1B Integrated Design Project
M1 Problem Statement
Weeks 1-4, Michaelmas Term 2018-19

M.1 Description of the task

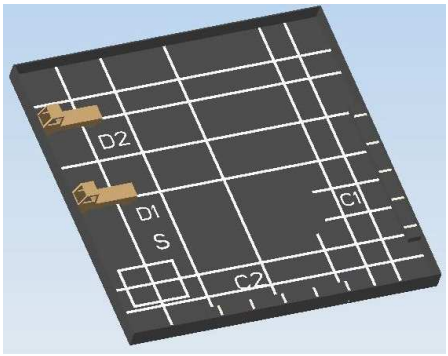
A distribution company is looking for a automated system to aid in sorting and loading of packages onto their lorries. In dispatch parcels of 5 sizes/types (see table below) are stored in random piles, 1 and 2 parcels high, at the two distribution areas (C1, C2) respectively.

The task is to build an Autonomous Guided Vehicle (AGV) to undertake the overall task of pick-up, identification of the parcels and placing them on the back of the lorries.

1. At the beginning of the task 15 parcels will be placed at C1/C2 in a random order.
2. All Parcels picked up from C1/C2 must be identified (type, number and location on AGV) via a set of *LEDs prior to moving more than 400mm from C1 or C2.

(*All LED displays must be unambiguous, easily readable, labelled and documented)

The AGV must carry out all movements within a playing area of 2400mm x 2400mm. The task will continue until 15+ parcels have been loaded or the time limit of five minutes is reached.



Parcels

Type		1	2	3	4	5
Colour		Red	White	Green	'Wood'	Trans.
WxDxH	mm	30x40x8	30x42x8	32x40x25	30x40x25	30x40x19
$\sim \rho$	kg/m^3	7800	1150	2700	1000	1180
Del Pt.		D1	D2	D2	D1	D1/D2

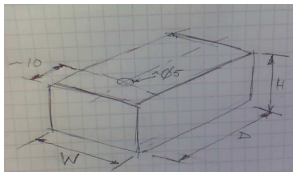


Figure 1: **Playing area and track layout** (not to scale). The lines are white and 19mm wide, the playing area surface is matt black. The starting area S is 400mm x 300mm, inclusive of the boundary line. Details of the track layout and the positions of objects, collection points etc should be taken from the playing areas in the EIETL laboratory.

M.2 Robot Assessment

Robot *design and construction* will be judged on the quality of the complete vehicle.

Robot *performance* will be judged by a competition to be held on Saturday 3rd November.

In the competition, robots will compete individually with all the robots built in weeks 1-4 of the Michaelmas term. Points will be awarded as described in the rule 3.6 below.

Robots will be placed in order according to the total number of points achieved. Robots tied on points will be ranked by restarts and then time penalties.

M.3 Competition Rules

1. The Judges' decisions are final.
2. Each robot will have five minutes to transfer parcels.
3. The robot must start with all points of contact with the playing surface inside the starting area S (inclusive of the boundary line).
4. No parcel must be handled when the robot is within 300mm of it. (Safety)
5. The arrangement of the identification and indicating LEDs must be marked on the robot and disclosed, verbally and in paper form, to the judges before the run. NB The LEDs should be easily visible, labelled and remain on until the parcel(s) has been delivered.
6. Scoring:

• Each parcel picked up and carried securely >400mm	scores **2** points
• LEDs correctly identifying the number, location and type of parcel(s) that are being carried (before moving >400mm),	score **5** points/parcel
• Each parcel delivered to the incorrect lorry	scores **7** [**3**] points
• Each parcel delivered to a correct lorry	scores **15** [**7**] points
• Delivery of, at least, 1 parcel of each type to their correct lorry	scores **25** bonus points
• >= 3 parcels delivered within the rear most 50mm of the correct lorry	scores **15**/lorry bonus points
• Correct delivery of 4 or more parcels and the AGV returning and stopping/remaining within the starting area	scores **20** bonus points
• Each parcel dropped outside a delivery area results in a time penalty of	**10** seconds
• NB Points in [..] above are awarded for parcels that are delivered, but overhang the sides of the lorry.	

   Marks will only be awarded to robots that are clearly attempting to meet the task's objective.
7. If for any reason the robot needs to be handled or the computer program re-started, the robot must be returned to the starting area and any parcel(s) being carried must be removed. A maximum of 3 re-starts is allowed. Minor repairs will be permitted between re-starts, but the clock will keep running throughout.
8. The pick up area will only be refilled once all parcels have been removed from the collection surfaces
9. Any parcel dropped onto the playing area or not placed on a lorry will NOT be removed until a robot is re-started.
10. The only interaction permitted is between the robot and the workstation. No information may be entered at the terminal during a run.
11. Judges will disqualify any robot or device that appears to be a safety hazard. Damage to the playing area, assemblies or the control system may also result in disqualification.
12. Teams will be allocated to a particular playing area on the day of the contest. Each robot will have access to its designated area for setting up and running preliminary trials for a period of at least 10 minutes before the competition run.