L1 Task: Find, Recover and Sort

Scenario

A technology demonstrator is required to show the capabilities of a wheeled robot to navigate obstacles, find objects and take decisions quickly and efficiently.

The ultimate objective is to find coloured blocks, determine their colour and deliver to the correct area based on their colour. The block can be delivered to the floor of the delivery area or onto the truck for extra points. The area contains white lines for guidance. An obstacle is situated between the starting and the drop off areas and the collection area which can be avoided by using either a ramp or tunnel. Each time a block is transported back across the obstacle a new block will be placed on one of the collection markers.

Deliverables

	Week 1					Week 2					Week 3					Week 4						Week 5					Week 6
	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	T	F	M	T	W	T	F	M	T	W	T
Reports						1st																	F				
Peer Assessment	�©					▨		▦			▨		▦												▨		▦
Competition																▪					▪						
Meeting/ Presentation				▪					▪					▪					▪								

Description	Deadline	Time
Initial blank peer assessments submission **(for all 3 assessments)**	20/01/2023	4pm
1st Presentation on design options	24/01/2023	9-11am
Initial report detailing project management and approach to problem	26/01/2023	4pm
Peer assessment 1 - evaluation deadline	30/01/2023	4pm
Peer assessment 2 – evaluation deadline	06/02/2023	4pm
First Competition	09/02/2023	9-11am
Final Presentation	14/02/2023	9-11am
Final Competition Robot assessment of build quality	15/02/2023	2-4pm
Robot build documentation (drawings, schematics, software doc and code)	20/02/2023	4pm
Final report including sub-team approach, analysis of the performance, recommendations	20/02/2023	4pm
Peer assessment 3 – evaluation deadline	23/02/2023	4pm

Standard Specification

- The robot must not have any sharp edges and must be safe around humans.
- The robot must display a flashing amber light (2Hz±10%) when and only when it is moving.
- The robot must be of modular construction and use standard components where possible to allow easy maintenance and repair in the field e.g. access to exchange motors, modules have plugs/sockets, fixings accessible.
- The robot must be well constructed i.e. not held together with tape and glue, unsupported/protected cables, parts not fixed down.
- The robot must be started in a controlled manner by pressing a push button switch or entering a command on the workstation.
- The robot must clearly display the team number on top (visible to the overhead camera) for all testing in black Arial font on a white background no smaller than 50mm high for all testing.
- All cabling must be neatly installed.
- Cable colouring must conform to the site regulations: red power +, black power -, all other colours can be used for signal/control.

- A complete set of mechanical drawings and electrical drawings are required of a standard which would allow another engineer to replicate the robot, or carry out repairs.
- A software print out and flow chart is required.
- Software should be maintainable and commented.
- The robot must fit entirely in the start/finish area.

The only interaction permitted is between the robot and a workstation. No information may be entered at the terminal during a run, except for a single instruction for the robot to return. The same program must be run after each restart.

Task Specific Specification

- Blocks should be clearly identified before they are transported. This should be indicated by illuminating a red LED for red blocks and a green LED for blue blocks. The LED should clearly illuminate for >5 seconds while the robot is stationary.
- Red blocks should be delivered to the red drop off square, blue blocks should be delivered to the green drop off square.
- The robot may traverse between the two sides of the table by either the ramp or tunnel.
- Blocks will be scored for delivery at the end of the task, with more points to those placed on the trucks.
- Only a single block may be transported at a time.

Evaluation

This will be judged upon the following:

- Teamwork and Time management
- H&S awareness and application
- Meeting the specification
- Physical testing
- Build quality
- Staged and final reporting.

Demonstration Task

Teams will be given 5 minutes to complete the task.

Teams must make a sporting attempt to complete the task – if in doubt about what is consider a 'sporting' attempt they should consult with the teaching staff.

Teams may restart their robot as many times as they wish. However, their score will be reset to zero each time and the table reset every time this happens. The timer will not be reset. The run with the highest score will count.

There is no upper limit on the number of blocks transported and points will accumulate per block.

Scoring

Action	Score
Robot first traverses to other side of table (no part of robot on ramp or in tunnel)	+10
Robot traverses both ramp and tunnel	+10
Block delivered to correct area* and placed on the floor (entirely within lines)	+10
Block delivered to correct area* and placed securely on the truck	+20
Block transported to delivery side of table (first time)	+10
Correct LED displayed to identify block (first time)	+10
Robot finally returns to a start/end box and stops such that the robot is entirely within the lines of the box. **The robot must have made a sporting attempt to identify and collect blocks.**	+20

1st Competition only – manual demonstration of block identification (block may be brought up to stationary robot by hand to demonstrate correct detection reliably).	+10

*What it has identified as the colour rather than the correct colour in the case when it is incorrect.

Component restrictions

Teams are limited to the quantity of the following major components and sensors which can be used in the robot:

1x Battery pack
1x Arduino Uno Wifi v2
2x Small Motor (18RPM)
2x Large Motor (40RPM)
2x Standard servo
4x Optoswitch OPB704
2x Transmissive Photo interrupter
1x TSOP4838
2x Ultrasonic Transducer
1x IR distance sensor 200-1500mm
1x IR distance sensor 100-800mm
2x AD22151 (IEP kit)
2x SN36529

Extra supplies of other components can be requested (within reason).

Table Layout

Not to scale – a scale drawing will be provided.

Lines are approximately 19mm wide
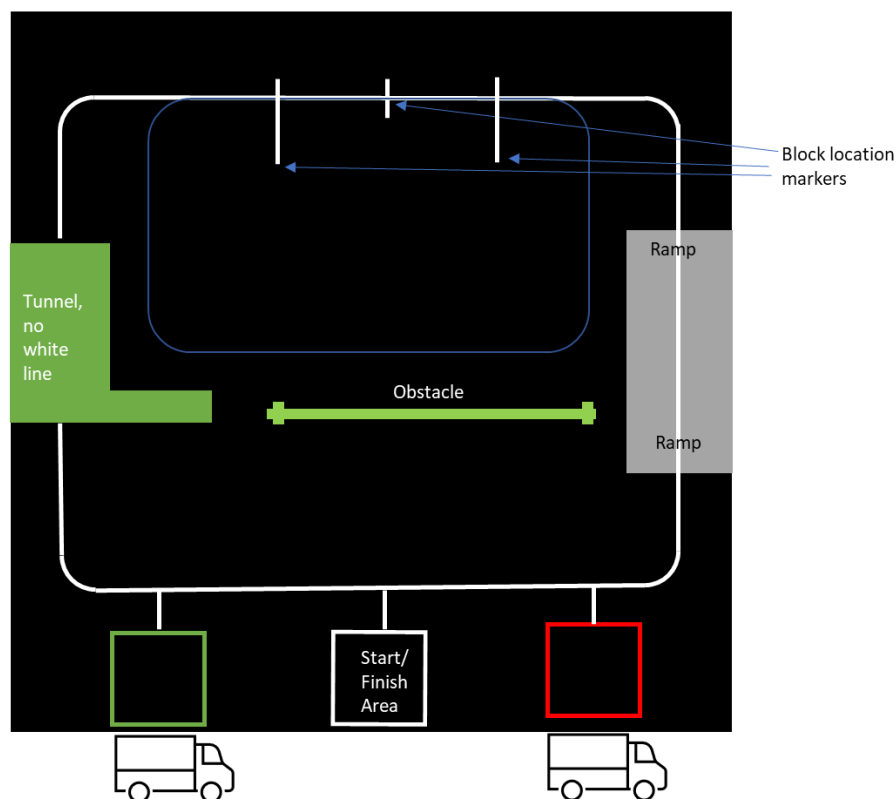
The blocks will be randomly placed on the white line markers. Subsequent blocks will be placed randomly on one of the three locations each time the robot traverses to the opposite side of the table. Blocks will continue to be placed until 5 mins is up or the robot returns to the start/finish area.
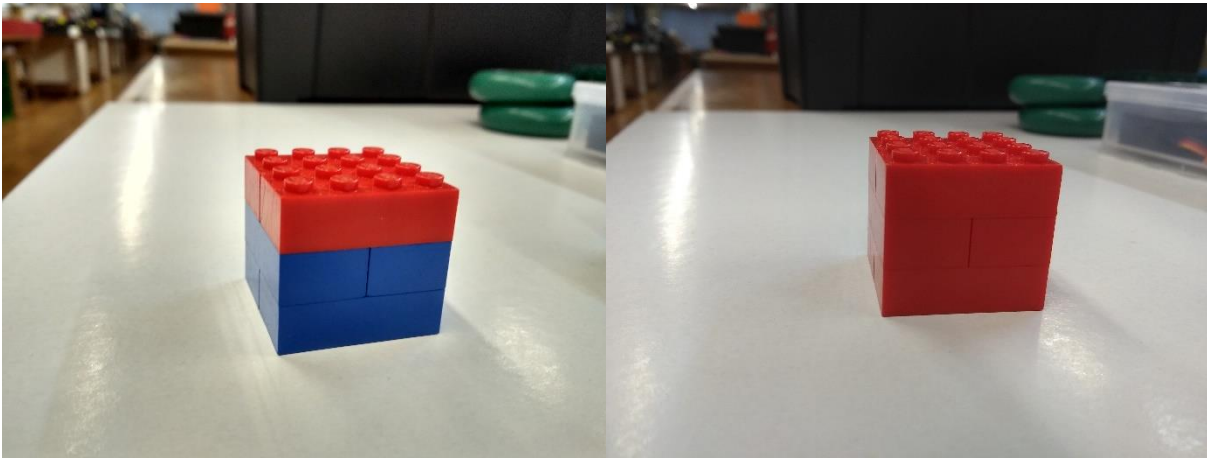
Photos of blue and red blocks:

Photo of example delivery area and truck: