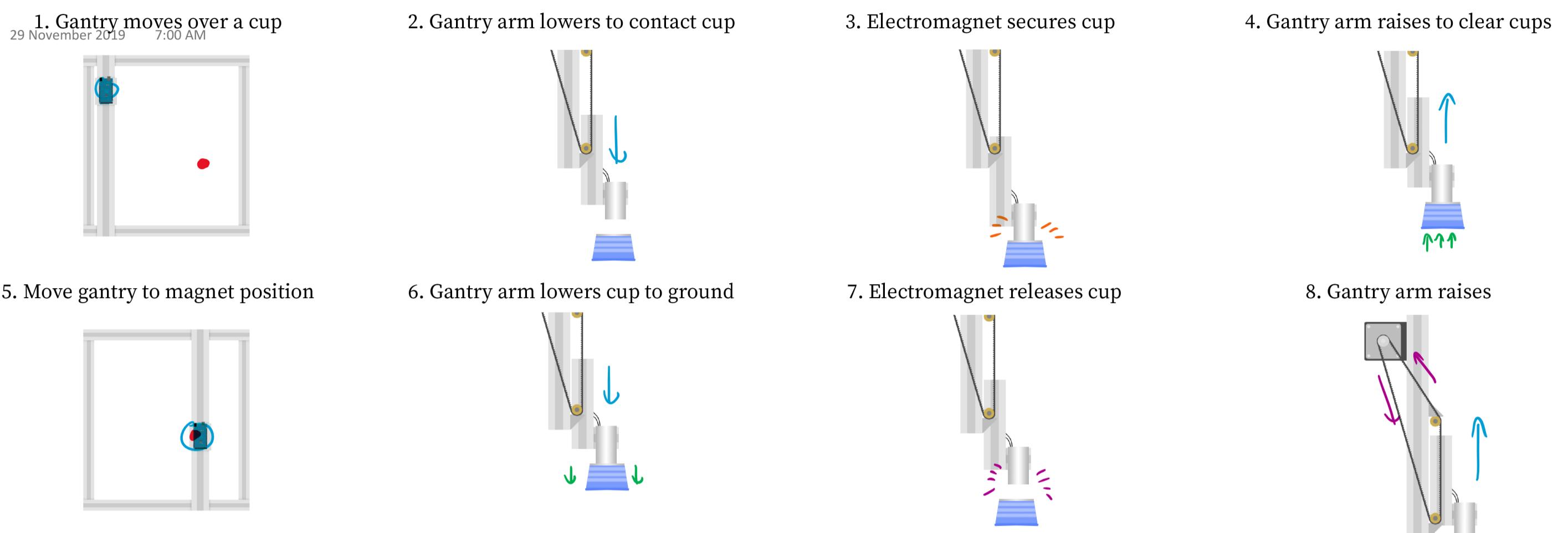


# gripper & algorithms

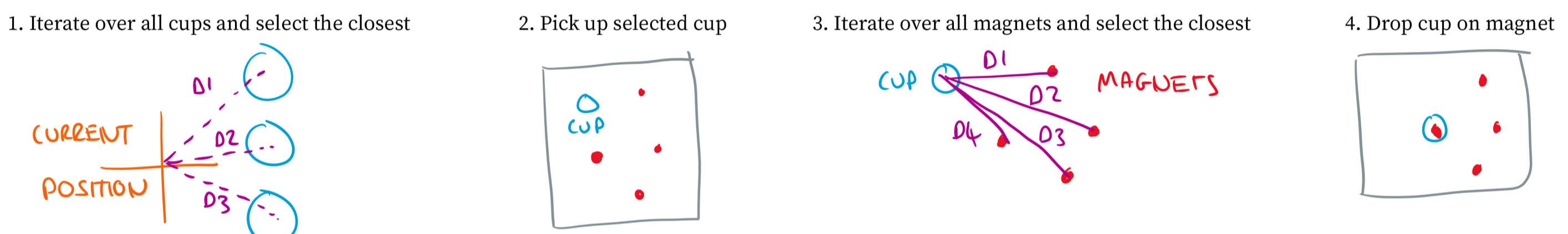
## gripper overview



## 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 its high adaptability to specific cases such as this one.



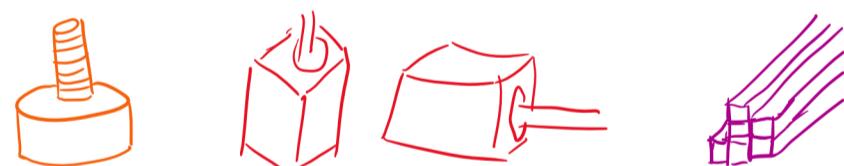
### general approach

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 unnecessary time and effort expenditure.

## modular design

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

- No fabrication required allows for rapid prototyping



- Easy alterations 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.

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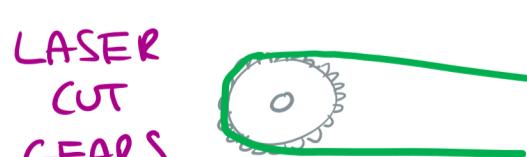
## algorithm implementation

```
function(path) = traverse(points.magnet, points.cups)
    set position vector to current position
    while magnets remaining > 0
        for all the available cups
            calculate distance from current position
            set next position vector to cup with lowest distance
        for all the available magnets
            calculate distance from current position
            set next position vector to magnet with lowest distance
        %% Output will be a position matrix in the form
        %% CUP > MAGNET > CUP > MAGNET > ...
        % To mark the cups the gantry must go to each position in order,
        % and alternate between picking up and dropping a cup
```

## 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.



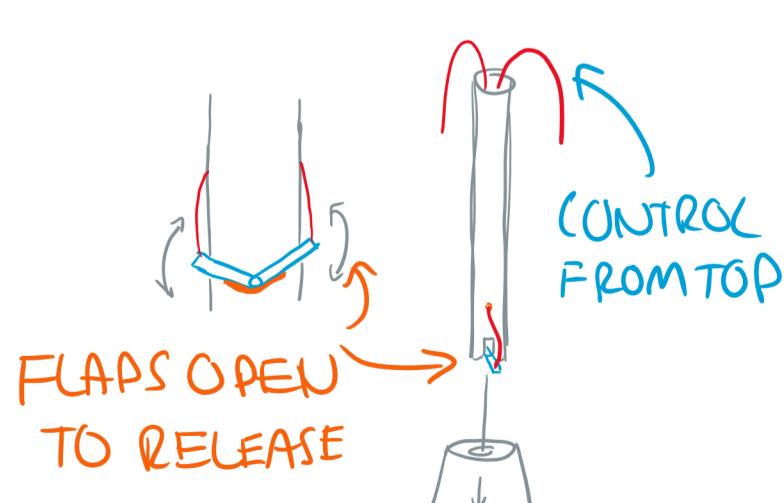
A pulley system would move the gantry arm out of the way from already placed cups. The initial idea was to achieve this through laser cut MDF toothed pulleys.



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

### gripper design

#### ORIGINAL DESIGN



#### FINAL DESIGN

