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Entries

Introduction: Team Overview

Andrew Curtis

- 12th Grade
- 4 years of experience
- 4th year on Dark Matter

Jobs:
- Coder
- Mathematician

Andrew is our programmer and has been well versed with the world of programming in real world scenarios. Andrew has taken last year to build some code elements like Monte Carlo Localization

Figure 1: “andrew”

Figure 2: “andrew”

Neil Joshi

- 12th Grade
- 6 years of experience
- 4th year on Dark Matter

Jobs:
- Designer
- Builder
- Driver
- Notebooker

Neil has had the most experience out of all of us in VEX. He is our driver, but also plays the vital roles of designing, building, and notebooking.

Shreyas Bhatt

- 12th Grade
- 5 years of experience
- 4th year on Dark Matter

Jobs:
- Designer
- Builder
- Notebooker

Shreyas is well versed in designing, especially using CAD, and building. He can lead and pitch in to almost any job required by the team along with documenting events.

Figure 3: “andrew”

By: Juliana Curtis
Witnessed by: Andrew Curtis and Shreyas Bhatt

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Introduction: Team Overview

Figure 4: *"andrew"*

Kairui Dai

- 10th Grade
- 4 years of experience
    - 2nd year on Dark Matter

Jobs:
- Coder
- Designer
- Builder
- Backup Driver

Kairui has four years of experience in the world of programming and driving. This experience allows him to complete both of his jobs with efficiency.

Juliana Curtis

- 10th Grade
- 1 year of experience
- 2nd year on Dark Matter

Jobs:
- Media Specialist
- Notebooker

Juliana is a fast learner and is excellent at project management, which helps to keep us on track as the year goes on. She is also great at documenting meetings in crucial detail.

Figure 5: *"andrew"*

Figure 6: *"andrew"*

Ryan Bhimani

- 9th Grade
- 2 years of experience
- 1st year on Dark Matter

Jobs:
- Builder
- Notebooker

project management

Introduction: Team Overview

This season, our team consists of 6 people. All of our team members have worked together at some point in VEX VRC. Andrew, Shreyas, and Neil started Dark Matter in 2022 whereas Kairui and Juliana joined in 2024, Ryan following this year. Shreyas, Neil, Kairui, and Ryan all participated in VEX VRC during their time at ACP Middle, so they have been on teams together. Combined, we total 22 years of experience in VRC and our team specifically has gone to Worlds twice along with all of our ACP members having gone at least once during middle school. In the past, we have had three, four, and five members on the team, but this is our first year of having six people, so we aspire to balance out the team dynamics as we work together.

By: Juliana Curtis — Witnessed by: Andrew Curtis and Shreyas Bhatt

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project management

Introduction: Past Achievements

781X Awards/Accomplishments

- High Stakes
  - Design Award at a local
  - Tournament Champion and Innovate at our second local
  - Sportsmanship Award at Mecha Mayhem
  - Think Award at States
  - Placed 3rd in the Research Division at VRC Worlds
- Over Under
  - Design Award at a local
  - Placed 4th in skills at States
  - Competed in the quarterfinals in the Innovate Division at VRC Worlds

Individual Achievements

- High Stakes (7830P - Ryan)
  - Design Award at a local
- Over Under (7830N - Ryan and Kairui)
  - Design Award at a local
  - Innovate Award at a second local
  - Excellence Award at a third local

By: Juliana Curtis — Witnessed by: Neil Joshi

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Introduction: Past Achievements

- Judges and Tournament Champion at States
- Spin Up (7830P - Kairui)
  - Tournament Champion at States
- Tipping Point (7830C - Neil)
  - Tournament Champion at States
- Tipping Point (7830P - Shreyas)
  - Inspire Award at VRC Worlds
- Change Up (7830C - Neil)
  - Tournament Champion at States
- Tower Takeover (6588B - Neil and Shreyas)
  - Excellence Award at a local
  - Sportsmanship Award at States

By: Juliana Curtis Witnessed by: Neil Joshi

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Introduction: Community Contributions

As a high school team with members who primarily started vex in middle school, we have created a lot of connections with other teams throughout our time in VRC. This includes our contribution to the local and global stage of VEX Robotics.

Mentoring

Shreyas and Neil have volunteered at ACP middle school (7830) for 4 years, ever since they graduated and started 781X. We have also scrimmaged with them in the past to provide driver practice. Andrew helps the teams learn more advanced coding methods, while Shreyas and Neil help them with the build aspects.

Last year, Juliana and Andrew helped a Basha AMS teacher start a team (50250) for her school of which the two graduated from. For the most part, they aid them in learning and understanding coding practices while building and documenting their robot's design process. Andrew primarily helps with programming and build techniques while Juliana does notebooking and logistics/support.

By: Juliana Curtis Witnessed by: Andrew Curtis and Neil Joshi

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Introduction: Community Contributions

Volunteering

As a team, we try our best to volunteer at least 2-3 times a season at local competitions. In the past, our team has filled roles involving refereeing, field resetting, queueing, and checking in teams. For example, the week before the high school States Competition during High Stakes, we helped out at the middle school States before meeting up and working on our autonomous code.

Scrimmages

Last year, we also dedicated time to planning and organising scrimmages with other highly skilled Arizona VRC teams we competed with in the past. These were held before both States and Worlds, so we hope to do this again this year as we all improved our robots as a result of guidance from each other.

Open Source Software

By: Juliana Curtis Witnessed by: Andrew Curtis and Neil Joshi

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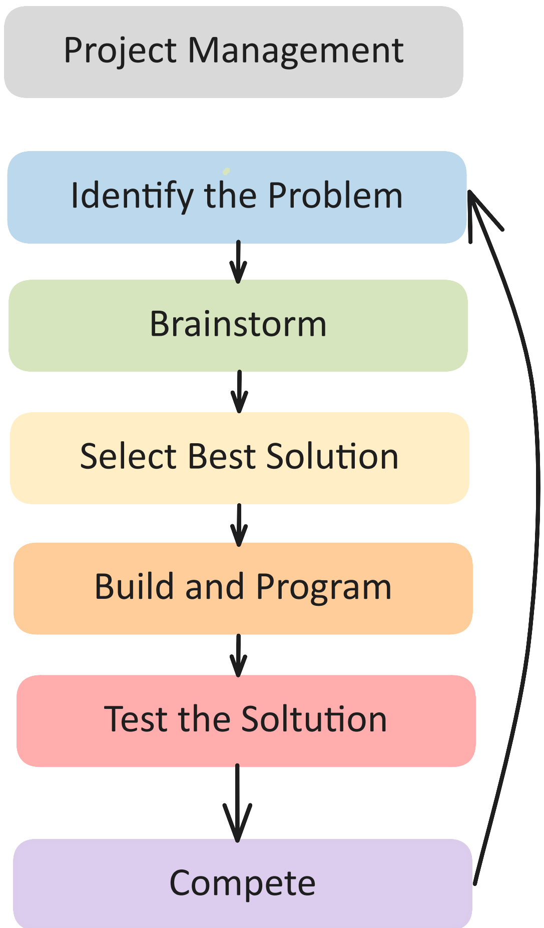
project management

project management

Introduction: Our Design Process



By: Juliana Curtis

Witnessed by: Andrew Curtis and Neil Joshi

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No next entry!

identify problem

Drivetrain: Requirements for Wheel & Gear Configuration

When designing a competitive drivetrain for this year's VEX Robotics competition, it's crucial to carefully select both the gear ratio and wheel configuration. These two factors significantly impact speed, torque, acceleration, stability, and the robot's ability to interact with game elements and the field.

By: Kairui Dai

Witnessed by: N/A

No previous entry!

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identify problem

Drivetrain: Requirements for Wheel & Gear Configuration

Key Considerations

Game Field Considerations

- **Flat surfaces:** This year's game field is mostly flat, which supports high-speed wheel configurations.
- **Barriers and obstacles:** If minor bumps exist, wheel size and ground clearance become more important.

Game Strategy & Movement Requirements

- Frequent traversal between scoring zones
- Agile repositioning for defense or descoring
- Precise alignment for scoring
- Consistent, reliable speed and turning control

This year's strategy demands a drivetrain that is optimized for **speed, maneuverability**, and **quick response**, with enough **torque** to hold ground when needed.

Robot Weight

- **Light robots** can use faster gear ratios and smaller wheels
- **Heavier robots** benefit from torque-oriented gearing and traction wheels to prevent stalling

Desired Performance Outcomes

To meet this year's game challenges, the drivetrain must:

- Maintain **high speed** across the field
- Turn and strafe quickly for accurate positioning
- Avoid slippage or stalling during contact with other robots
- Adapt smoothly to different gameplay scenarios

By: Kairui Dai Witnessed by: N/A

No previous entry!

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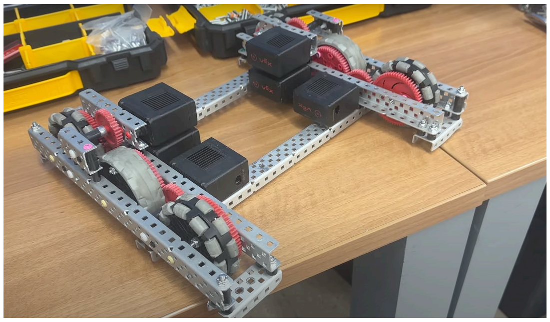
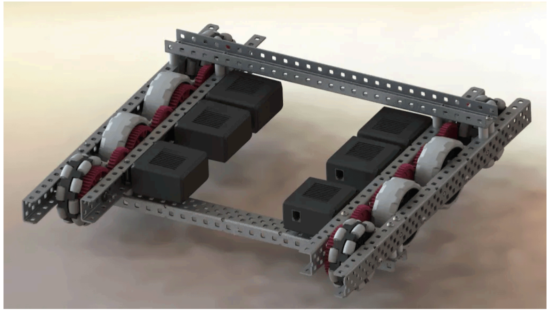
Drivetrain: Wheel & Gear Configurations

There are many possible wheel and gear configurations possible, however only a few options are viable for a reasonable amount of speed and torque. The wheel and gear configurations that we are considering for this robot are of the following:

- 360 rpm on 3.25 in wheels
- 450 rpm on 2.75 in wheels
- 450 rpm on 3.25 in wheels
- 480 rpm on 2.75 in wheels
- 480 rpm on 3.25 in wheels
- 600 rpm on 2.75 in wheels

 *Figure 7: 360 rpm on 3.25 in Drive from Vex Robotics Drivebase Tutorial by 9MotorGang on Youtube*	edef
 *Figure 8: 450 rpm on 2.75 by Owen 16610A on Discord*	ef

)

By: Kairui Dai

Witnessed by: N/A

Drivetrain: Requirements for Motor Cartridge

When selecting the appropriate **motor cartridge** for the **drivetrain** in this year's VEX Robotics competition, it is important to analyze both the **game requirements** and the **robot's performance goals**. The drivetrain controls how fast and efficiently the robot can move around the field, so choosing the right motor cartridge directly affects overall strategy.

Key Requirements

Game-Specific Demands

- This year's game requires fast movement between key scoring areas such as the **long goal** and **center goal**.
- The ability to make **quick adjustments**—like parking or descoring—is critical.
- Therefore, the drivetrain must prioritize **speed, acceleration**, and **responsiveness**.

Motor Cartridge Options

- **100 RPM (Red)** – High torque, low speed
- **200 RPM (Green)** – Balanced speed and torque
- **600 RPM (Blue)** – High speed, low torque

Desired Performance Outcomes

To meet the game's challenges, the drivetrain must:

- **Traverse the field quickly** to score and defend efficiently
- **Accelerate quickly** to respond to sudden changes in gameplay
- **Maintain control** during sharp turns or fast maneuvers
- Avoid stalling, especially during pushing or tight situations

Robot Weight and Design

- A **light to medium-weight robot** can safely use 600 RPM cartridges for maximum speed.
- If the robot is heavy, using **external gear reduction** or switching to 200 RPM may be necessary to prevent motor stalls.

By: Kairui Dai
Witnessed by: Ryan Bhimani

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Drivetrain: Selecting Motor Cartridge for Drivetrain

The following criteria was considered in the design matrix:

Top Speed (Weight: 1)

- **What it is:** The maximum speed the drivetrain can reach.
- **Why it matters:** In fast-paced games, top speed allows your robot to quickly move between key zones (e.g., goals, parking zones, scoring areas). A higher top speed reduces travel time and increases scoring cycles.
- **Used in:** Games with a large field, multiple scoring zones, or limited match time.

Acceleration (Weight: 1)

- **What it is:** How quickly the drivetrain reaches its top speed.
- **Why it matters:** A robot with strong acceleration can respond faster to changes in gameplay, like dodging an opponent, contesting a goal, or switching directions. This is crucial for real-time strategic plays.
- **Used in:** Defense, racing to contested goals, or sudden tactical moves like endgame parking.

Torque Output (Weight: 0.6)

- **What it is:** The amount of rotational force the motor provides.
- **Why it matters:** High torque is essential for pushing other robots, moving heavy game elements, or driving over resistance (like field barriers). If torque is too low, the robot may stall under pressure.
- **Used in:** Pushing, defense, lifting, or heavy robot frames.

Control & Precision (Weight: 0.8)

- **What it is:** How easy it is to drive or program the robot for accurate, smooth movements.
- **Why it matters:** Robots need precise control when navigating tight spaces, turning accurately, or aligning with goals. Faster motors can be harder to control without tuning.
- **Used in:** Autonomous routines, alignment with goals, or narrow pathways on the field.

By: Kairui Dai

Witnessed by: Ryan Bhimani

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Drivetrain: Selecting Motor Cartridge for Drivetrain

Field Coverage Speed (Weight: 1)

- **What it is:** How quickly the drivetrain can move across the game field during normal gameplay.
- **Why it matters:** Fast field coverage is essential for maximizing scoring opportunities and minimizing downtime between tasks. It combines top speed and acceleration in a real-game context.
- **Used in:** Games with high movement demands, like retrieving/distributing game pieces or switching field sides.

By: Kairui Dai

Witnessed by: Ryan Bhimani

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Drivetrain: Selecting Motor Cartridge for Drivetrain

Criteria	Weight	100 RPM	200 RPM	600 RPM
Top Speed	1	1	3	**5**
Accelerate	1	2	4	**5**
Torque Output	0.6	2	4	5
Control & Precision	0.8	**5**	4	2
Field Coverage Speed	1	1	3	**5**
Total	—	11	15	17.2

Scoring Notes

- **Scores range from 1 (worst) to 5 (best)** for each category
- **Weight** reflects how important that criterion is for drivetrain performance in this year's game

Decision Reasoning

We weighted the categories of top speed, acceleration, control, and field coverage speed the highest because, based on our game analysis (see page [insert page number here]), we determined that a fast robot is essential for effectively controlling both the long goal and the center goal. Additionally, high speed is critical for making split-second decisions, such as parking, descoring, or preventing a descore by the opposing team.

In contrast, we assigned lower weights to torque output and control & precision, as they are less important in this year's game. As stated in our game analysis (see page [insert page number here]), all game elements are relatively lightweight, so the drivetrain does not require a high amount of torque to perform effectively. The need for precision is also reduced, since we can improve the robot's accuracy using hardware solutions like aligners, allowing us to deprioritize software-based precision control.

By: Kairui Dai

Witnessed by: Ryan Bhimani

select

Drivetrain: Selecting Motor Cartridge for Drivetrain

Conclusion

Despite its **lower torque and control**, the **600 RPM cartridge** ranks highest in this matrix due to:

- Fastest **top speed**
- Best for **quick field traversal**
- Optimal in **speed-based game strategies**

By: Kairui Dai

Witnessed by: Ryan Bhimani

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select

build

Drivetrain: Finalizing Construction

GOALS:

- Bracing the Drivetrain
- Mounting Odom Pods

Odom Pods:

The odom pod was built from 2, 2 inch wheels mounted together to a rotation sensor. The rotation sensor will provide information about the speed of the robot and its orientation, which is used in calculations to help get a more consistent autonomous by using odometry. Odometry has awareness of a robots positioning to help it follow a predeterimined path.

Bracing the Drivetrain:

If the robot is able to twist and rotate, than bracing ifs required to give adequate strength to the robot. Cross bracing gives the robot adequate support to not only retain its structure and hold its own weight, but redistibutes loads from collisions. We added 2 channels spanning the entire width of the robot to brace it, while adding occasional boxing to prevent the channels from caving in.

Mounting Odom Pods:

By: Ryan Bhimani

Witnessed by: Kairui Dai

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No next entry!

build