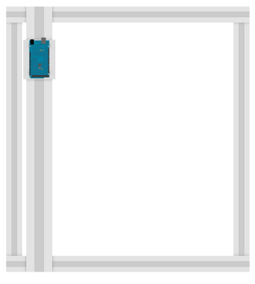
gripper & algorithms

gripper overview

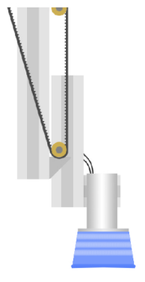
1. Gantry moves over a cup



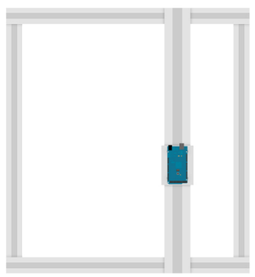
2. Gantry arm lowers to contact cup

3. Electromagnet secures cup

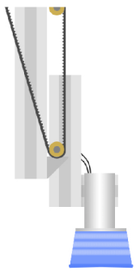
4. Gantry arm raises to clear cups



5. Move gantry to magnet position

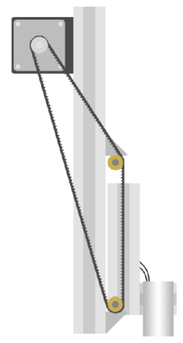


6. Gantry arm lowers cup to ground



7. Electromagnet releases cup

8. Gantry arm raises



traversal algorithm

The problem faced is an adaptation of the travelling salesman. The points to visit must alternate in the order cup - magnet.
The nearest neighbour algorithm was implemented due to it's high adaptability to specific cases such as this one.

1. Iterate over all cups and select the closest
2. Pick up selected cup
3. Iterate over all magnets and select the closest
4. Drop cup on magnet

general approach

In most cases, the simplest / easiest algorithm was implemented first, and only changed if it proved to have fatal limitations. Trial and error proved faster and more efficient than alternative methods, and working in this manner could help minimise unecessary time and effort expendature.

modular design

Aluminium extrusions were used throughout the design for two main reasons:

1. No fabrication required allows for rapid prototyping

2. Easy alternations should a design require changing

The final design was a result of hundreds of small changes and iterations which would not have been possible without the modularity of the design.

iterations

pulley system

The initial design had no pulley system, however it was quickly determined that a software solution to avoid knocking over existing cups would be complicated and prone to failures.

A pulley system would move the gantry arm out of the way from already placed cups. The initial idea was to achieve this through laser cut MDF toothed pulleys.

The design was later upgraded to off the shelf components due to their increased reliability and tighter tolerencing, allowing for more precise control.

gripper design

ORIGINAL DESIGN

FINAL DESIGN