Task:

Build a mobile robot to collect and store as many ball bearings of a known diameter and appearance as possible. Target bearings will be spread across an arena, with distractor bearings intermixed.

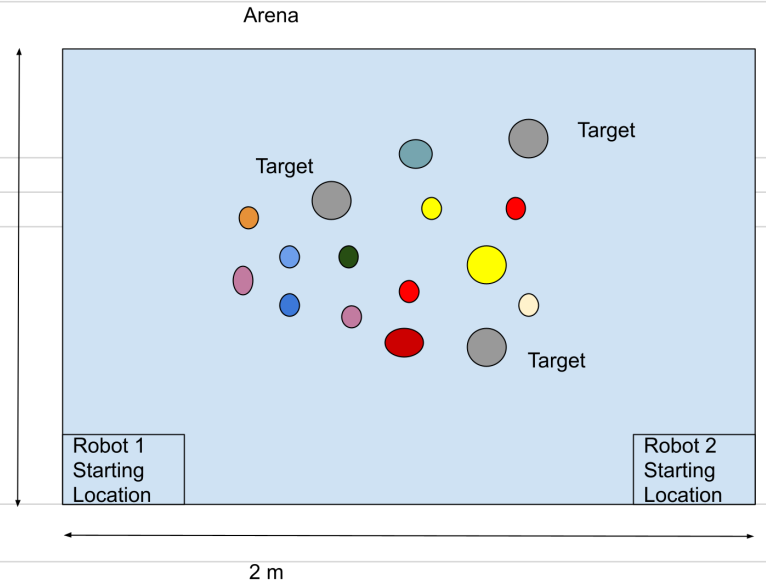
Two robots will compete simultaneously to collect bearings, 10 points obtained for every correct bearing captured. A 5 point penalty will be deducted each time a robot incorrectly collects the wrong bearing, collides with the arena walls, or with another robot.

Components:

You will be provided with the following to help you achieve this:

- 1 x Dual motor Tamiya gearbox and 2 DC motors
- 1 x Motor encoder
- 1 x Castor wheel
- 1 x Standard robot base
- 1 x Rasberry Pi Model 4 B+ and power supply
- 1 x Raspberry PI camera module
- 3 x Servo motors to build a pan-tilt unit to move the camera or design a suitable bearing collection mechanism.
- 2 x Ultrasound units for obstacle avoidance

You may use additional components and parts to customise the design, and are allowed to replace the Raspberry Pi with an alternative embedded device if desired.



You will also be provided with a number of opportunities to 3D print parts required for mechanisms you may wish to include.

This capstone project will bring together your skills and knowledge in sensors and artificial perception, telecommunications, information and networks, computer organisation and programming, digital systems and electrical circuits. However, the core learning outcomes of this project are to:

1. Apply in-depth electrical and computer systems engineering knowledge to compose and assess possible solutions for sub-problems in a complex engineering project, and select suitable solutions based on available data.

2. Analyse and identify possible causes for practical problems encountered in the complex engineering project, and solve these problems through appropriate research methods

3. Design a sustainable prototype according to specified project constraints whilst complying with health and safety requirements.

4. Demonstrate commitment to carry out the design project as an individual and as a member of a team

5. Demonstrate effective project management skills to carry out a project in an organised manner.

6. Generate written reports and oral presentations to communicate the outcomes of the project.

Teams:

You will be grouped into teams of 5, with team members selected to span multiple disciplines (Electrical and Computer Systems, Robotics and Mechatronics, AI Stream).

Teams will also have both remote and on-site members, and you will be required to collaborate across borders and timezones. This will be a particularly valuable exercise, exposing you to the realities of real world and the importance of project planning, clear role assignment and communication.

Design choices:

Along the way, you will be required to make a number of design choices.
- What operating system will you use on your processor?
- What programming language will you use to develop software - c++/ python, or something else?
- What mechanism will you use to capture the target objects?
- Will you use a static camera, or a moveable one?

We will provide some suggested approaches, but these certainly won't be the best (if such a thing exists), and you have complete freedom to change the design in any way you wish, add components (at your own expense), swap microprocessors, sensors, etc.