UCS: Atacc

Engineering Notebook

VEX In The Zone (2018-19)

12345

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Part I

Introduction

Chapter 1

Heading on level 0 (chapter)

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1.2 Lists

1.2.1 Example for list (itemize)

- First itemtext
- Second itemtext
- Last itemtext
- First itemtext
- Second itemtext

Example for list (4*itemize)

- First itemtext
  - First itemtext
    - First itemtext
      - First itemtext
      - Second itemtext
    - Last itemtext
  - First itemtext
- Second itemtext

1.2.2 Example for list (enumerate)

1. First itemtext
2. Second itemtext
3. Last itemtext
4. First itemtext
5. Second itemtext

Example for list (4*enumerate)

1. First itemtext
    (a) First itemtext
        i. First itemtext
            A. First itemtext
            B. Second itemtext
        ii. Last itemtext
    (b) First itemtext
2. Second itemtext

1.2.3 Example for list (description)

First itemtext

Second itemtext

Last itemtext

First itemtext

Second itemtext

Example for list (4*description)

First itemtext

  First itemtext

    First itemtext

      First itemtext

      Second itemtext

    Last itemtext

  First itemtext

Second itemtext

Part II

Stratagy

Chapter 2

Rules Analisis

The rules of VRC Challenges are always over-complicated and pedantic so it is important to make sure a team knows them inside out before a team can strategize.

2.1 Size Limitations

By $< R4 >$ and $< SG2 >$, the robots size is limited during the match. At the start of the match, the robots size must not exceed 18" x 18" x 18" All subsystems must fit within this boundary. Robots may expand to a width and length of 36" x 36" during the match.

With regard to height limit, the rules are very different to previous years. Set by $< SG2 >$, these rules could make, break or disqualify a robot, so it is very important that the robot is kept within the acceptable limits.

Because of $< SG2 >$, within the Expansion Zone [Figure 2.1], the robot may expand to any height, but outside this zone, the robots height may not exceed 18" This differs from previous years where robots could expand to any height in the match

$< SG2 >$ states that

> Once the Match begins, a Robot which is contacting the Expansion Zone may expand vertically with no height limit. However, once fully outside of the Expansion Zone (i.e. no longer contacting it), the Robot must return to a height limit of 18" (45.72 mm) tall.

As a consequence of $< SG2 >$, the robot cannot legally touch High Flags, meaning that High Flags can only be flipped using balls thrown or shot from the robot. If the robot is to flip these High Flags, it must include capability for collecting and launching balls. It may be helpful to examine which designs were effective in the VEX IQ Bankshot and VRC Nothing But Net challenges.

2.2 Possession Limits

$< SG4 >$ states that

> Robots may Possess a maximum of one (1) Cap and two (2) Balls at a time.

This means that if a robot canot employ a hoarding stratagy. However hoarding is already banned by $< SG5 >$

The more signifigan impact of $< SG4 >$ will be on the design of ball launching systems, as they will have to

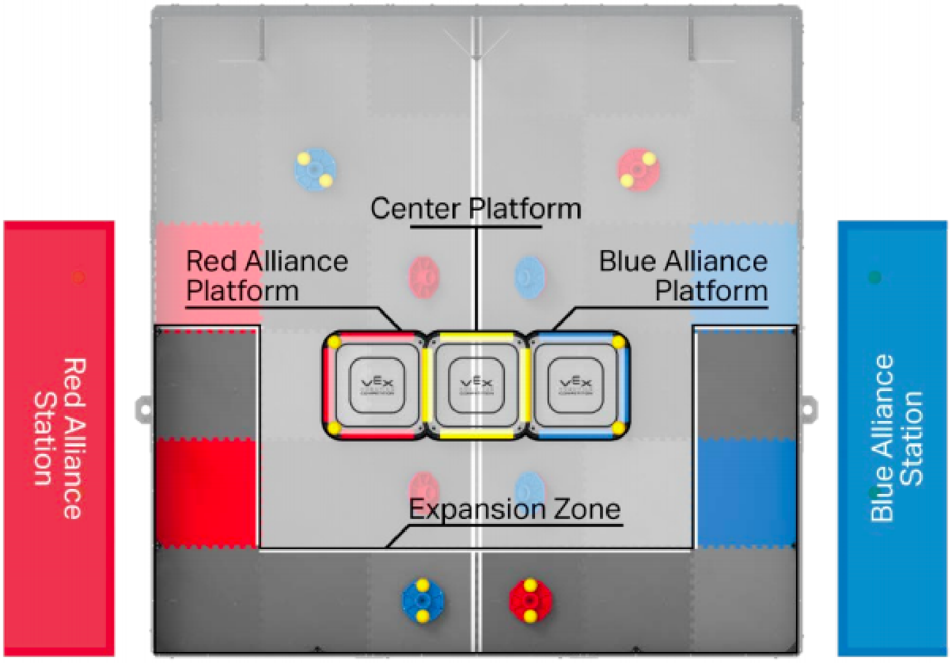

Figure 2.1: The Expansion Zone

- be small enough to not have enought space for 3 balls.
- have the driver not pick up 3 balls.
- have the software moniter the number of balls in the robot and automaticly shut off the ball intake once there are 2 balls

2.3 Autonomous Limits

By $< SG3 >$, the robot may only venture into its own half of the field during the autonomous period, and no robots can centre park during this time. [Figure 2.2]

This means robots can be more confident in their autonamus as no enemy robots will be on their side

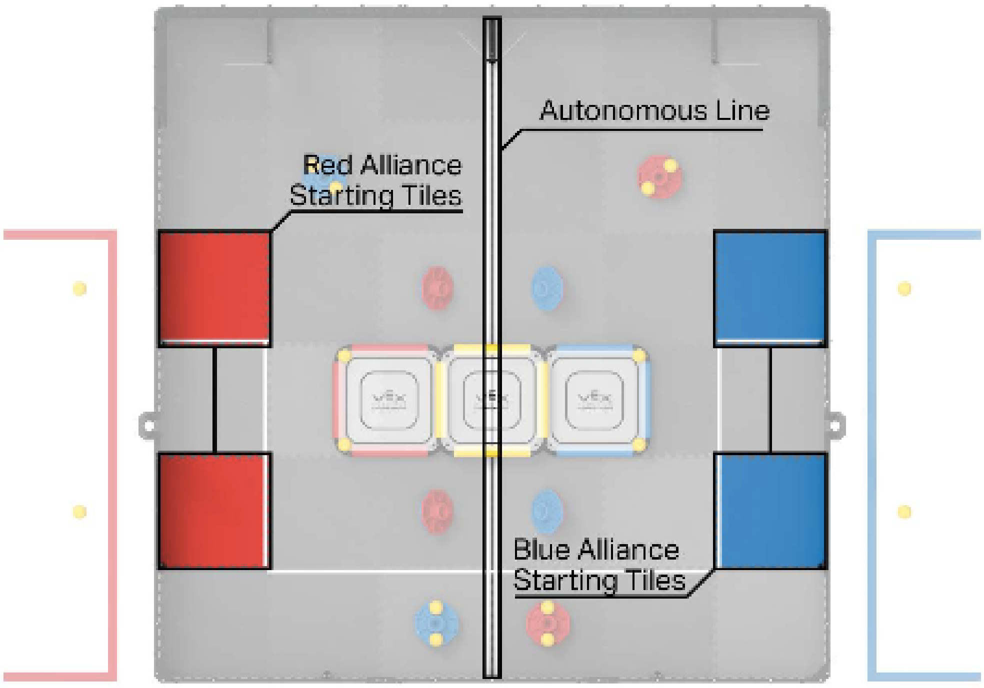

Figure 2.2: The Autonomous Line

Part III

Design

Chapter 3

Drivetrain

Every robot needs a drivetrain.

3.1 H-Drive

A H-Drive consists of 4 Omni-Wheels Parallel to each other layed out in the format of a tank drive. Then in the middle there is a aditional Omni-Wheel perpendicular to the others.

Because of this an H-Drive is holonomic (can move in any direction) because when the robot goes forward, the 4 main wheels are powered and the rollers on the secondary wheel can slide to allow the robot to roll forward.

Similarly to move sidewast the secondary wheel gets powered. At the same time the rollers on the main wheels roll to allow the robot to move. By combining the forward movement and sideways movement, the H-Drive can move in any direction.

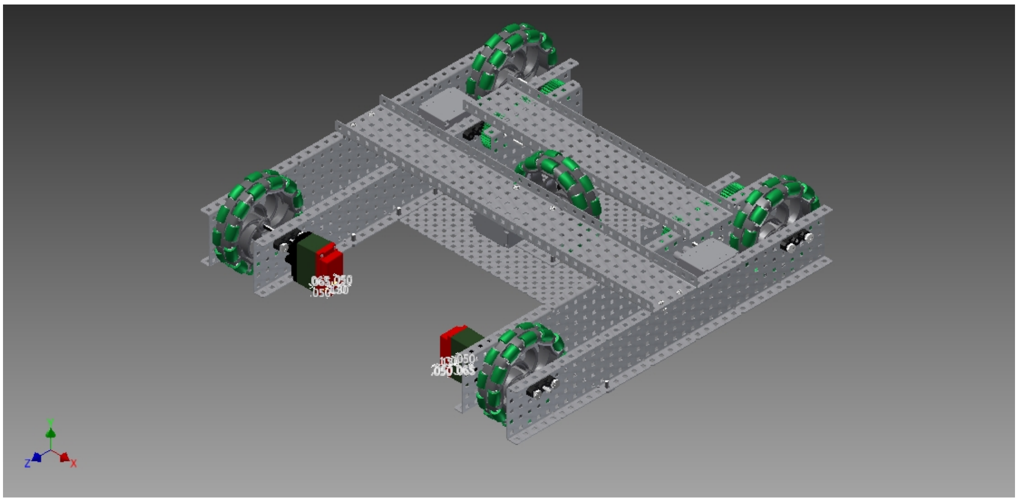

Figure 3.1: A Typical H-Drive

3.1.1 Advantages

- Holonomic (can move any direction)

3.1.2 Disadvantages

- Easy to push sideways as only one wheel is providing traction in that direction.

3.2 Mecanum Drive

¡+descirption of drivetrain+¿

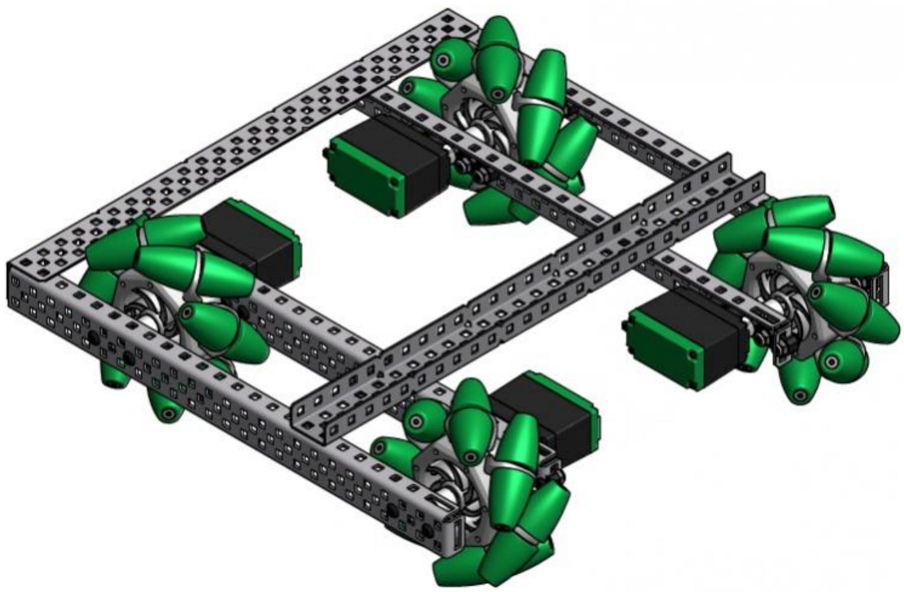

Figure 3.2: A typical mecanum drive

3.2.1 Advantages

- Holonomic
- Is a sqare base with 4 wheels so it can be easily converted into a tank drive.

3.2.2 Disadvantages

- Only moves at $\frac{1}{\sqrt{2}}$ the speed of the wheels when moving sidewast negating alot of the benefit of having a holonomic drive.
- Requires four motors, which is half the availible motors for the v5 platform
- Is unstable and generaly bad at climbing over objects (we learnt this the hard way in ITZ), so it will be unable to contend the center platform.

3.3 Tank Drive (All Omni-Wheel)

This style of tank drive consists of 4 Omni-Wheels in parallel to each other

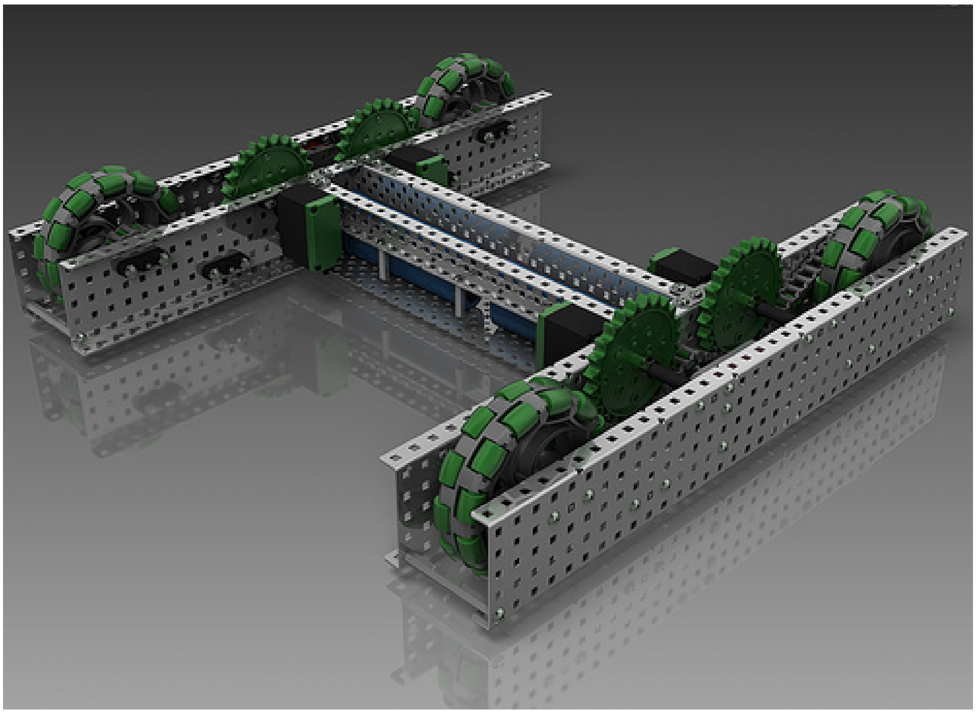

Figure 3.3: A typical tank drive with all omni-wheels

3.3.1 Advantages

- Has no skiding problem unlike a tank drive with all traction wheels
- Has the turning point in the center of the drivetrain
- Can easily be converted into other kinds of tank drives

3.3.2 Disadvantages

- No resistanse in the sideways axis means that the robot will easily be pushed off the center platform

3.4 Tank Drive (All Traction Wheels)

This drivetrain consists of 4 Tracion wheels parallel to each other

3.4.1 Advantages

- Very strong and stable so will be better at staying on the center platform
- Can easily be converted into other kinds of tank drives

3.4.2 Disadvantages

- Will skid when turning, causing unpredictable autonamuses and impercision for the driver

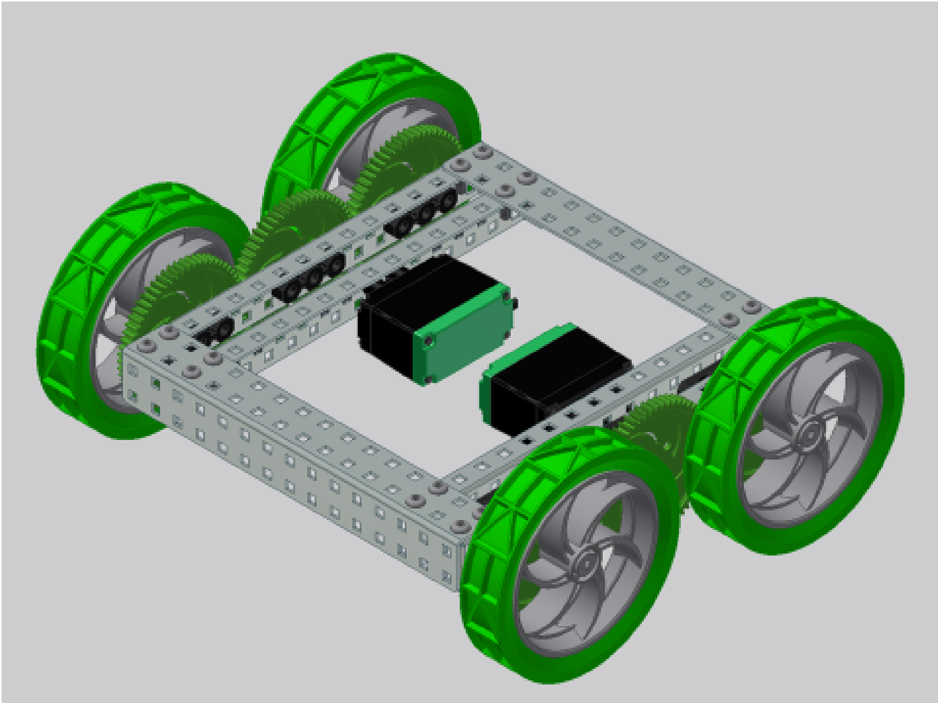

Figure 3.4: A typical tank drive with all traction wheels

3.5 Tank Drive (Half Omni, Half Tracion)

This variant of a tank drive consists of a pair of tank wheels on one end and a pair of omni-wheels on the other

3.5.1 Advantages

- Isn't prone to skiding like a tank drive with exclusivly omni-wheels
- Can be easily reconfigured to other kinds of drivetrain

3.5.2 Disadvantages

- Turning point is on the edge of the robot, not the middle, reducing manuverability

3.6 X-Drive

¡+descirption of drivetrain+¿

3.6.1 Advantages

- Fast, moves at $\sqrt{2}$ times the speed of the wheel forward and sideways due to both sets of wheels moving the robot.
- Holonomic

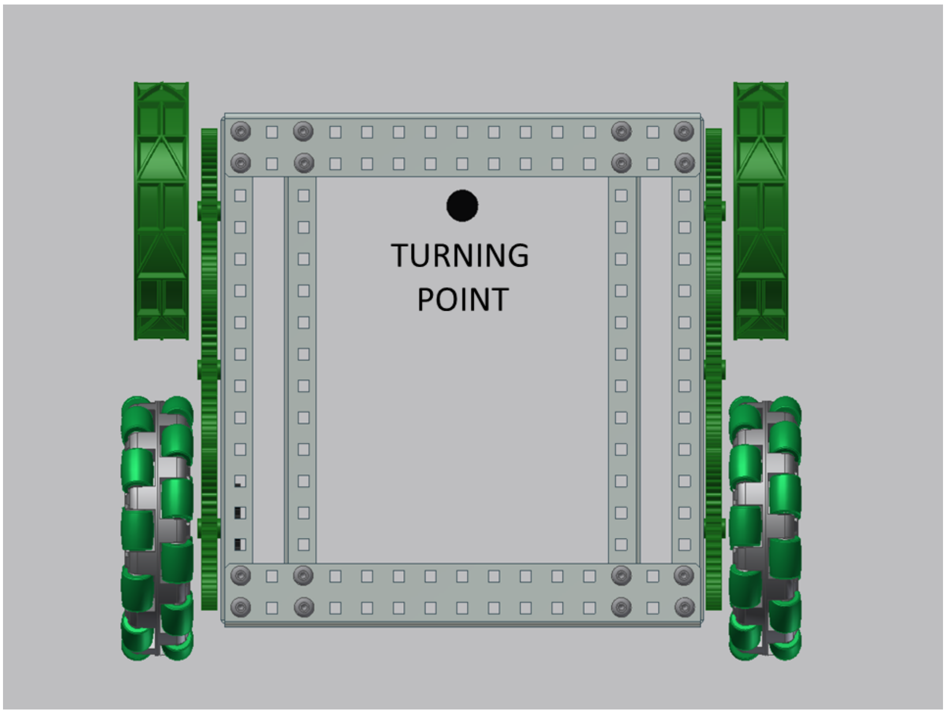

Figure 3.5: A typical tank drive with half omni-wheels and half traction wheels

3.6.2 Disadvantages

- Hard and unstable to build due to 45 °angles.
- Require four wheels, which is half the allowed motors if we use a v5

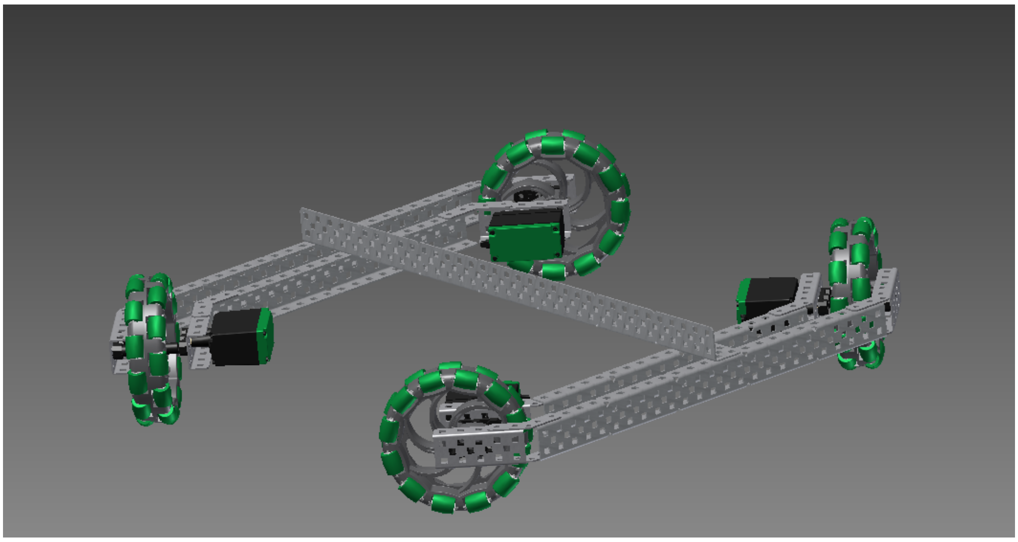

Figure 3.6: A typical X-Drive

Chapter 4

Lift

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Chapter 5

Cap Fliper

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Part IV

Competition 1: xxxxx

Chapter 6

Building

6.1 SOME DATE

6.1.1 Nixon: Drivetrain

To start out with, Nixon build a drivetrain frame. This is because we were not sure what a optimal claw would look like yet and Nixon hadn't build enough lift yet to be trusted with building one. Therefor he was entrusted with the drivetrain as this was a common component that he had built before.

A decision was made to build the drivetrain frame out of c-chanels at it had worked reasonably well in the past and we had plenty of them. However the question now became how to properly join them at right angles into a strong and stable rectangle.

On previous occasions we had decided just to screw the c-chanels together at the end with one screw, however this led to two problems.

- There was no garentee that the frame would stay square. Sure, it might be held in place by by the other stuff we end up putting on but then again it might not. And we want the drivetrain to suport the robot, and not the otherway round.
- Becase of the way they'd be atached (TODO: figure) the beems runing perpendicular to eachother would we at slightly different hights, constraining what we could do in terms of building the rest of the robot.

Therefor we needeed another, better way to atach the c-chanels together.

6.1.2 Oscar: Claw

A claw for rotating a object as large as a cap has never been built by anyone on our team before. Therefor we decided to build physical prototypes of the claw to see what design would be better

We made two different prototypes which were quite similar in design, both were fixed beams coming from a plate at the back, which were simply to be driven into the caps and held. It was decided that they should be held loosely so that there was room for human error when driven towards, and so that they would slide back off with ease once on the posts. This decision was made becase past experiences had taught us the precious lession that fault tolerence was importand not only for driver speed but also for autonomous reliability, both of which yeilded lots of points.

We had the standard Vex claw already in our kit, so we began by trying to use this, but quickly realised, after looking at the field specification, that it was not large enough and could not grab the central circle of the disk. To combat this problem, we tried extending the arms of the claw to give it a larger reach but the claw was ineffective and we decided we could make a more specialised tool ourself.

We made two different prototypes which were quite similar in design, both were fixed beams coming from a plate at the back, which were simply to be driven into the caps and held. We spaced the beems further apart then was needed to fit which not only gave us the fault tolerence we discussed earlyer but also ment that they would slide back off with ease once on the posts.

The two designs were similar in function but the one that held the cap by the central cylinder (as opposed to the outside rim) was chosen because it didnt require as much precision when lining up. This is due to the fact that the outside rim is an octogon, so the radius varies around the shape. This means the cap will act differently depending on where it is inserted to the rim design. However by griping the centeral circle, a shaped defined by its constant radius, the interaction would always be the same, leading to consistancy, which in turn creates reliability, which is the key to a good autonomous and fast driven control.

Then the design was rebuilt in aluminium and supports were added for additional structural strength. Finally it was fixed to a backplate and motorised so it could rotate.

Chapter 7

Programing

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Chapter 8

Driver Training

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