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[Name, Lab Group, College, Sub-team]

*TEam 4 IDP L1*

Team Name: Porous a Drink

Robot Name:

# Approach: (TO INCLUDE SKETCHES THROUGHOUT)

We have opted for a general, works for all approach, where we account for all possibilities of where the cube could be by sweeping all possible positions, removing the need for cube detection. To collect the cubes, we aim to use two large arms which will open when sweeping, drive the car forwards to a maximum value, and close around the cube, but not squeeze it. At this point we will measure porosity, either by using infrared sensors to measure along the cube, or a combination of infrared sensors with a mechanical force input. The car will reverse over the ramp and drag the cube behind it, ensuring the cube isn’t lost by using arms of similar height to it. When depositing the cube back, we aim to turn the car 90 degrees on the spot and put down the first cube deeper in the box, or alternatively manoeuvrer into the box.

## Concept Ideas

**EVALUATION CHARTS WITH PROS & CONS**

Primary drawings

**ROBOT CONCEPT & DIAGRAM**, CAD model

## Moving

Keeping robot movement as simple and fundamental as possible, and minimising or completely removing the number of turns it must make, will ensure an accurate and robust result. If the robot can remain on the white line for the duration of the exercise, this removes one of the largest uncertainties in the task: the robot losing its positioning.

We will opt for 2 fixed, rear wheels connected to a motor and explore the possibility of 1 or 2 ball rollers at the front of the vehicle. This would allow us to turn on the spot when delivering the cubes, but also micro adjust to ensure the robot stays on the central white line. The rear wheels would generate sufficient torque to cross the ramp both forwards and in reverse.

The argument against 4 wheels, whether fixed or rotational, was that…

## Arms

As mentioned above, the cubes will be collected by two wide arms in a pincer motion, sweeping a wide arc which covers all possible cube positions (ref figX). If the cube is towards the start of the possible locations, the robot will gently push the cube forward, and once the arms are closed and it starts reversing, the cube will be securely dragged behind it, not squeezed (ref figX).

We decided on this approach to entirely remove the need for cube detection, which would have been one of the most complicated steps when finding the third cube. The main risk is knocking other cubes out of place, but careful and gentle arm movements will ensure this is not a problem. When reversing over the ramp, if necessary, the arms will raise a small amount to in order for the robot to clear it.

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Initial idea of interlocking arms

Pushing vs squeezing of cube

## Determining Cube Porosity

Shape, whiteboard

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IR sensor through cube as car drives along it, compare mean values

Squeeze top of cube with mechanical arm, IR sensor measuring distance from arm to floor

## Depositing into Box

Diagram

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Rotate arms into box, poke inside if necessary

Rotate car on spot

Turn car wide, reverse back onto line

## Following the line

Never leave the line

Hard programming when leaving line

Line sensors for robustness

# Implementation:

**OVERALL SYSTEM LEVEL DIAGRAM,** how each sub-team interacts

## A picture containing indoor Description automatically generatedDiagram, engineering drawing Description automatically generatedDiagram Description automatically generatedMechanical

Materials consideration

Construction method consideration

Rough dimensions

“Consideration of materials and construction method for chosen design. Reasonable size. Consideration of motor/ sensor placements and possible interactions.”

## Electrical

List of sensors/circuits

**CIRCUIT & BLOCK DIAGRAMS**

“This should include a list of sensors/circuits required, any circuit diagrams/block diagrams which may have already been developed and or tested. Discussion as to if/why some processing will be performed in electronics opposed to software (e.g. obtaining digital outputs from analogue signals) and initial specification of interfaces”

## Information

**Diagram

Description automatically generatedEXPLORATION & NAVIGATION ALGORITHMS**

“Exploration and navigation algorithms. Interface to electronics, discussion of choice of algorithms, any failure detection/recovery which will be implemented.”

# Risks:

**[RISK, LIKELIHOOD, MINIMISING]**

Failing to collect cube, slipping out

Knocking into other cubes

Failing to cross ramp

Failing to determine porosity

Losing track of white line

# Project Management:

## Gantt Chart

The Gantt Chart will help keep all team members on track and aware of upcoming deadlines. Keeping it updated through the project and overestimate the length of task will ensure punctuality by good time management.

## GitHub Repository

Using a single repository to share and store all files such as code, CAD models, sketches and graphs, will simplify distribution and version control across teams, maximising coordination and communication.