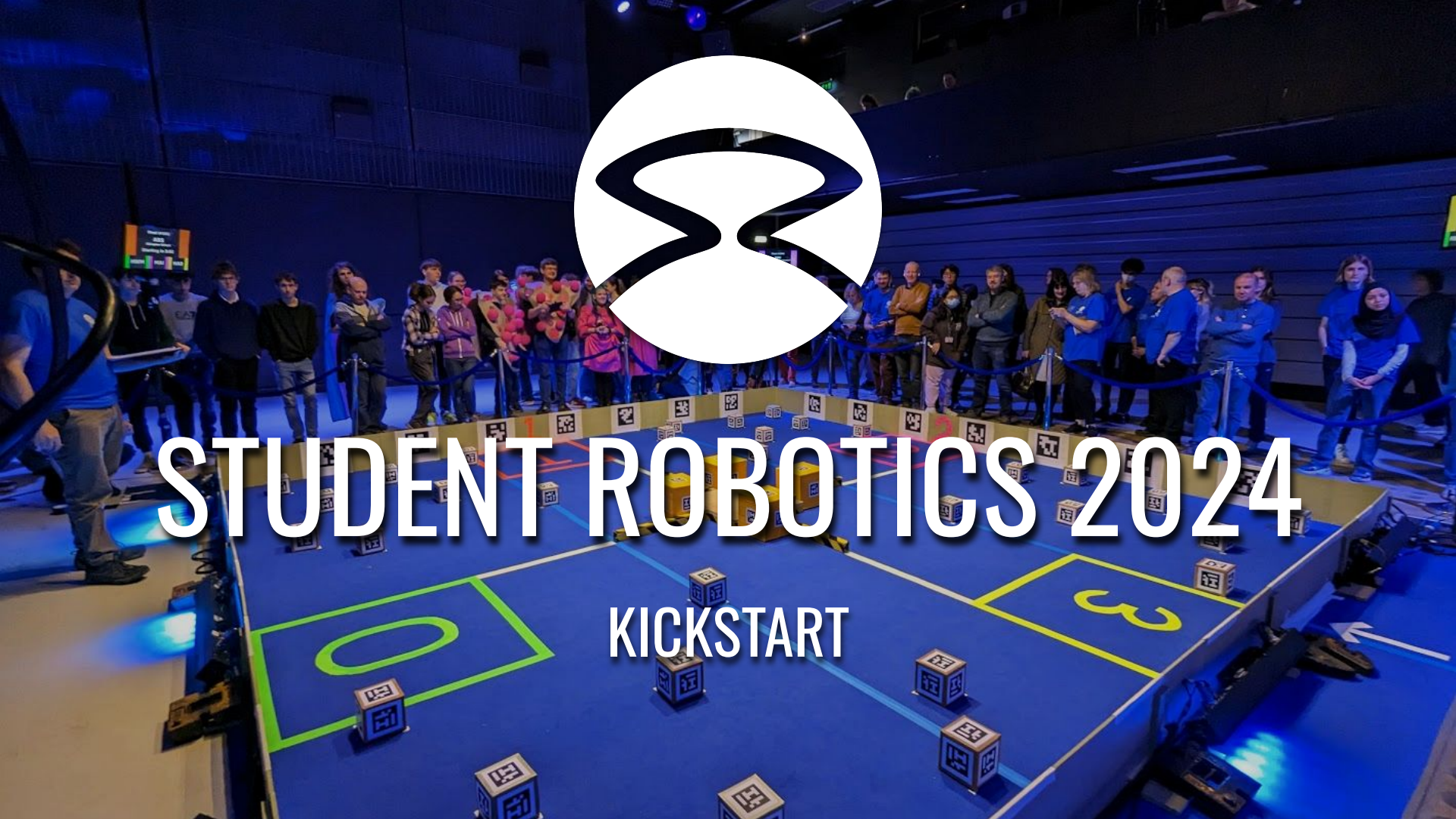


STUDENT ROBOTICS 2024

KICKSTART

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

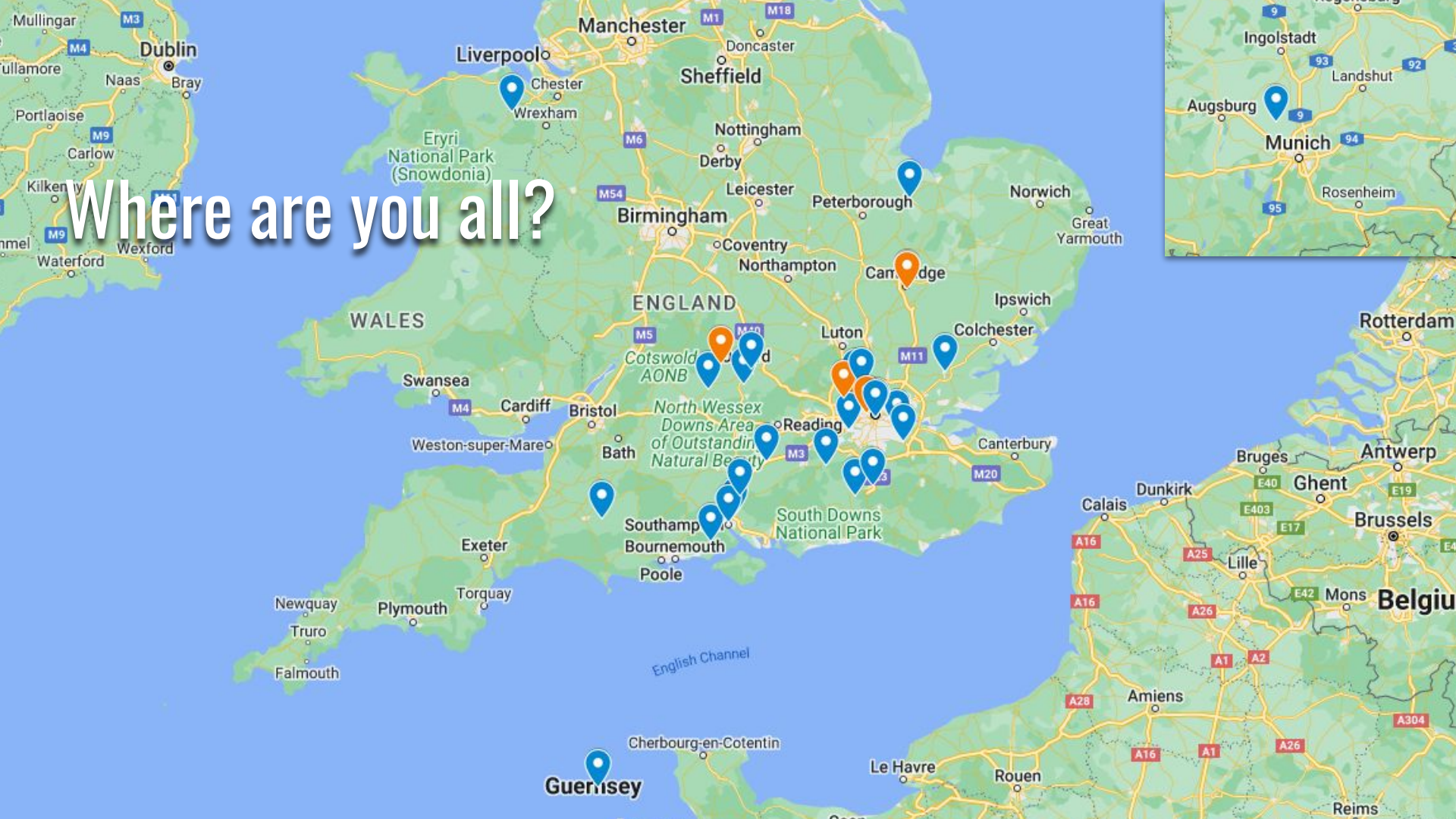
QUESTIONS

WHAT IS STUDENT ROBOTICS?

The Volunteers

We’re here to help!

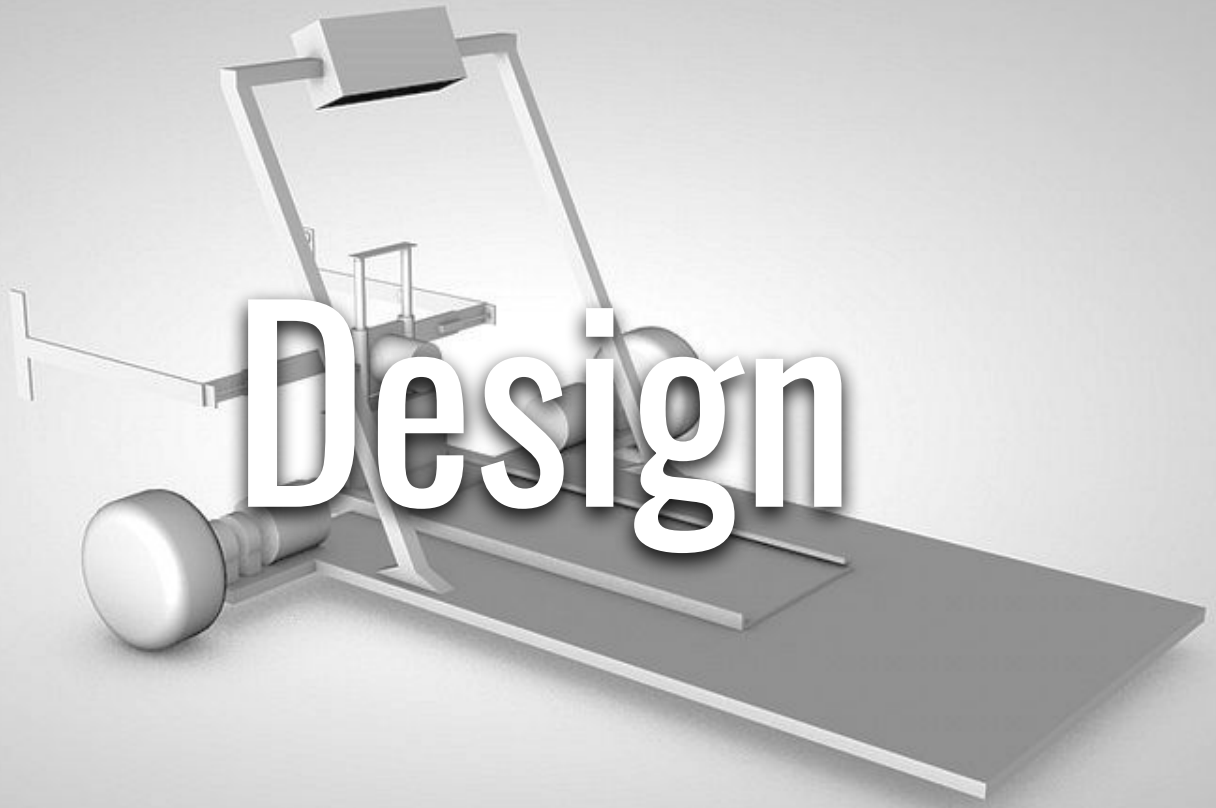
The Teams

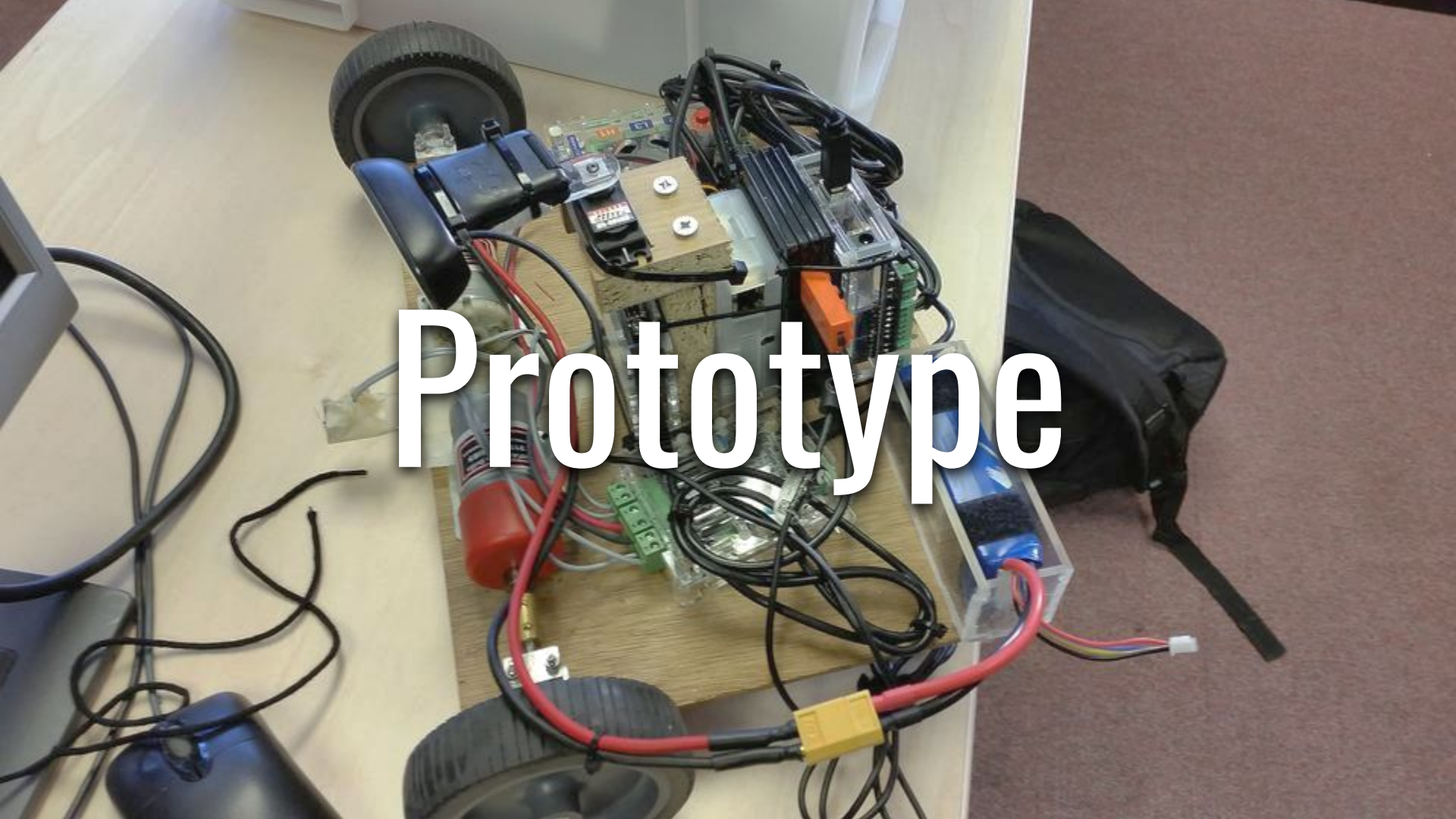

Where are you all?
Manchester
Liverpool
Sheffield
Chester
Wrexham
Nottingham
Derby
Leicester
Peterborough
Norwich
Great Yarmouth
Birmingham
Coventry
Northampton
Cambridge
Ipswich
Colchester
Luton
ENGLAND
WALES
Eryri National Park (Snowdonia)
Cotswolds AONB
North Wessex Downs Area of Outstanding Natural Beauty
Swansea
Cardiff
Bristol
Weston-super-Mare
Bath
Reading
Canterbury
Southampton
Bournemouth
Poole
South Downs National Park
Exeter
Torquay
Plymouth
Newquay
Truro
Falmouth
English Channel
Cherbourg-en-Cotentin
Guernsey
Le Havre
Rouen
Amiens
Reims
Dunkirk
Calais
Bruges
Ghent
Antwerp
Brussels
Lille
Mons
Rotterdam
Ingolstadt
Landshut
Augsburg
Munich
Rosenheim
Dublin
Bray
Naas
Portlaoise
Carlow
Kilkenny
Wexford
Waterford
Mullingar

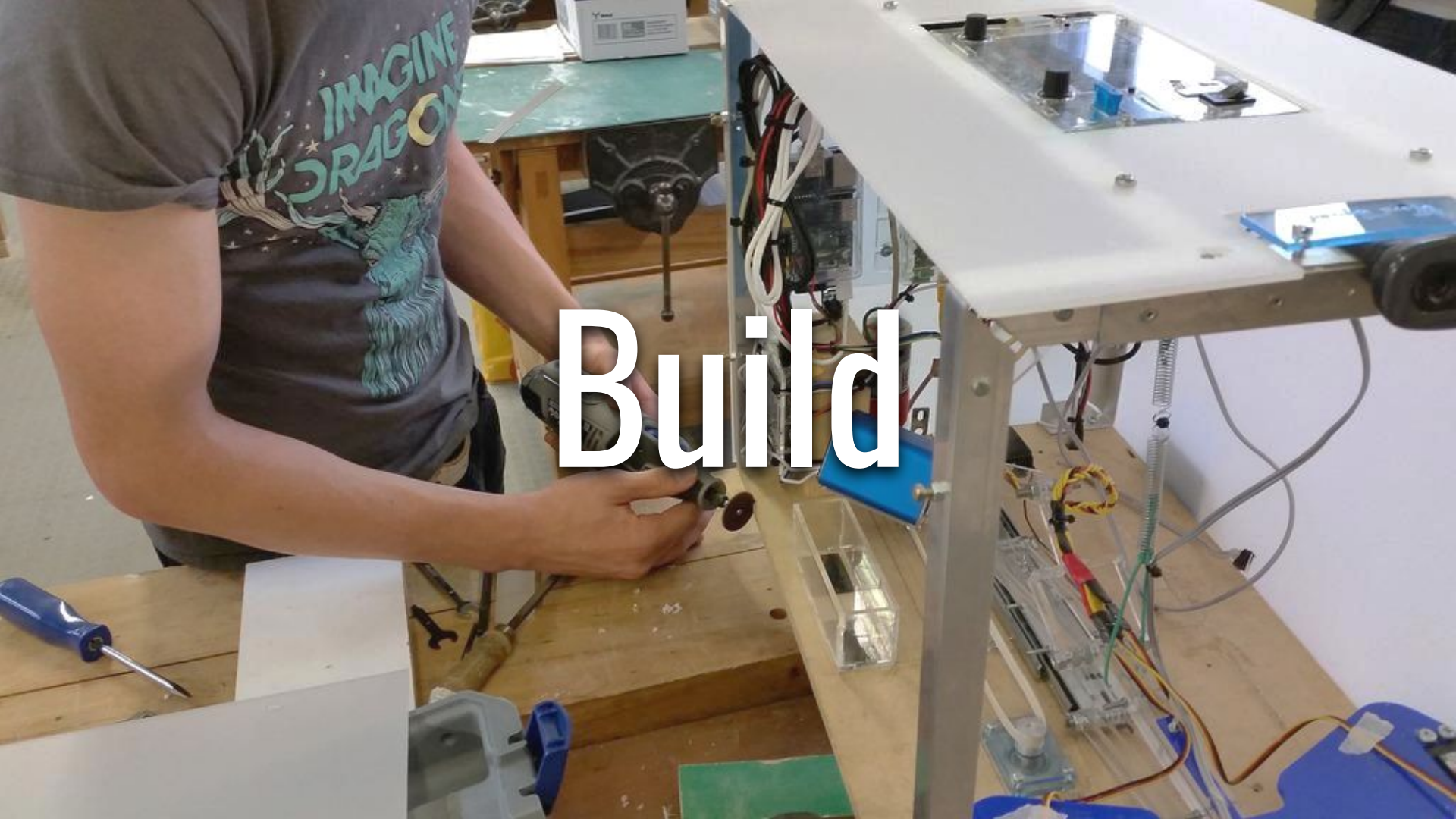
5 MONTHS

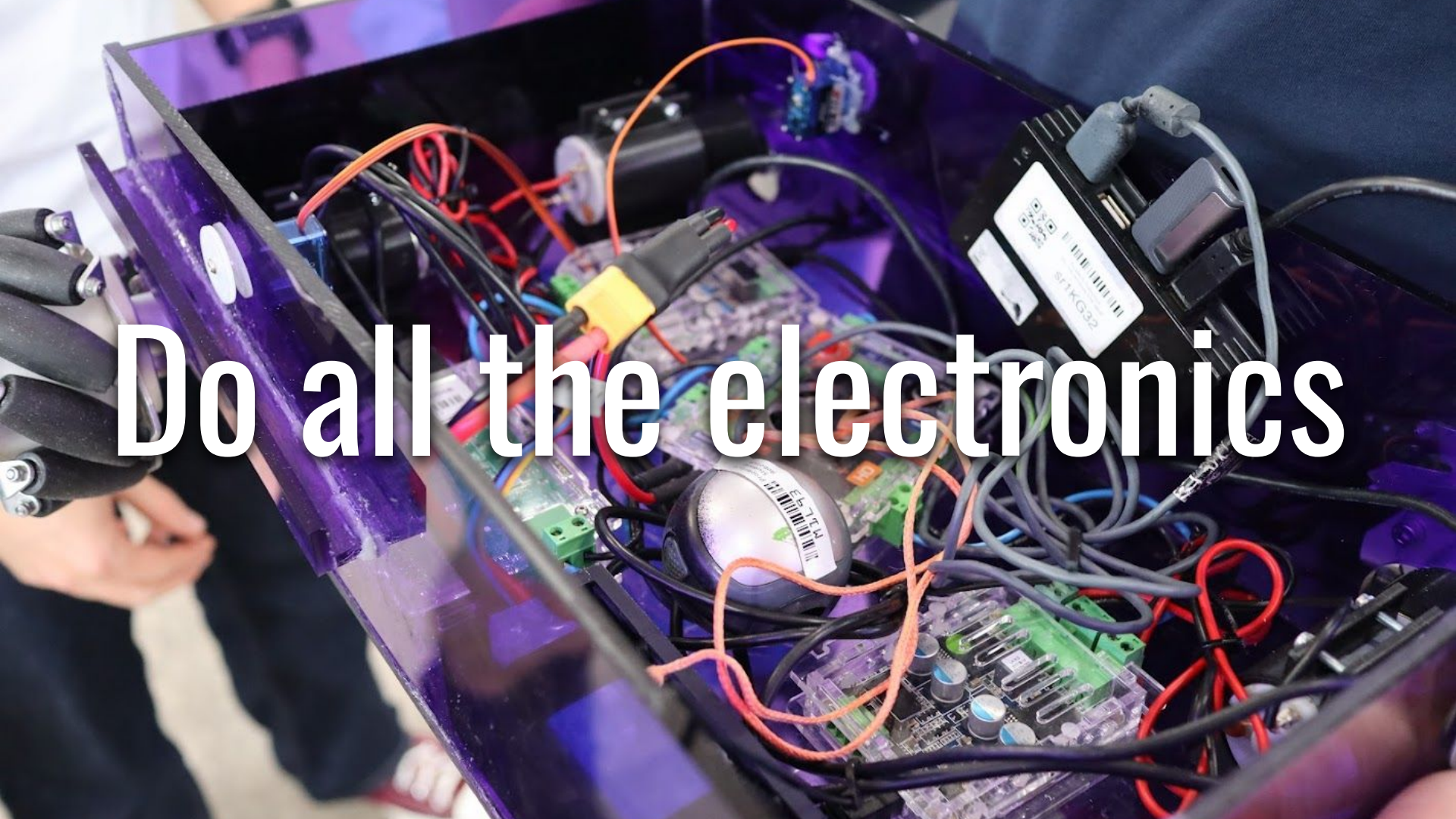
You have **ONLY** 5 months to...

Design

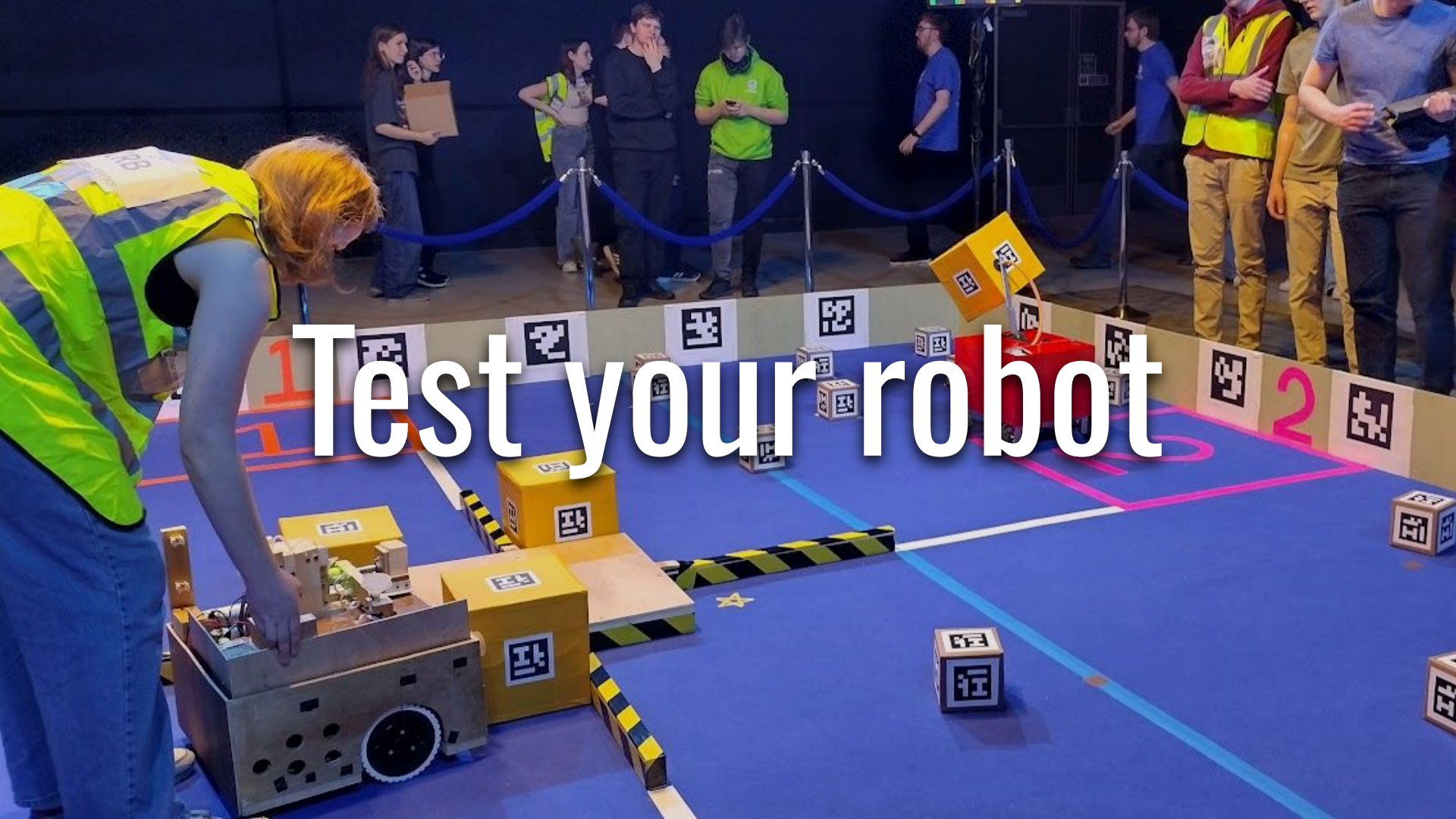



Prototype


Build


Do all the electronics

Write lots of code


Test your robot

Test it some more

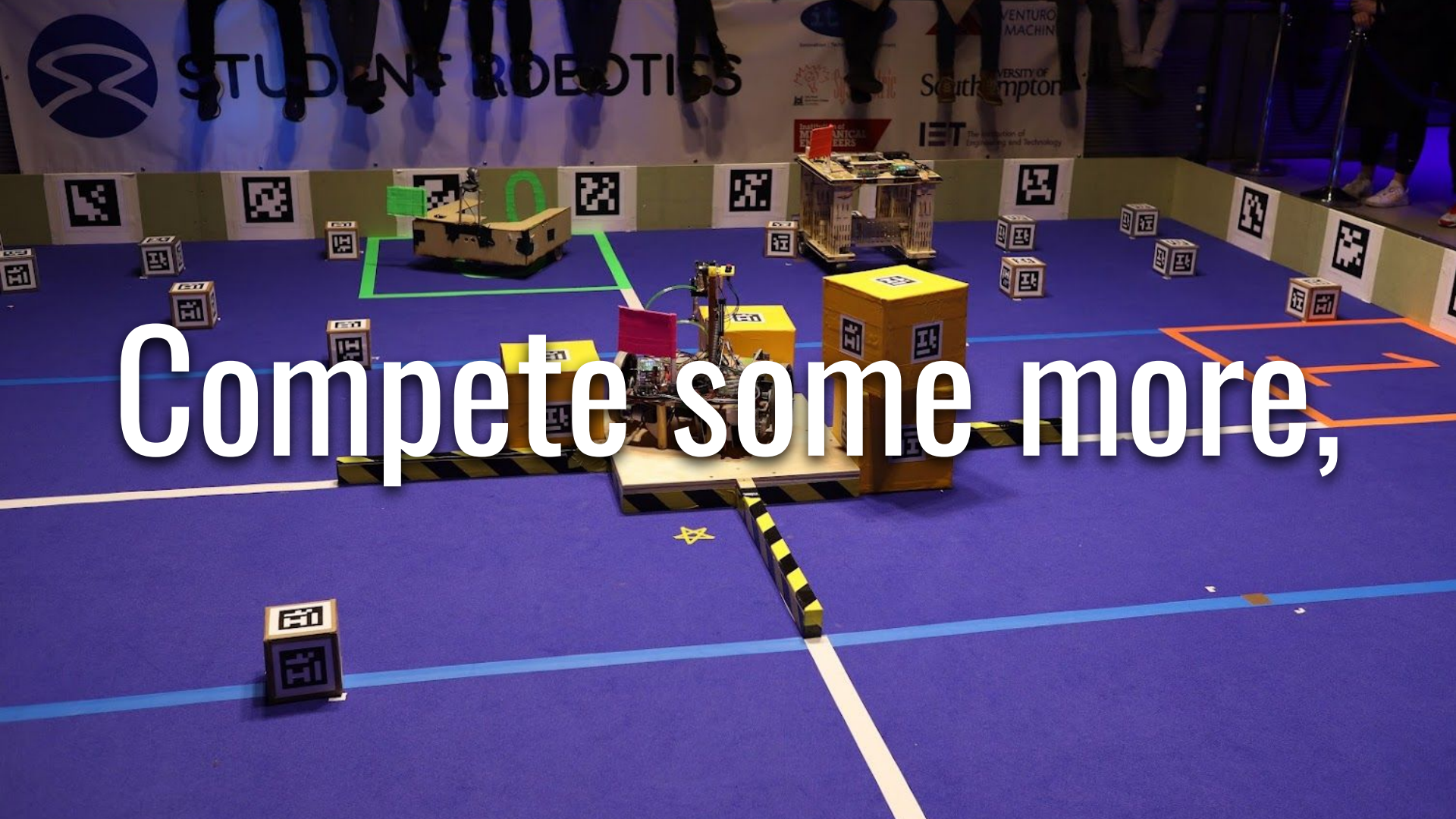
Test it a *bajillion times*

Work as a team

* Work as a team

Get your robot inspected

Compete,


STUDENT ROBOTICS
Compete some more,

Compete *even* more!

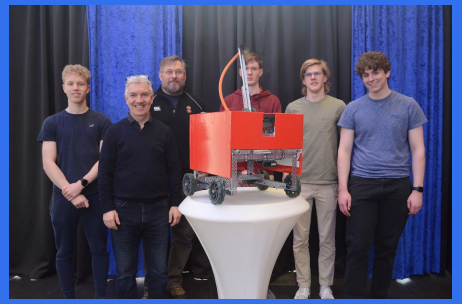
Meet other robots

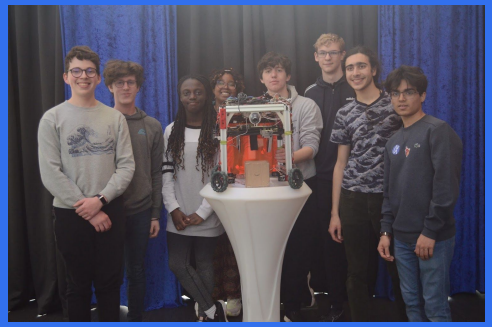
Meet other people

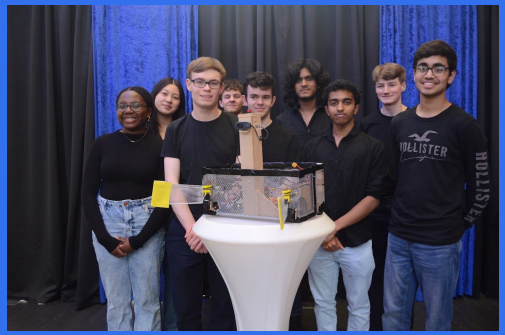
Score some points

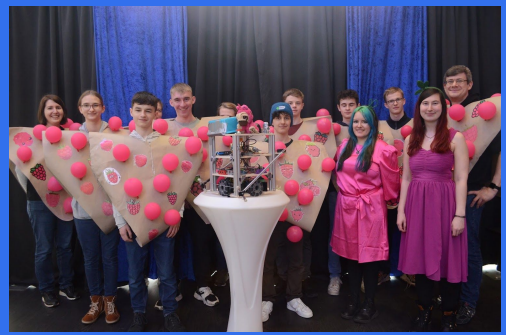
Win some prizes

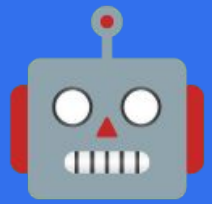
Have fun!

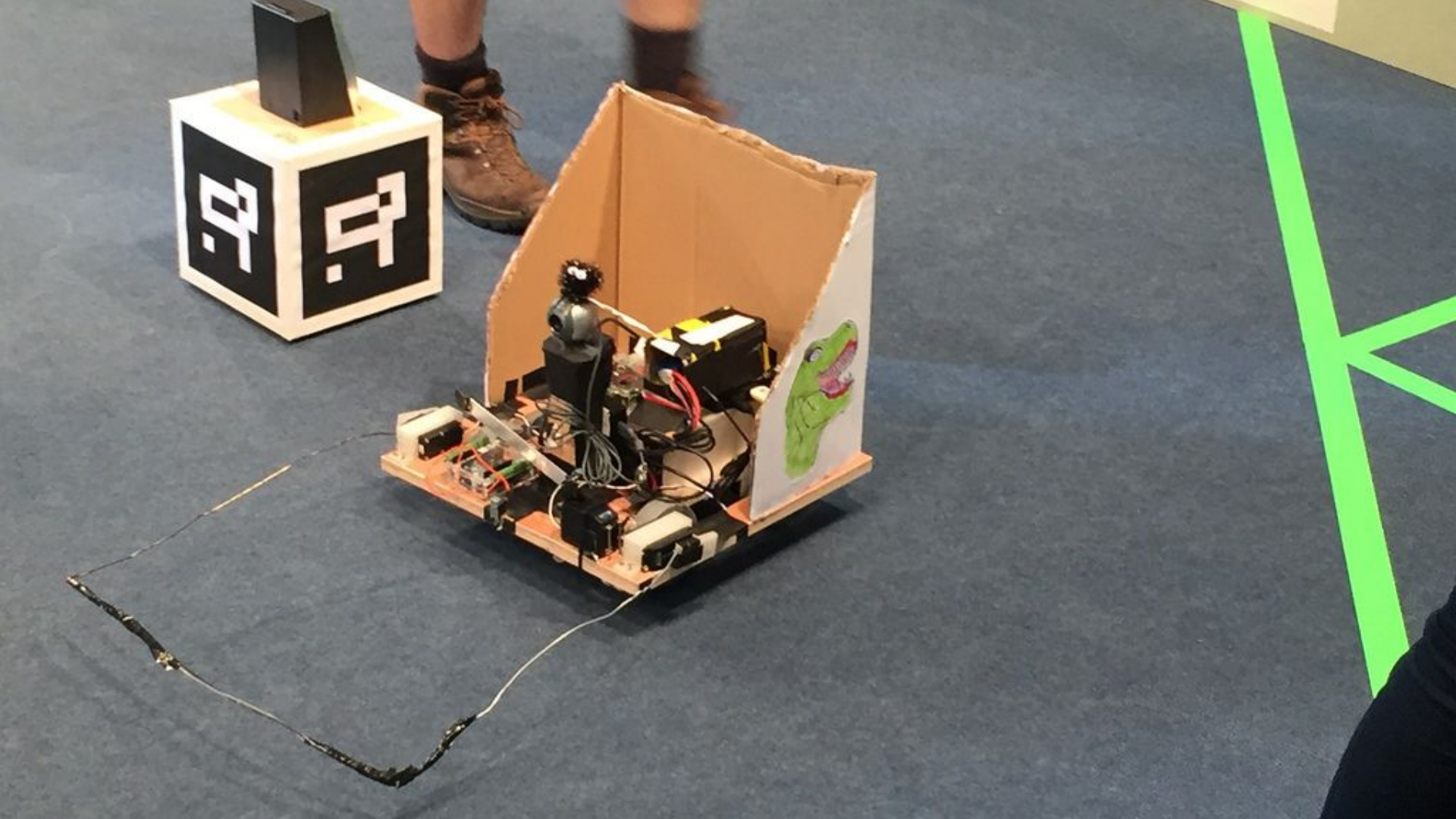


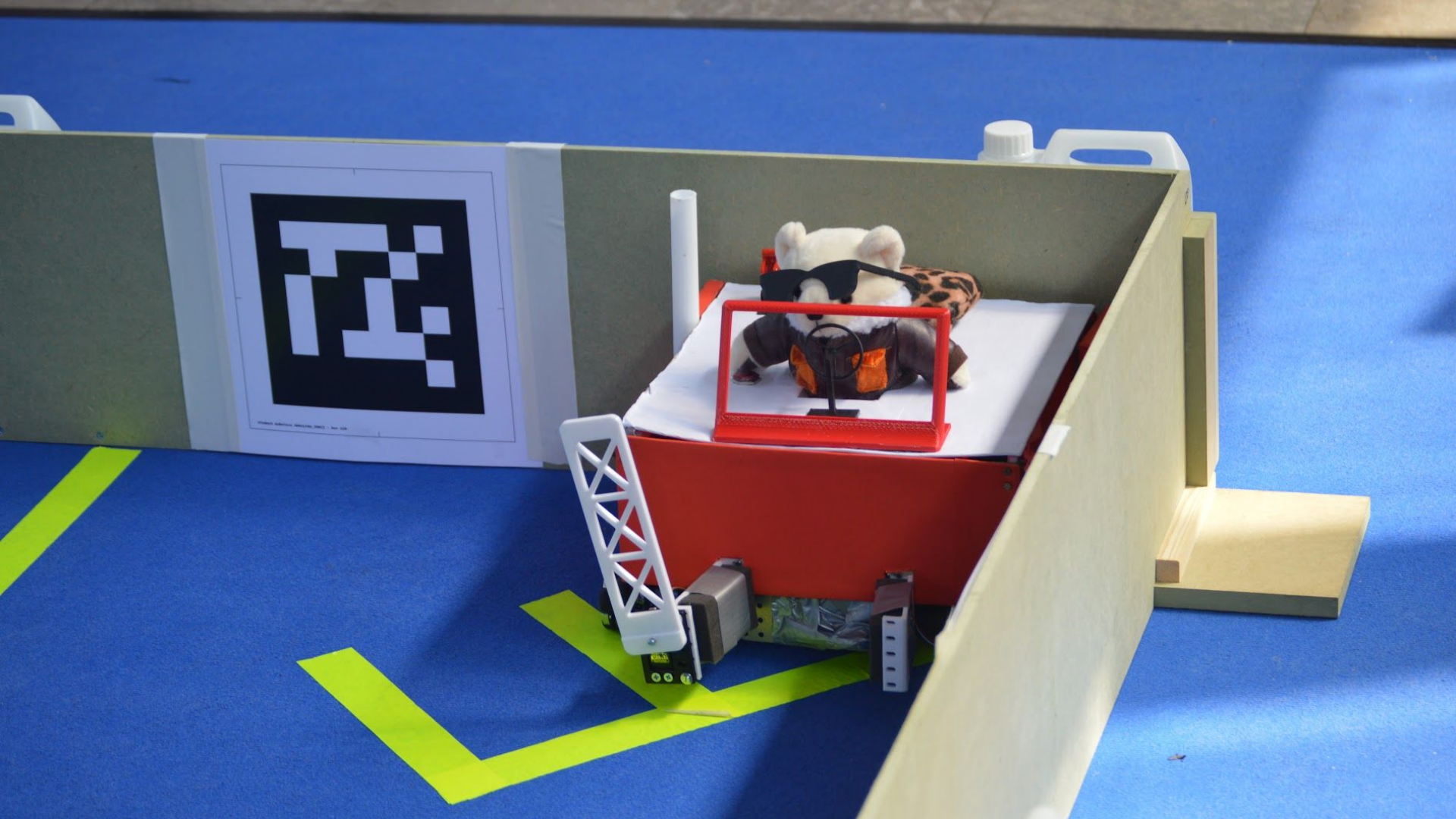


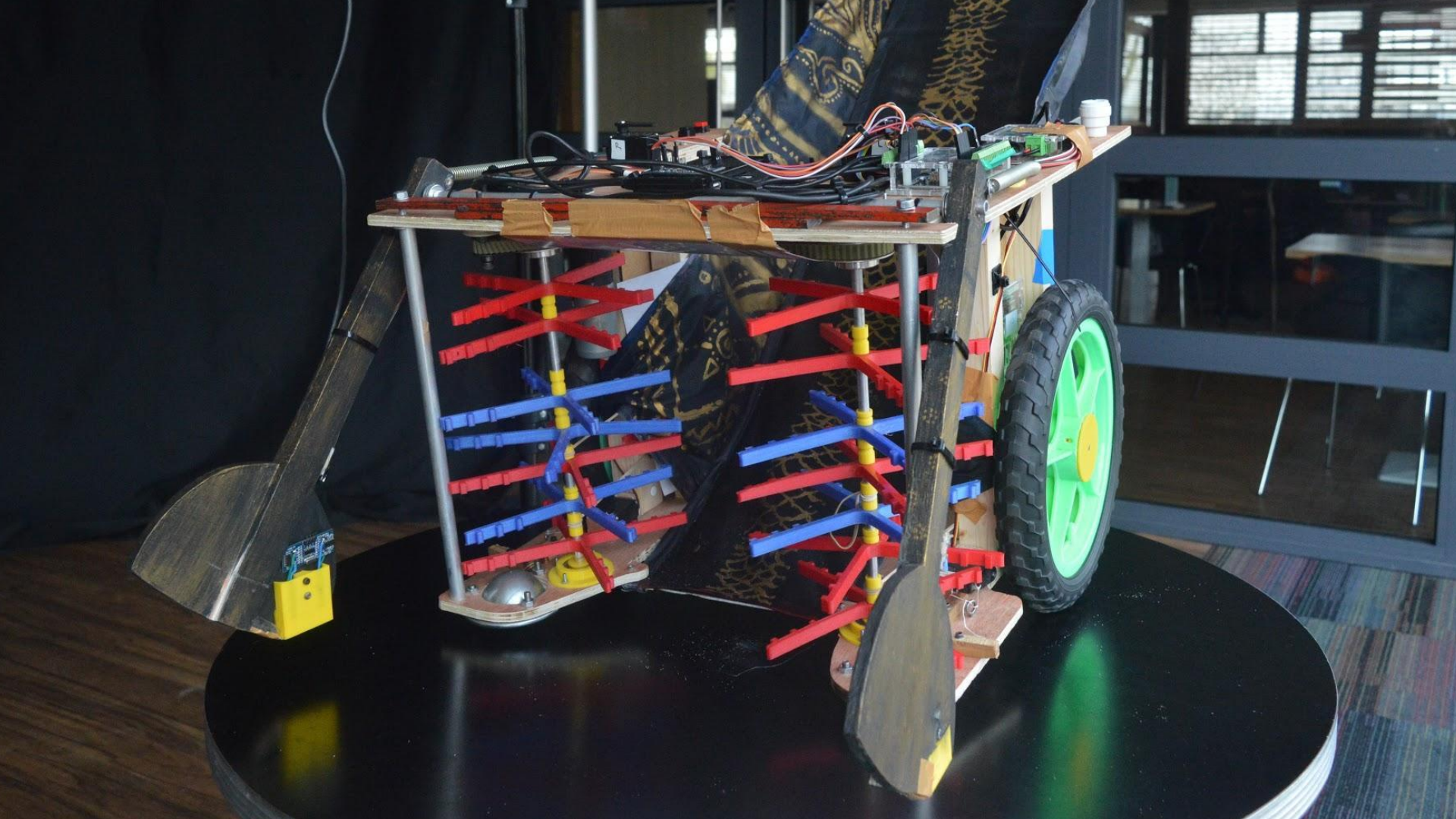


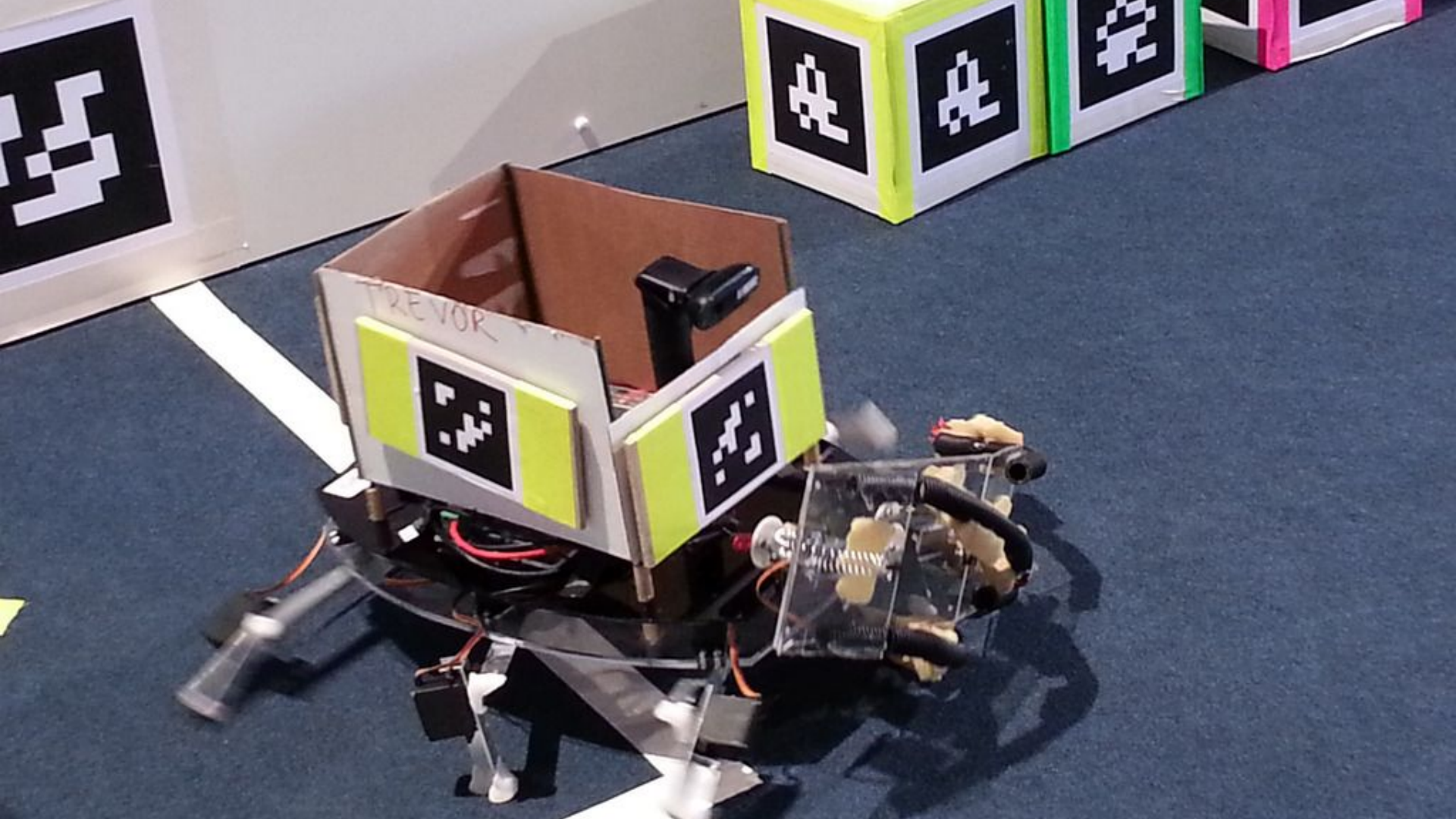


What does a  look like?

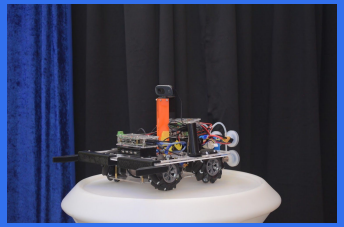


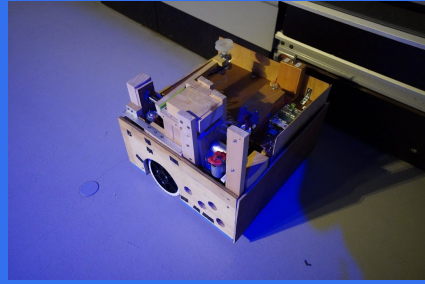


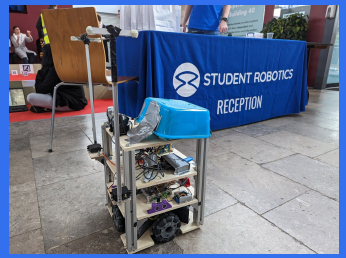


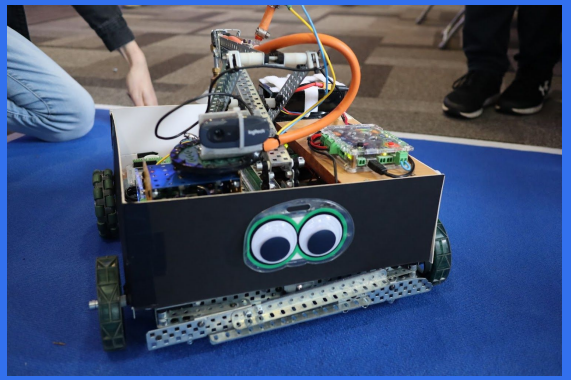

TREVOR

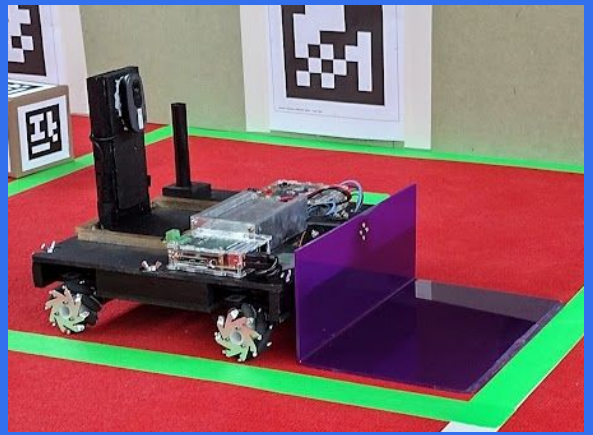
KNIGHT BUS

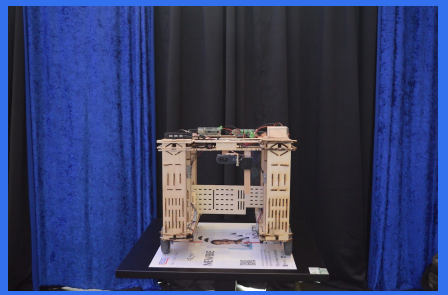





STUDENT ROBOTICS
RECEPTION

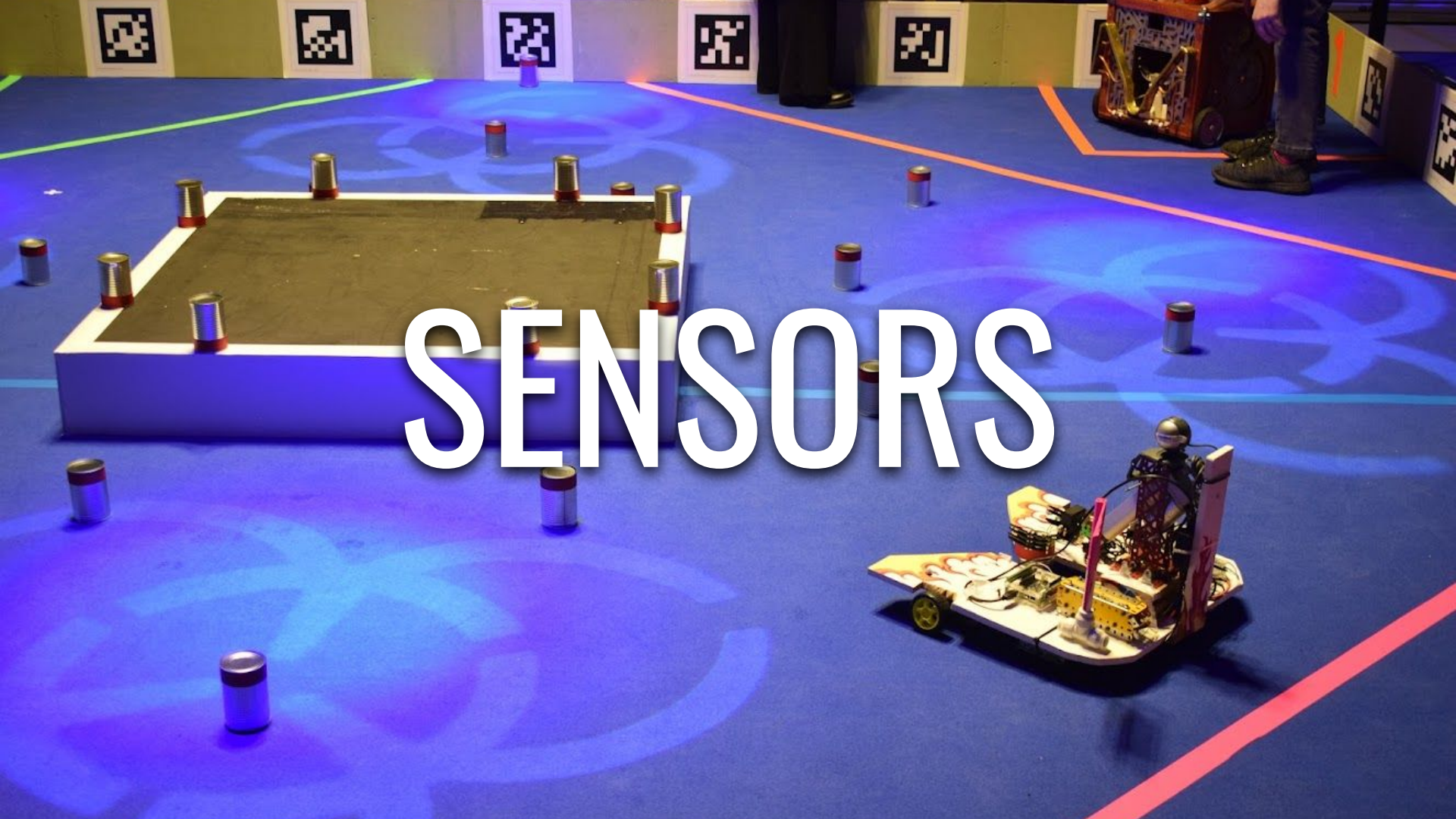


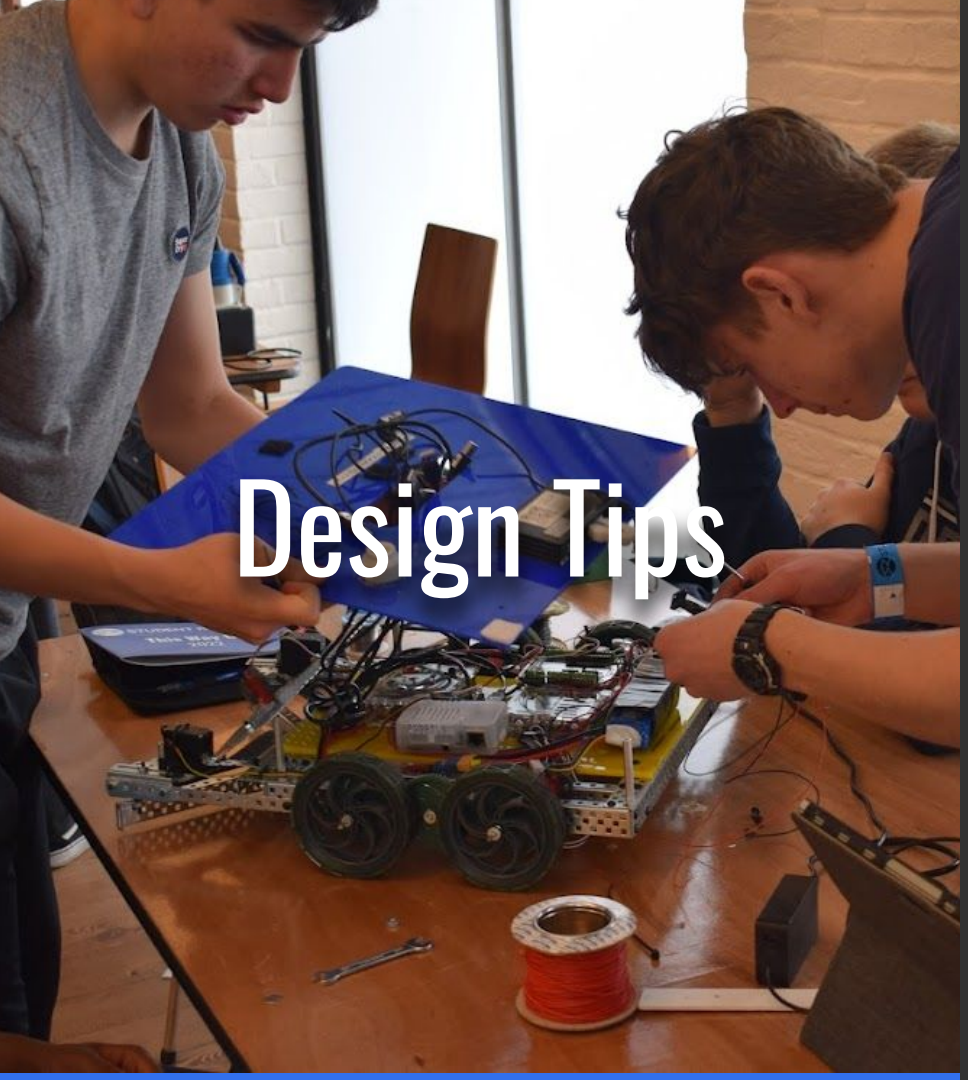




Design Tips

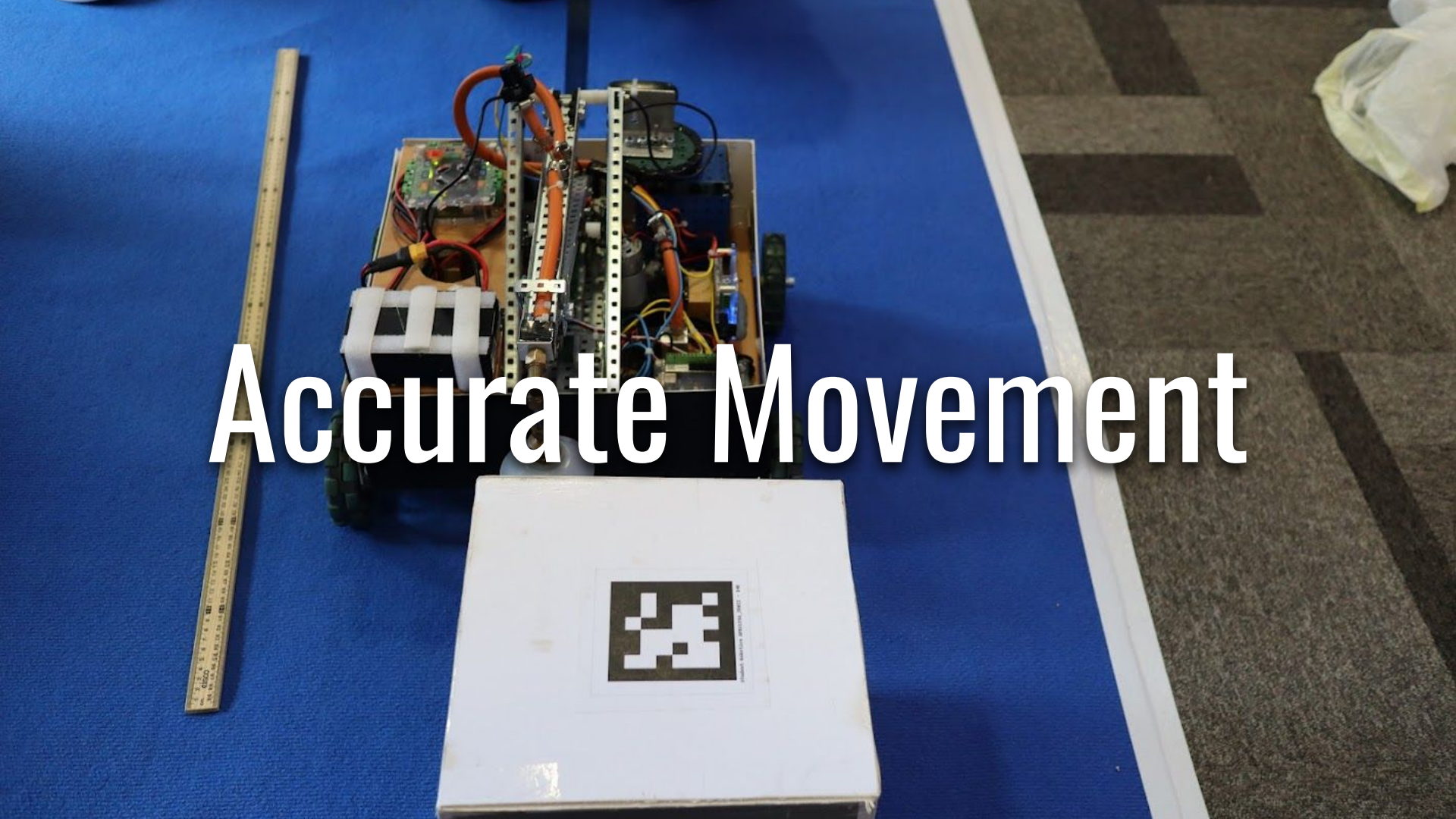
- **Read the rules!**
- Movement
- Exposed Mechanisms
- Servos
- Couplings
- Size
- Tooling
- Sensors


SENSORS



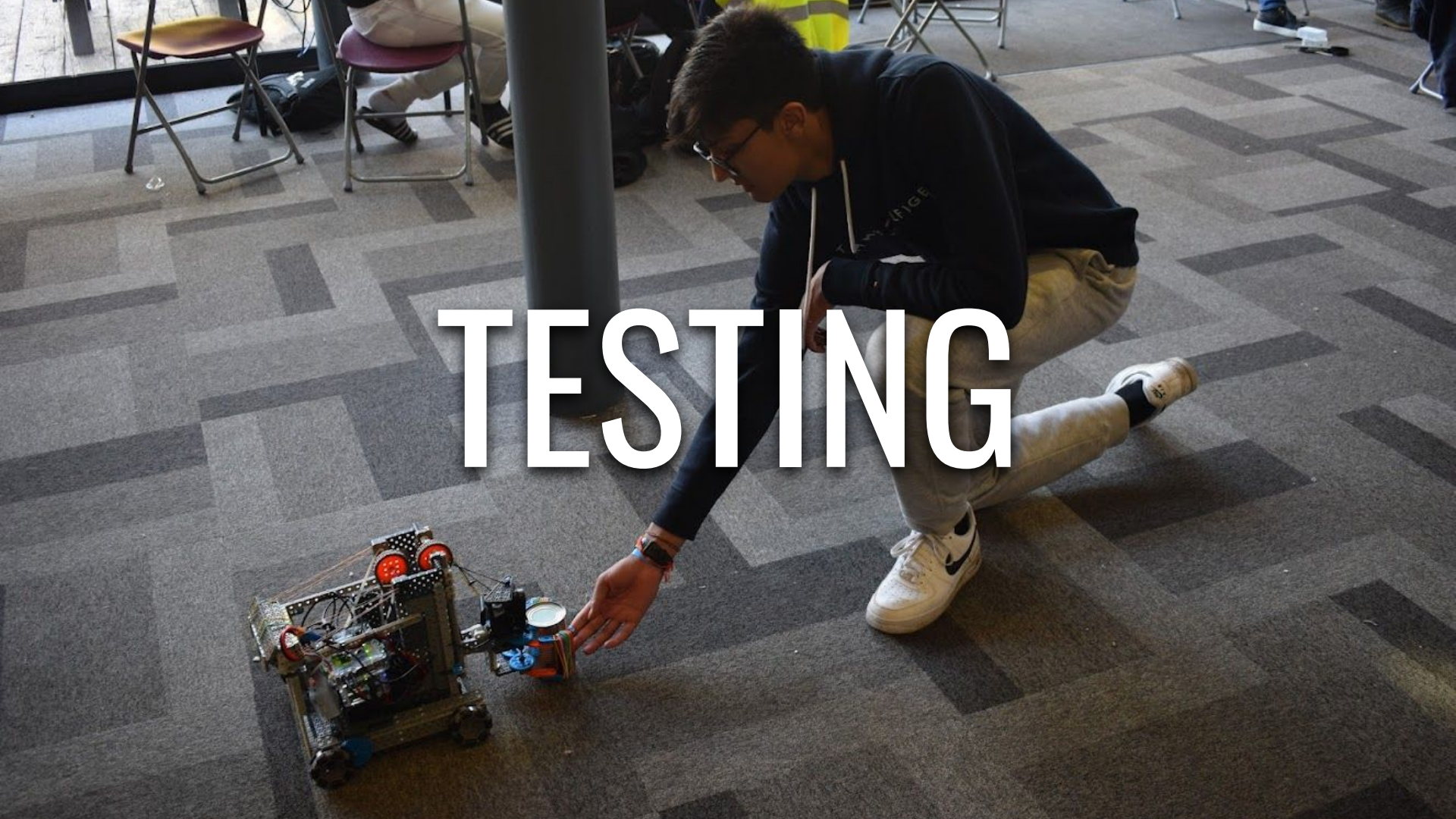
Electronics

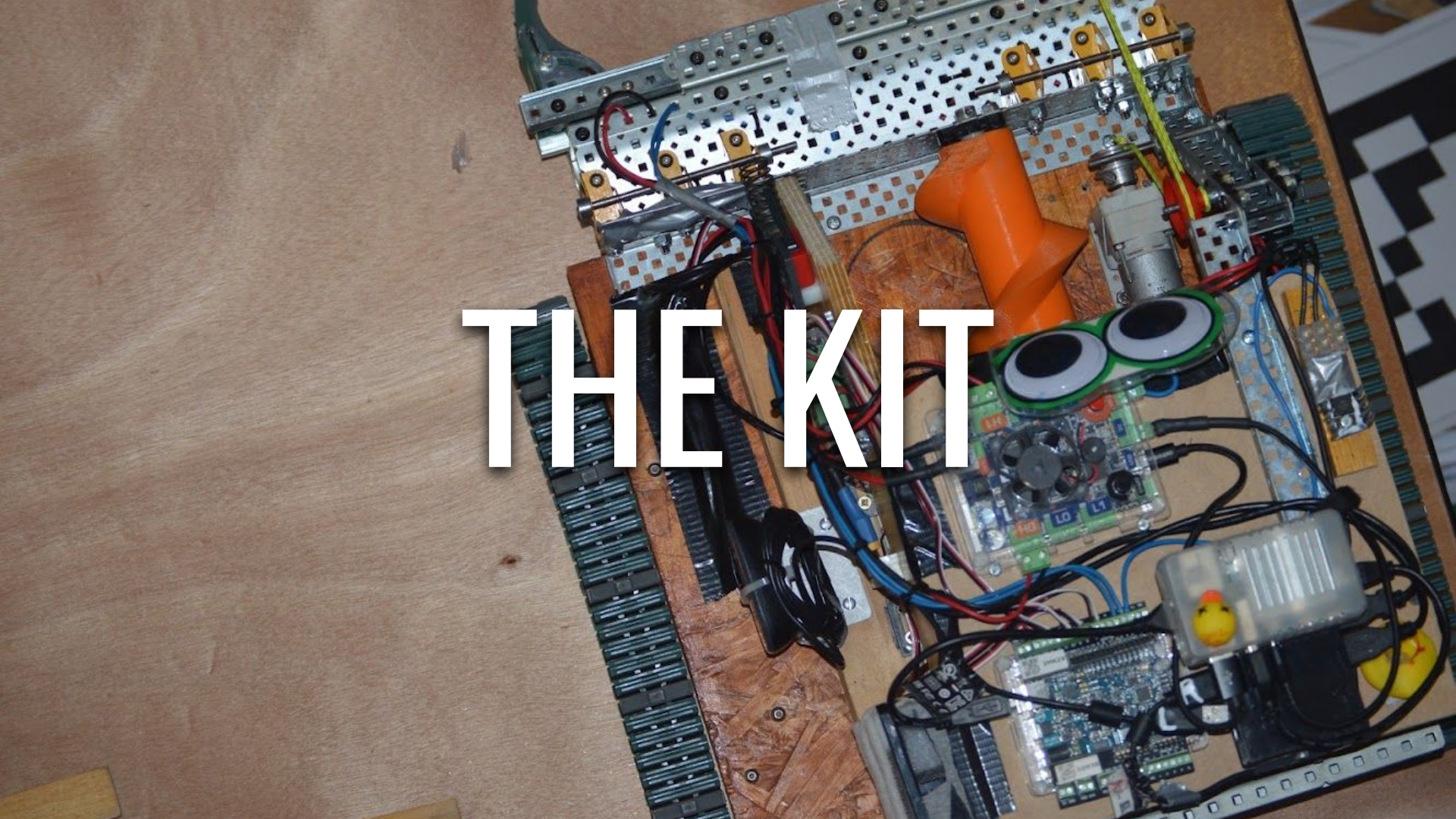
- Where do your electronics go?
- How long should the wires be?
- Start/Stop button needs to be accessible
- USB stick(s) needs to be accessible
- Battery needs protecting


Accurate Movement

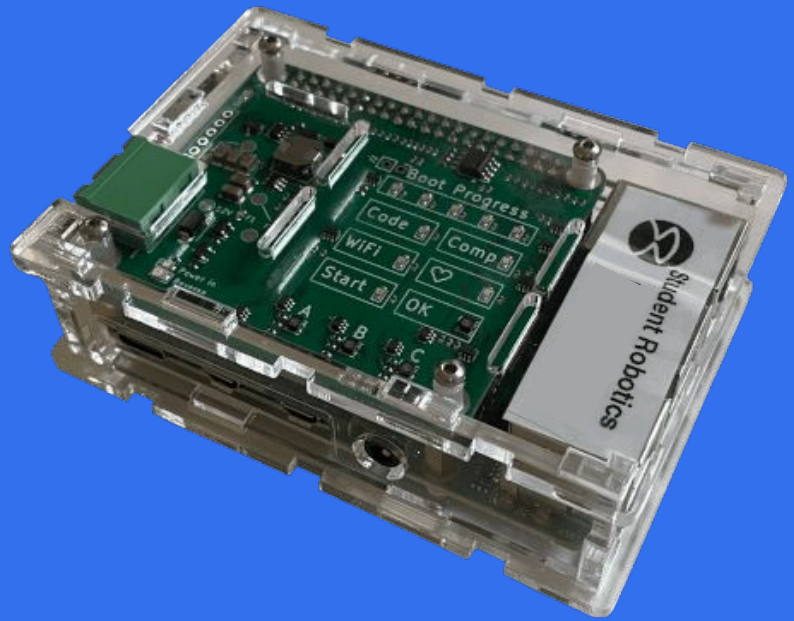
Recommended Procedure

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

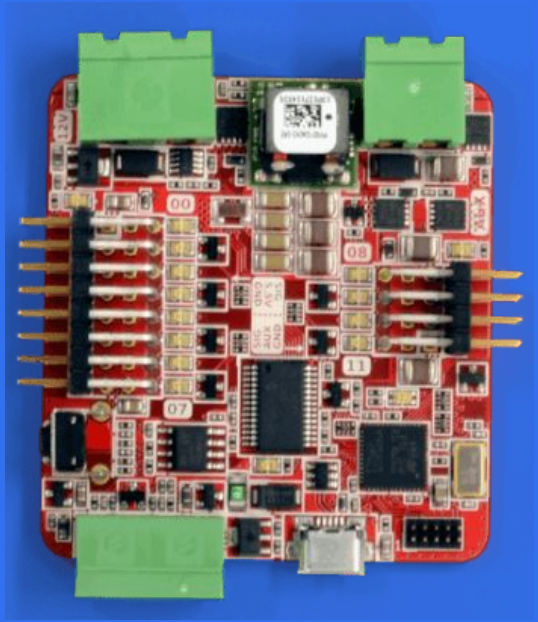
- Controls boards
- Code runs here
- Raspberry Pi 4 with a KCH
- Controllable RGB LEDs

Motor Board

Controls motors

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

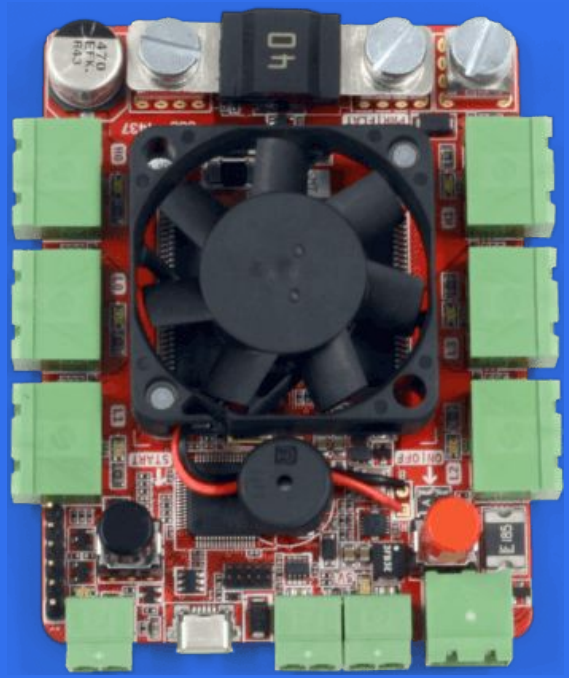
Servo Board



Controls servos

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

Power Board



POOOWWWWEEEEERRRR!

- 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**!

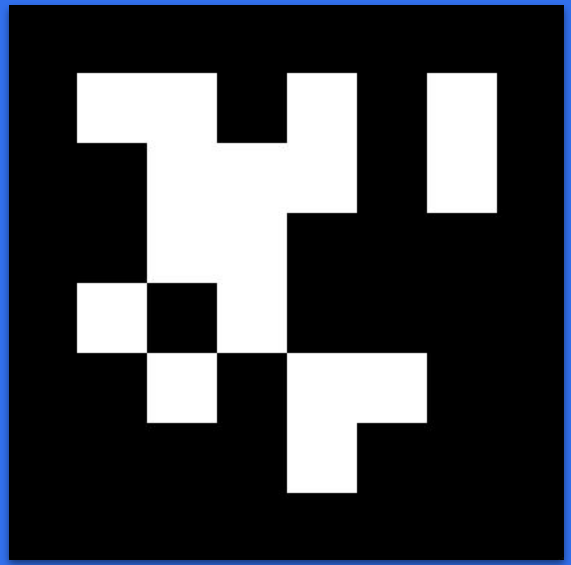
Arduino

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

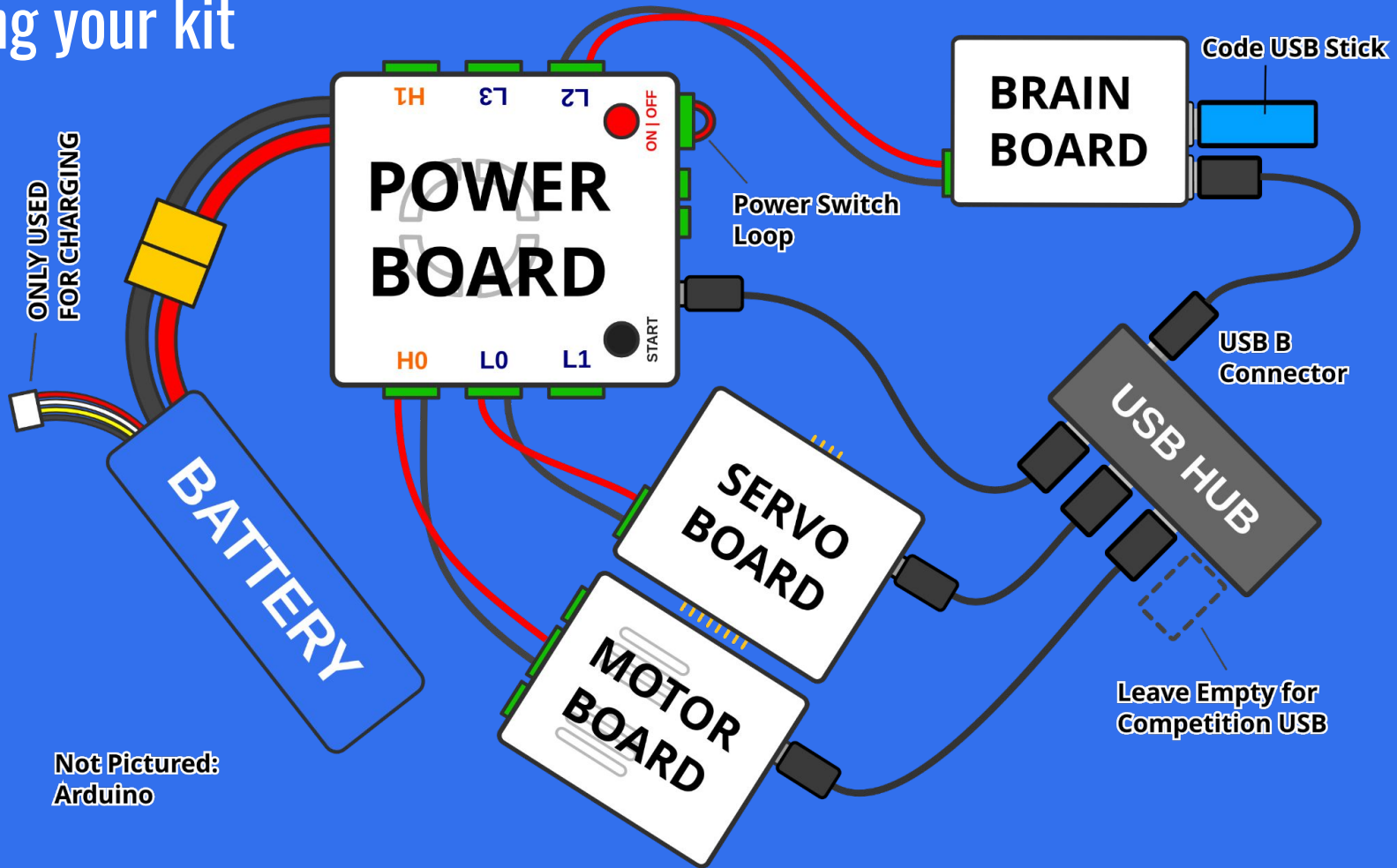
Fiducial Markers

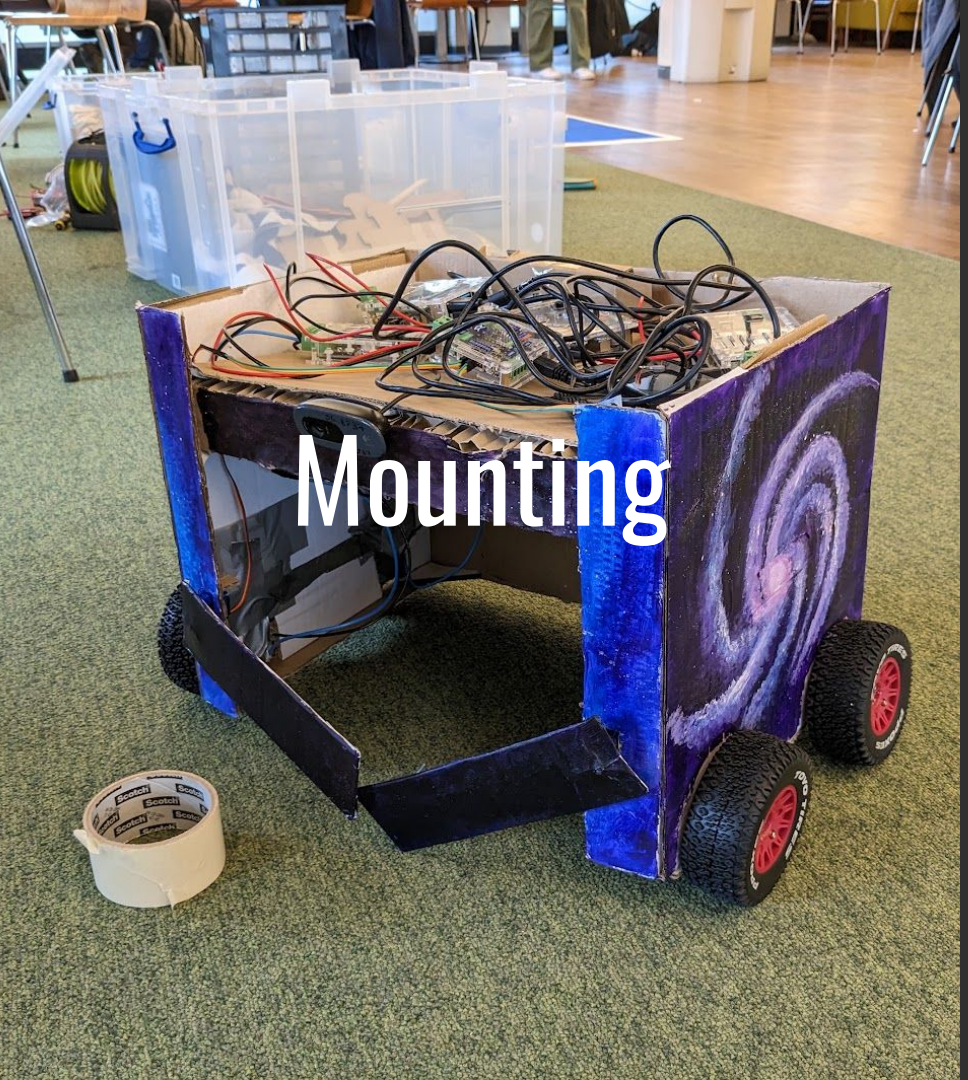


- On arena walls and props
- Properties:
  - Type
  - ID
  - Distance from webcam
  - Position relative to webcam
  - Orientation

Carpet

Connecting your kit

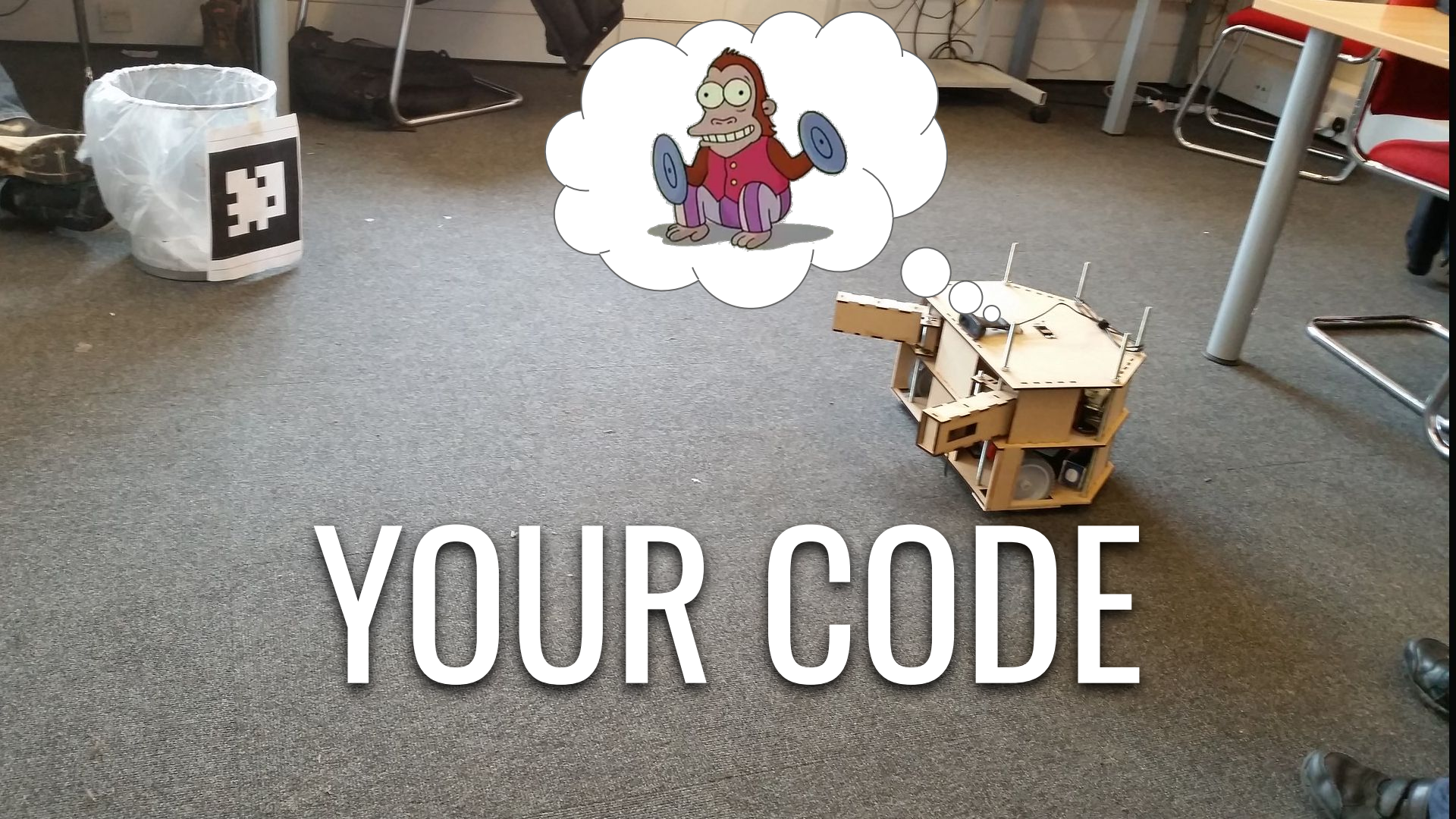




Mounting

- Screws ✅
- Velcro ✅
- Cable Ties ✅
- Screws (through the provided case holes) ✅

- Gravity ❌
- Hot Glue ❌
- Tape ❌
- PVA ❌
- Blu Tack ❌


YOUR CODE

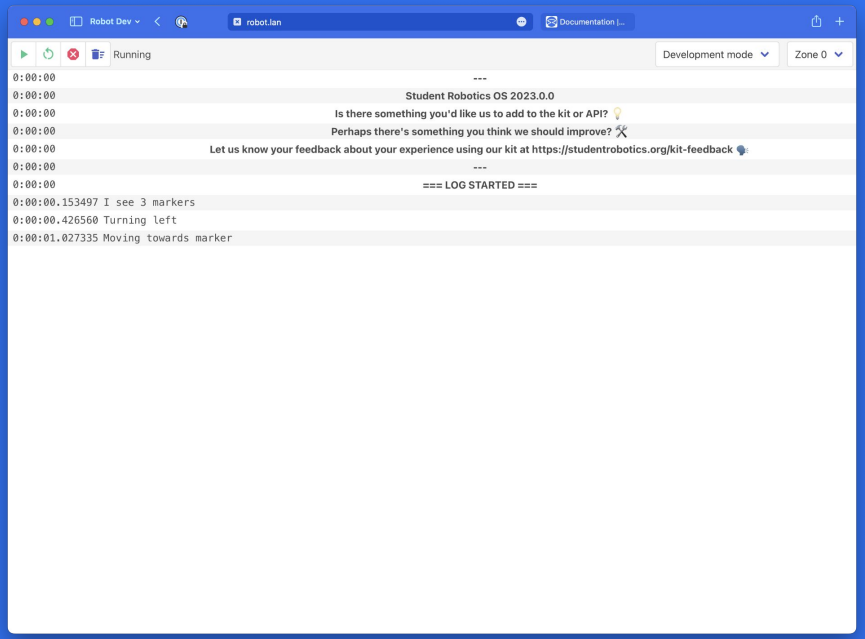
Your Code

- 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



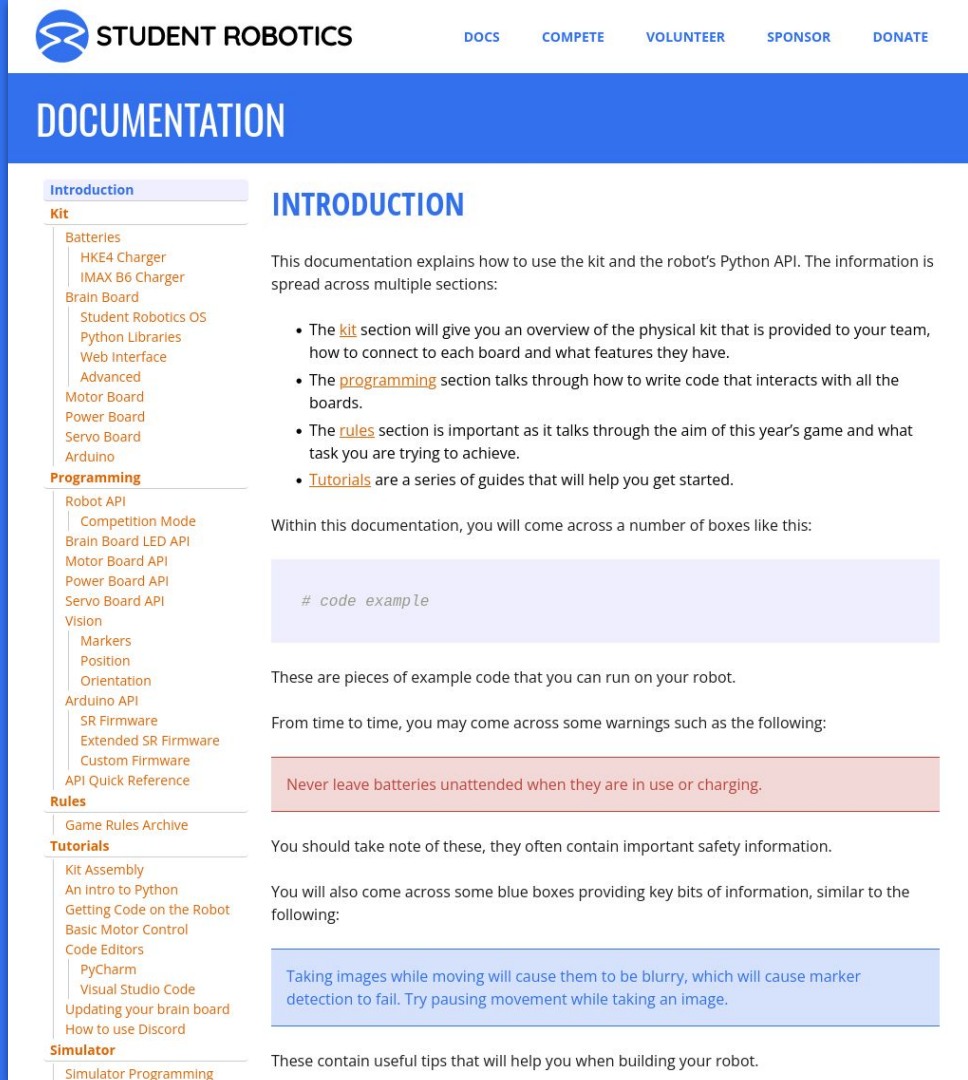
- WiFi
- Live logs
- 1-click start
- 1-click *re*start

Kit Changes

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

Read The Docs!

srobo.org/docs



STUDENT ROBOTICS

DOCS COMPETE VOLUNTEER SPONSOR DONATE

DOCUMENTATION

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:

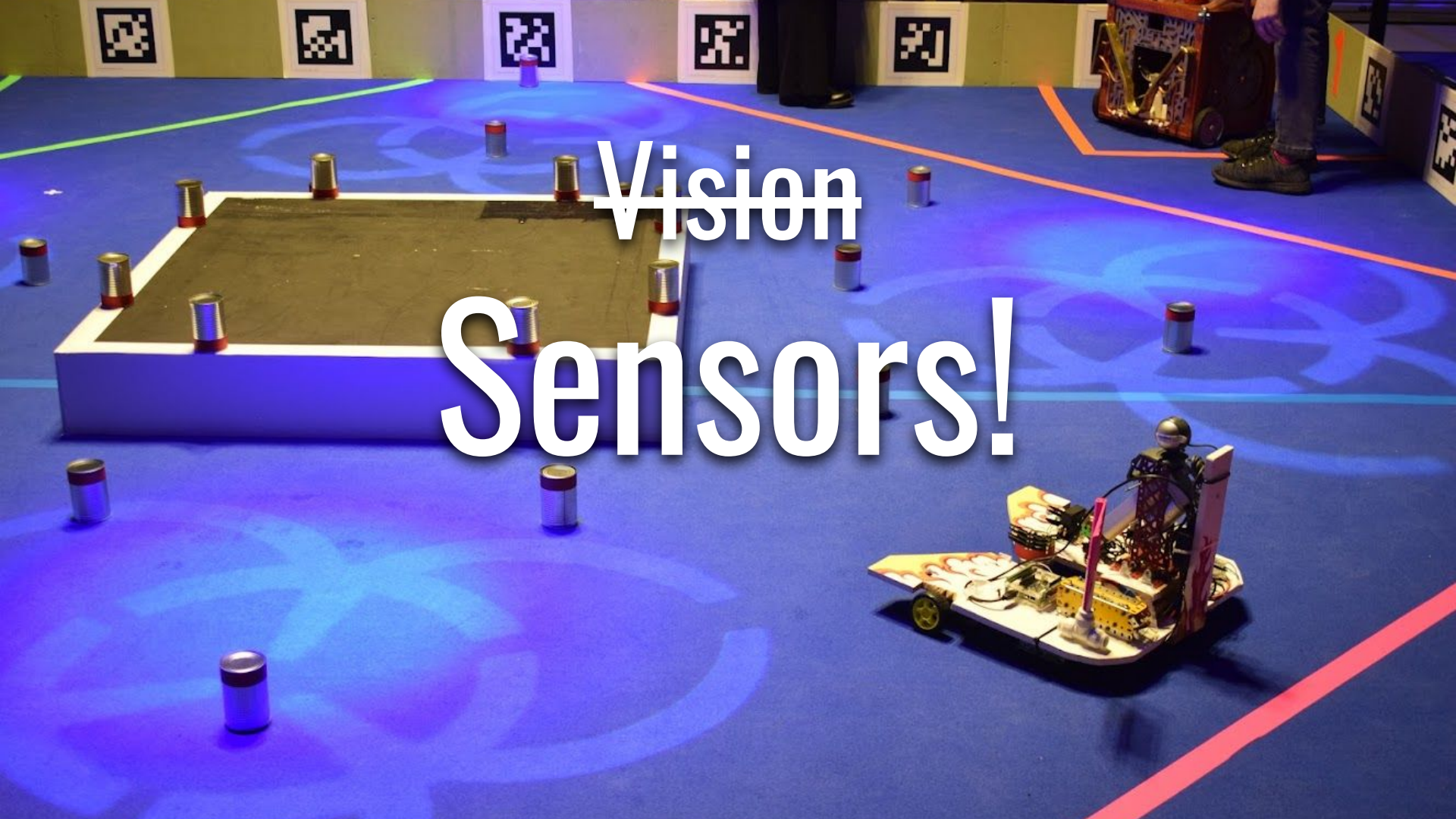
Never leave batteries unattended when they are in use or charging.

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.

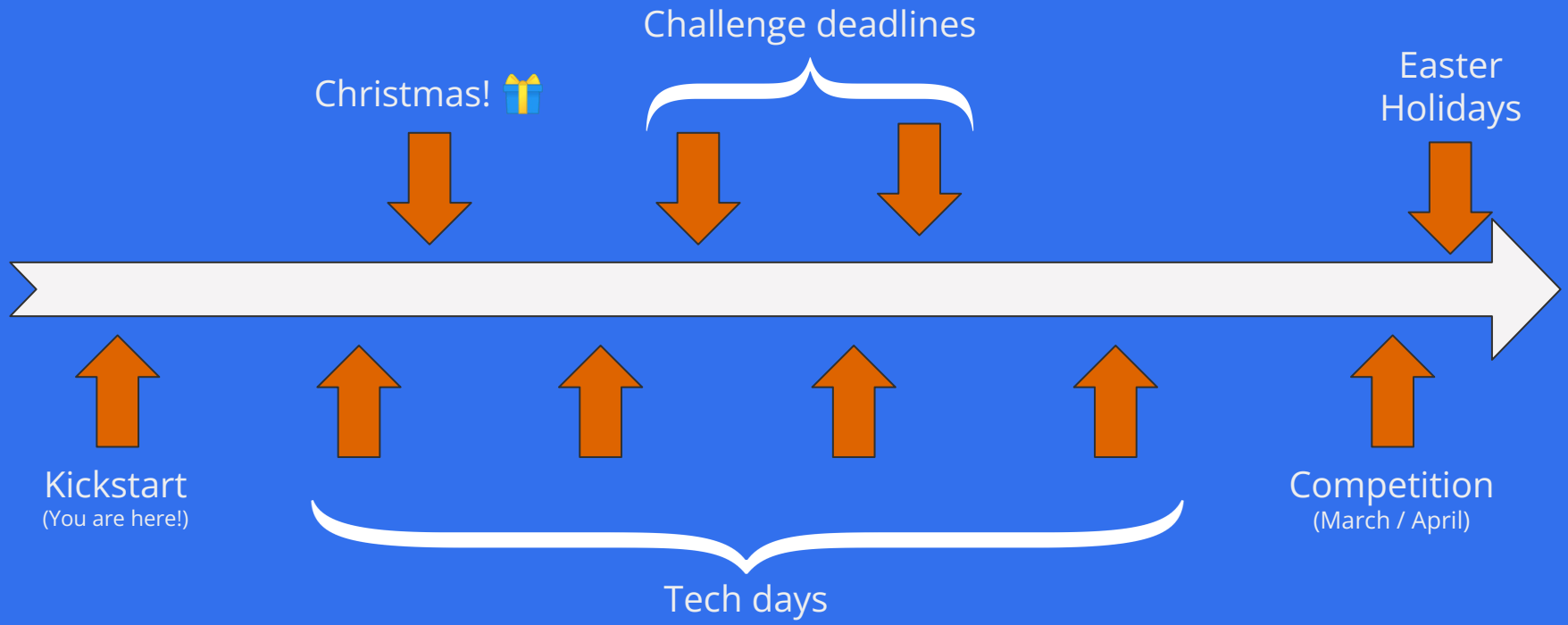
These contain useful tips that will help you when building your robot.


~~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

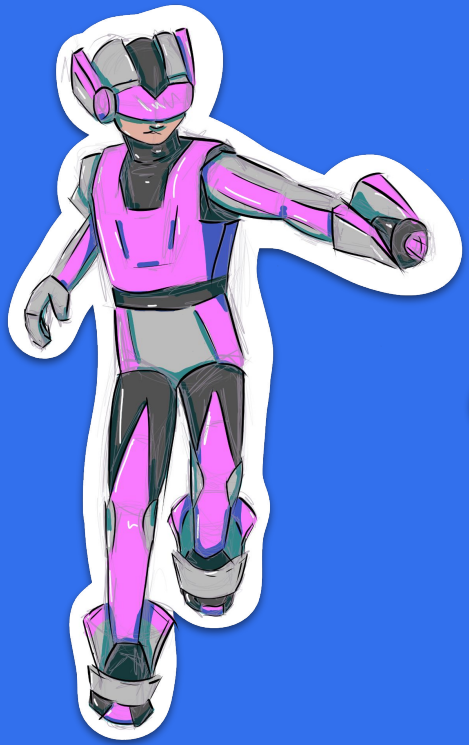
- Communicate with us and your fellow teams
- Get support
- Share tricks
- Brag about how good your team is!

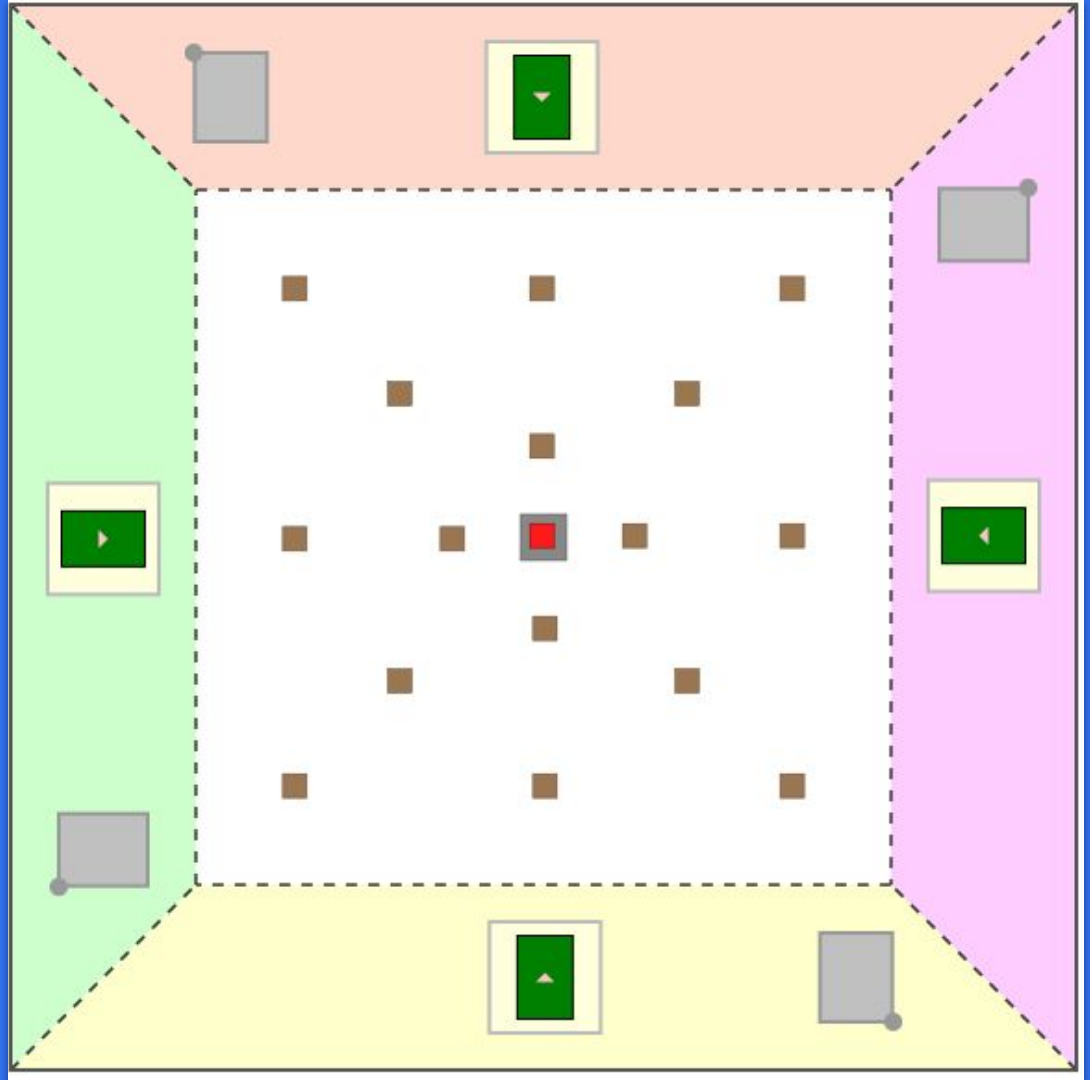
THE GAME?

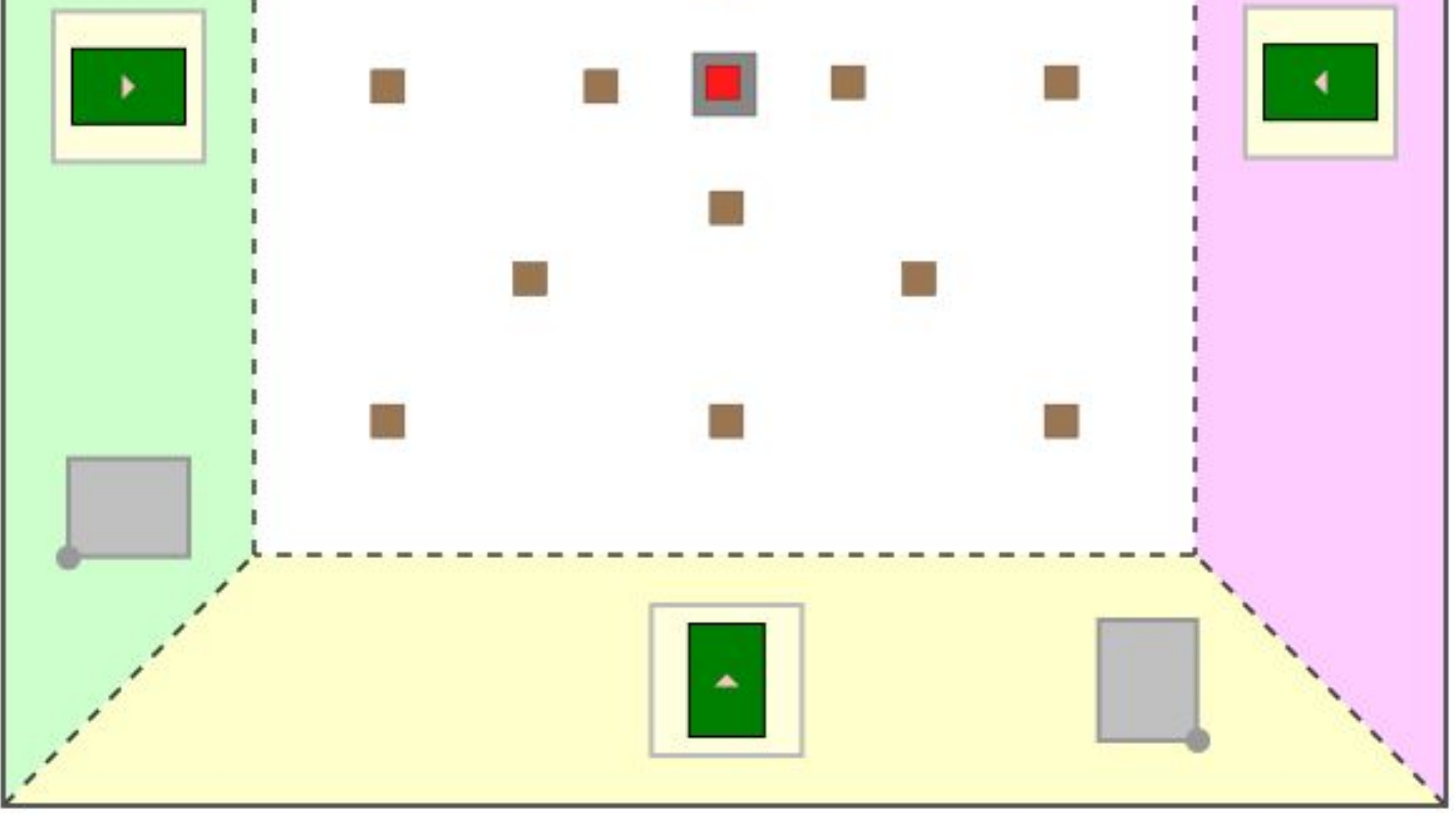
The moment you've all been waiting for!

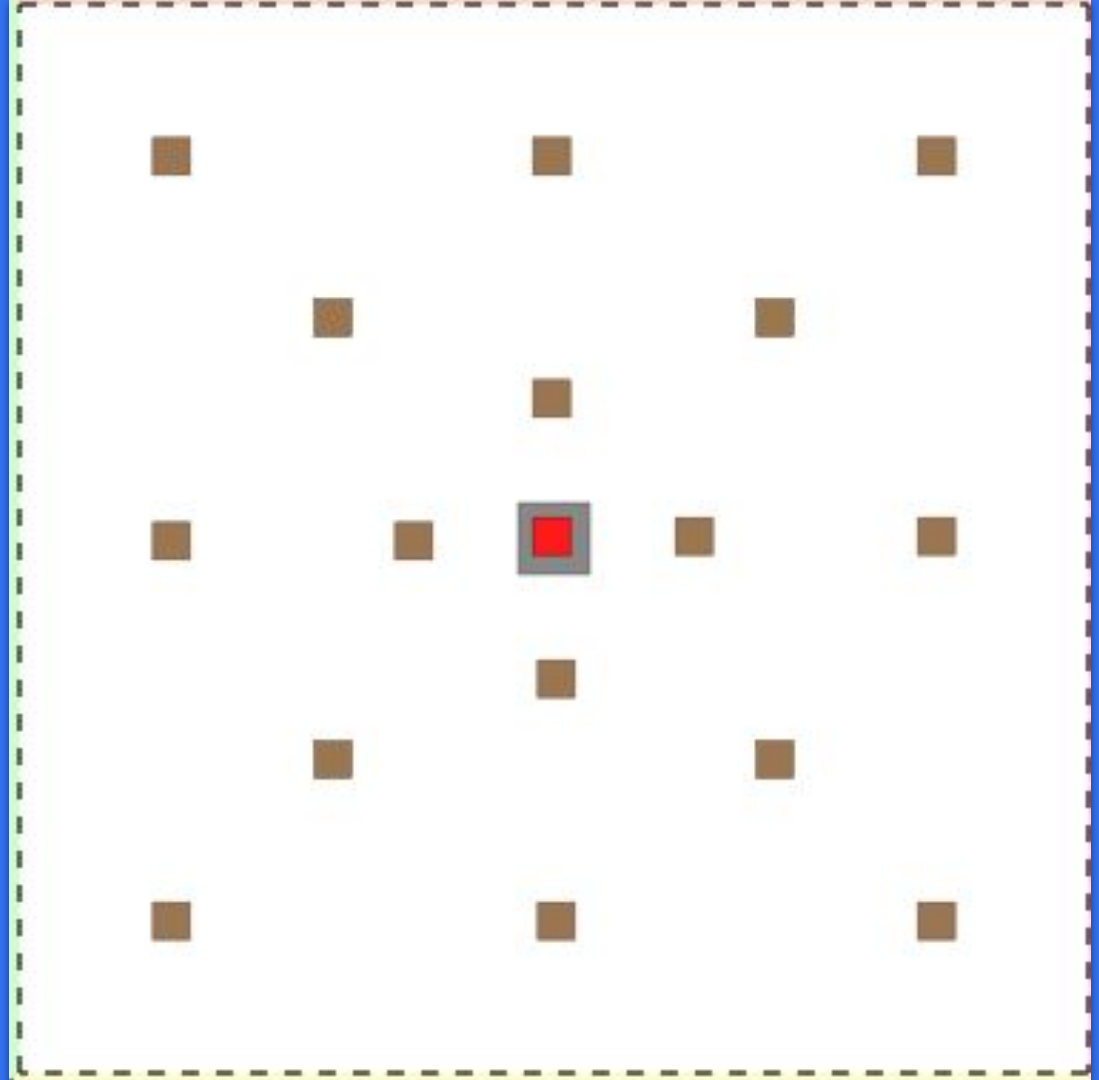
Final Frontier
SR2024

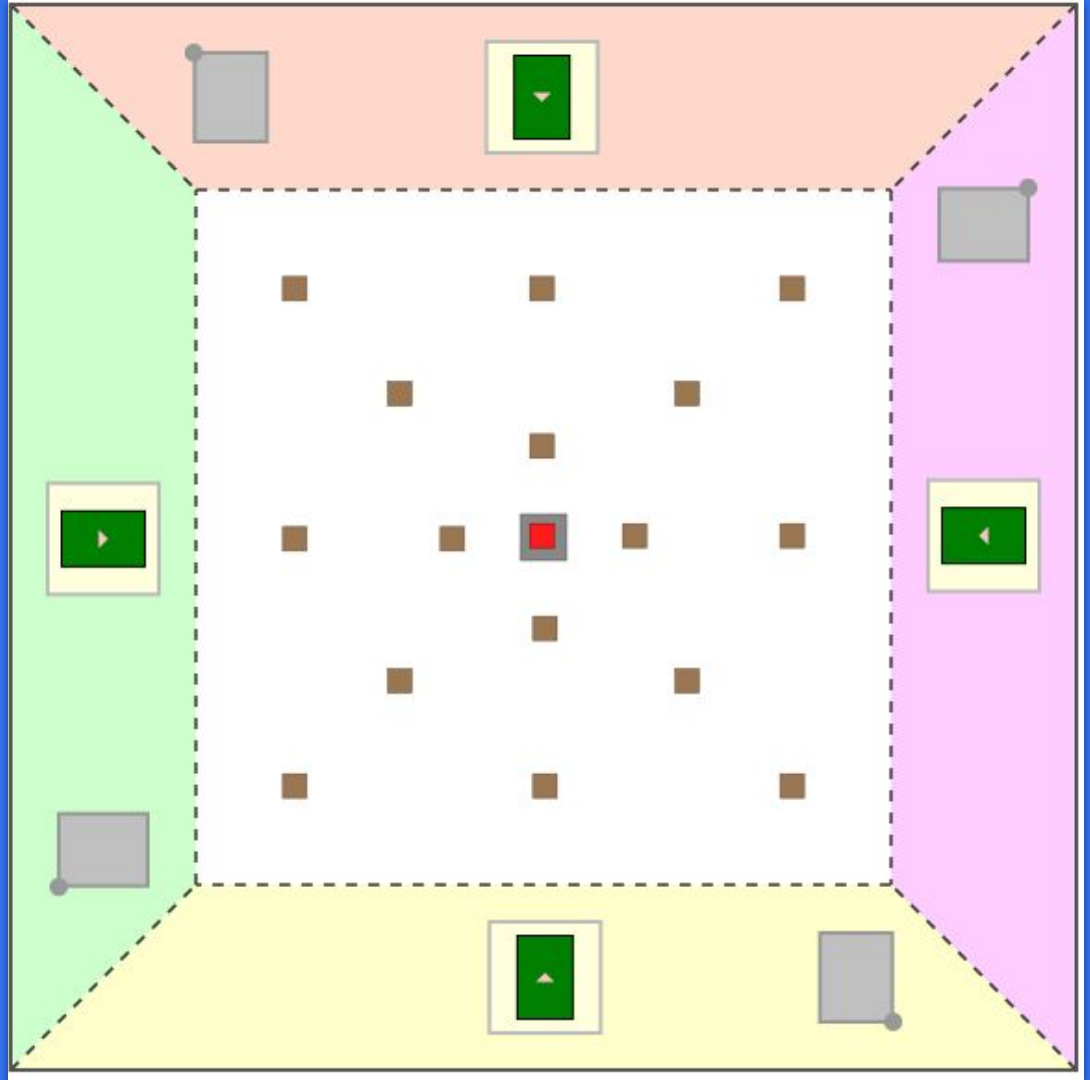
Backstory

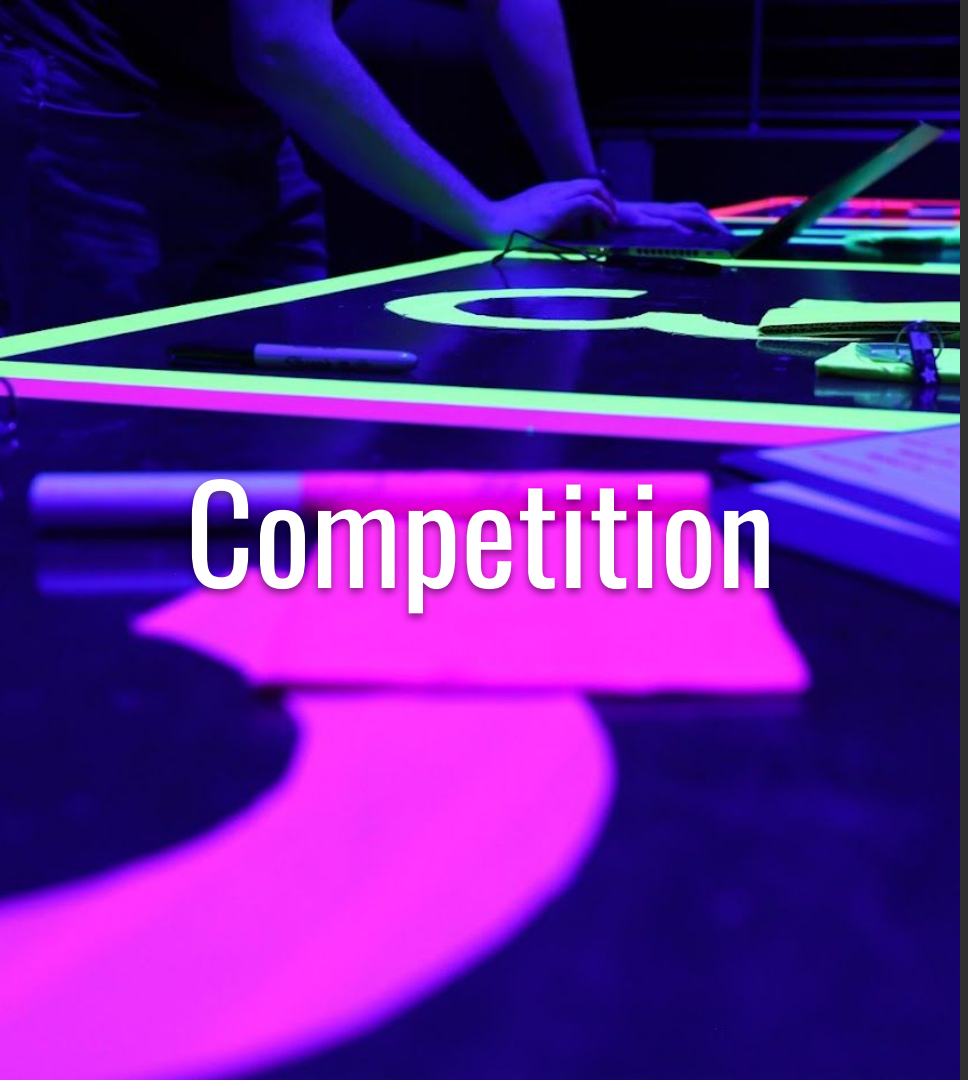












Competition

1. Challenges
2. League
3. Knockouts

STUDENT ROBOTICS
CHALLENGES

Challenges

- Movement
- Mechanics
- Vision

Challenge Submission Dates

- January 7th
- February 4th

PRIZES

STUDENT ROBOTICS
ADVENTUROUS MACHINES
UNIVERSITY OF Southampton

First Place

Second Place

Third Place

Obviously!

Excellence in Engineering

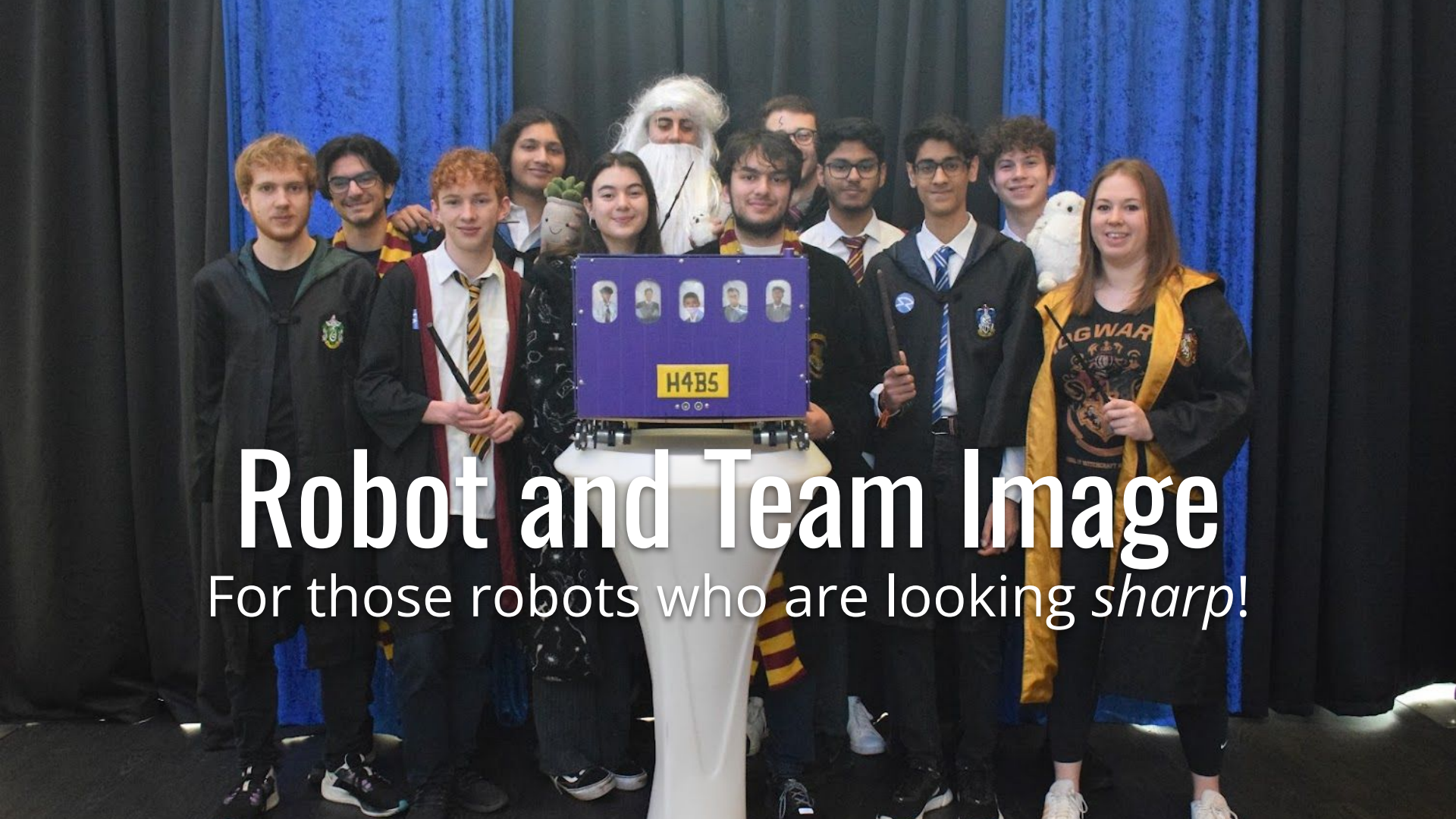
For ingenuity & elegance in robot design

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!

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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...

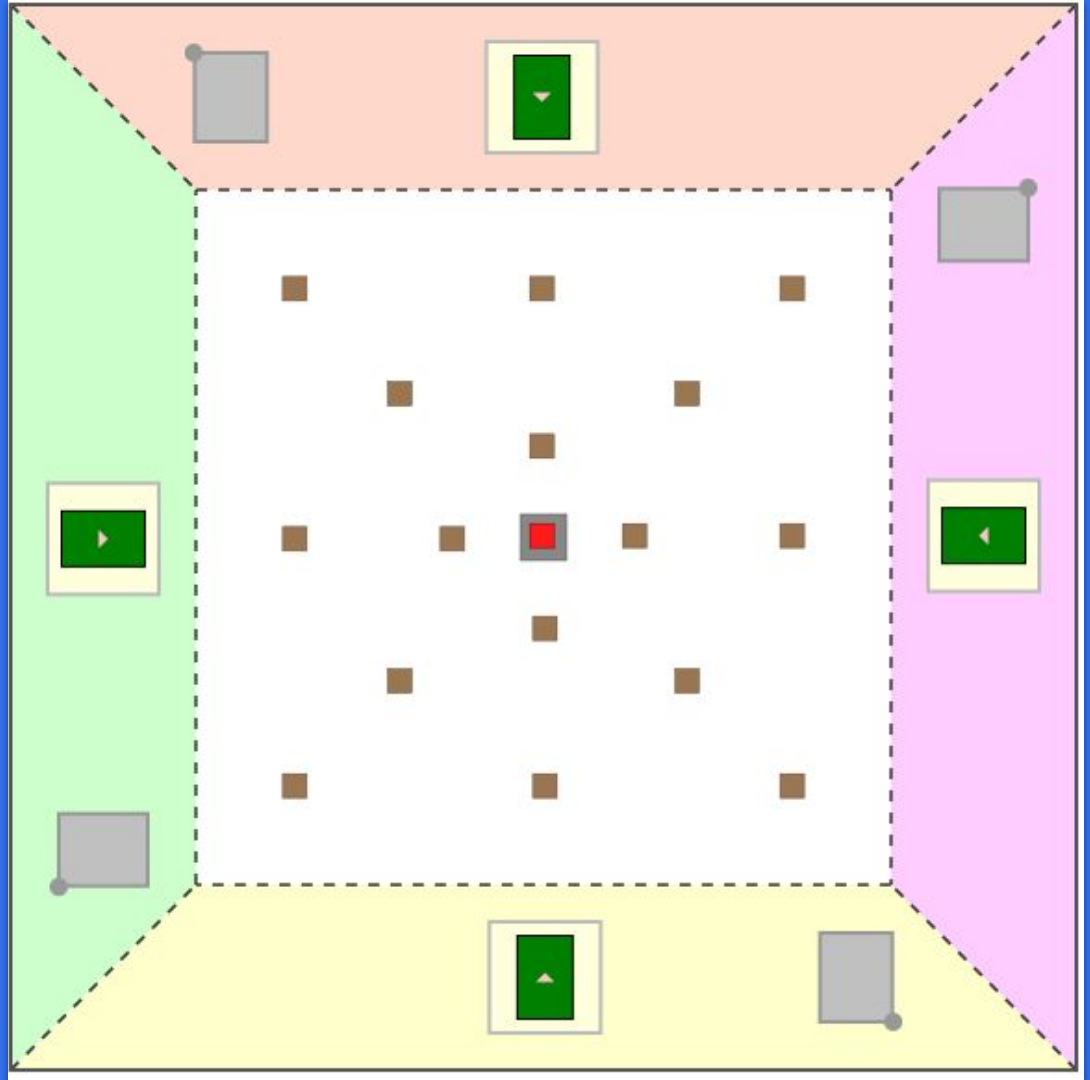
GAME RULES

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!

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