# Executive summary

Very brief summary of the main findings/recommendations of the report with some justification.

# Introduction

Briefly describes the project (provides context for the report) and outlines what the reader can expect to find in the rest of the report.

# Requirements specification

General

Movement

Collection/Identification

Construction

Safety

You’ll need to develop the system requirements from the vague description you have received (the rules etc.) – this isn’t simply copying them down, but converting them into formal requirements that your design can ultimately be measured against (tested). For example:

“The robot actuator arm shall be able to lift an object weighing greater than 1.0kg”

Note: These requirements are those that are general to the project. There will be additional requirements depending on the strategy you eventually decide to follow, which you will develop later. For example, a robot designed primarily to prevent the competition gathering weights will have some shared and some different requirements to a robot designed to gather as many weights as possible while ignoring the competition.

# Design space and concept generation

Tactics and Navigation - Peter

* Collect weights as fast as possible, bring back to base (pathfinding) - flowchart
* Ignore base, pick up heaviest weights (random) - flowchart
* Follow the wall - flowchart

Navigation Sensors (discussion) – Ryan taylor

A mechatronics system relies on enteracting with the world around it, it uses sensors to see and give feedback to dicide what the system should do. The robot we will design has a wide range of sensors we could use. In “table 1” a list of sensors are provided.

|  |
| --- |
| Ultrasonic |
| IR (infered) |
| Colour detector |
| IR Camera |
| Limit Switch |
| Weight |

Table 1, sensors provided to use on our robot

To navagate around the arena sensor feedback will be needed to give distances to objects around the robot. Ultrasonic and IR sensors give distance feedback rangeing from 40mm to 5m. IR gives close to medium range with a small beam angle and ultrasonic gives medium to long range with a large beam angle. Using both types of the sensors at the same time will give a good range in terms of distance and angle. The microconroller will have good information for its navagational system. The downside of the ultrasonic is it has a 100ms messurement cycle compareded to the IR 30ms messurement cycle. Both are angalong devices?

The colour sensor will be used for detecting wheither the robot is in a base or not, and further to detect what base it is in. The robot can’t pick up weights from the other teams base so the robot will need to retract any mechanism for weight retreval. Once three weights are onbord the robot will need to return to home base to drop them off. The colour sensor will confirm that it has moved from the arena to the home base before it starts to drop them off.

An IR camera is also suplied, this camera can see IR or fire soruces. Because there is no fires in the arena to navagate the only soruce would be IR from the other robot, provided they have used IR sensors. Know where the other robot would be usefull but the camera would only pick the robot up when it was pointing its IR sensors at our camera. This wouldn’t happen very often. This operates using I2C.

The limit switches supplied have a long arm to move to activate the switch. These could have a viriaty of different uses from detecting when the robot drove into a wall or a weight is picked up and bumps the switch.

A weight sensor suplied is able to measure a load its self. It uses a strain gauge to detect the the load. If a weight is placed on the sensor it could regester the load. The weights in the arena of three different types, 0.5kg, 0.75kg and 1.0kg. More points are awarded for the heavyer weights. This means the heavier weights are more valueable when picking up weights. With the limitation of only having 3 weights onboard having 3 light compared to 3 heaviy could be a loss of half the points. Implementing the sensor mechanicaly to have the correct reading will be quite hard as the picking up or holding system will have to be suspended by the sensor. This sensor is digital, with serial output.

Locomotion (discussion) - Jack

* Tracks
  + Environment
* Wheels
* Talk about chassis

You should describe the boundaries of your robot/solution in terms of hardware, different strategies to beat opponents, the competition environment, etc. You could mention/describe the equipment you have been provided. Very briefly describe how you came to these ideas – i.e. using methods that we spoke about in class (brainstorming, concept tables etc)

# Proposed concepts

-sketch each overall concept, plus any additional ones for picking up if required

## Concept 1

Pathfinding will be used to navigate the robot around the arena. Once a weight is seen the robot will use a magnet to pick it up. The robot will drive upto a weight and it will attach to a magnet. A halleffect sensor will regester when the weight is attached. The whole picking up assembly will rotate so the weights don’t get knocked off and to ensure the no weights are picked up in the others base. There are three magnets one for each weight, once three are on board the robot will drive back to base to drop the weights off by retrackting the magnets and knocking off the weights. This process will be repeated until the end of the round. Figure 1 shows the state machine the robot will use to exciute the task.

The magnets used will be strong enough to pick the weights up in any orintation. Because the magnets are strong a powerfull method of detaching the weights is nessisary. All of the magnets will be linked and will retracket together. A perpex sheild will allow the magnets to pass though and and weights will now. Two geared stepper motors will be used to drive the mechanasim. This may take a while to complete but is worth it because of the power of the magnets.

IR, ultrasonic and colour sensors will be used to aid the pathfinding. IR and ultrasonic will give the position to the walls, these will be placed on top of the robot to make sure it doesn’t regestier the other opostion into the map. They will be placed to face all four direction. There will also be a IR sensor mid way up the robot on the front to see where the robot is going. Low mounted IR sensors will find the weights. Colour will be used to detect what area the robot is in, this will be placed under the robot.

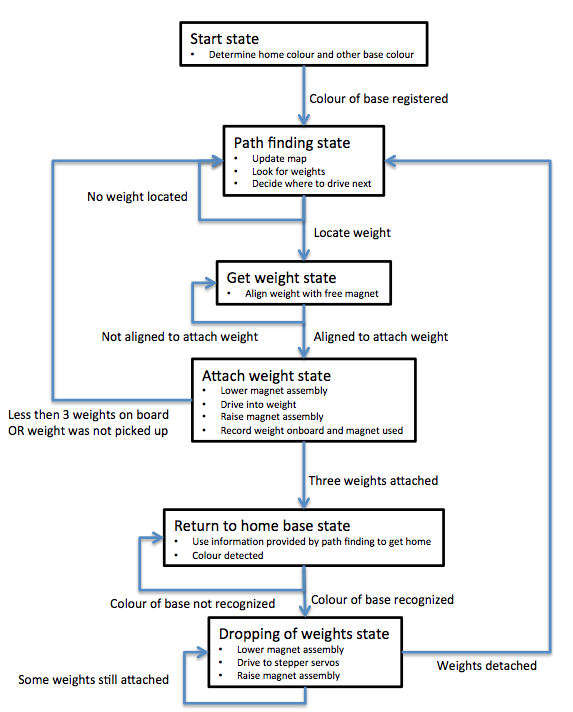


Figure , Finite state machine for concept 1

## Evaluation of concept 1!!!

### Robustness

With the perpex frame at the front of the robot a solid barrier is the first point of contact. This is good because small parts wont break off when in contact with things. The magnets out the front might come into contact with the other robot and attach to the robot. If this happens there will be no way to detach with out dropping our weights. The robot may be more prone to front weight distubrution. If the other robot is very high our sensors on top of our robot will give us wrong readings because of the obstruction.

### Reliability

The magnets will be industial grade and not be prone to chipping or lose of magnitism. This concept heavily reliyes on the path finding algorythme to work. If it map is incorrect the robot will not know where it has been or has to go. If the map works but the sensors don’t give reliable imfomation the algorythem wont know where to go and will get confussed. Gears slipping in the pick up mechainsim could also be a problem.

### Ease of build

The pick up mechainsim will be the hardest part to build as the it has a few tricky gear process. This will take planning and will have small tolleriances. Because the build is only a few moving parts it wont take very long to get things fabercated.

### Maintenance

With the front of the robot having a perpex sheet access from the top of the robot will be easy and prefered. The main controller and battery will be able to be removed via a quick release mechanism. The pickup assembley will be able to be fully detached easiy for maintenance inside the chassie or to work on the pickip assembley.

### Modularity

I don’t know what this means???

### Cost

Ignore base, pick up heaviest weights (random) - Jack

* No return
* Scoop
* Speed

Follow the wall - Peter

* Return
* Electromagnet
* Sensor interference

Present initial sketches, models, and descriptions etc of your 3 options. You need to show that you have thought through high-level system design of these concepts, using some techniques such as – Context diagrams, functional architecture diagrams, N2 charts, behavioural flow chart, FSM graphs. (Not all of these, but choose a couple that you think are appropriate to indicate how your concepts would work and be put together).

# Concept evaluation

- calculations

- ‘Merit table’ score chart

Need some basic/approximate calculations or estimates of costs, forces, power requirements, available computation and memory. Evaluate/compare the concepts – FOM table. This doesn’t need to be exquisitely detailed or accurate at this stage – just provide enough to be able to evaluate and compare the concepts in a relatively objective manner. Briefly discuss/comment on these 3 concepts in the context of the competition and specs – factors such as robustness, reliability, ease of build and maintenance between rounds, modularity, and cost.

# Conclusions and recommendations

Based on your evaluations, make a recommendation for one of the concepts to be developed – back this up by summarising its benefits or why you chose it. While we won’t hold you to this design, we would expect that your final form be based on what you present in this report.

# Contribution statement

Jack Hendrikz

Peter Nicholls

Ryan Taylor

Briefly describe the specific contributions of the team members in the project up to this point. For example:

Howard Wolowitz:

 Requirements specification

 FOM calculations for concept 1 and 2

Leonard Hofstadter:

 Sketching concepts

 FOM calculations for concept 3

 Report writing

Sheldon Cooper:

 Room-mate agreement

 Making tea

Parts List:

* DC Motor x2
* DC Motor driver x2
* High current driver ?
* IMU ?
* IR PhotoInterrupter x1
* IR Camera ?
* IR LED ?
* IR MR \ 1 of these ?
* IR SR /
* IR Variable distance x1 (or 3)
* LED ?
* Power Protection Circuit x1
* Relay x2
* Standard Servo x4
* Micro Servo x4
* Smart Servo x4
* Sonar x1
* Stepper Motor x2
* Stepper Motor Geared x2
* Toggle Switch x1
* Variable Resistor 10k
* Weight Sensor x1

Weight (kg)

* On flat: 15.4, 15.7, 16.1
* On curve: 12.5, 12.4, 13.4
* On edge: 8.6, 7.8, 8.8

Diagrams:

* State diagrams
* Flow diagrams
* Functional diagrams
* Context diagrams
* N2 charts
* Data flow diagrams