

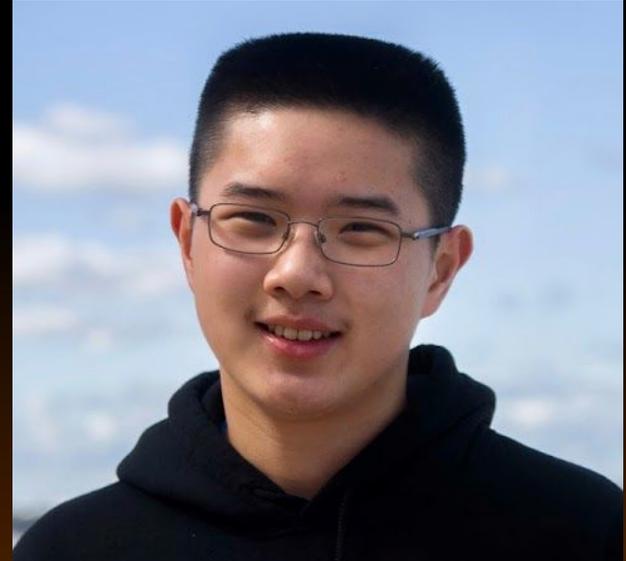


PREPARING FOR BUILD SEASON

HICKSVILLE J-BIRDS | FRC 1468

Introduction

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 - CAD and Design, Strategy



Introduction and Targeted Audience

- This presentation teaches the basics of what a FRC game is, how to analyze a game, and techniques used to design the robot for the new game.
- This presentation is made for new students and members on FIRST Robotics Competition teams and also serves as a refresher for veteran members.

1. WHAT IS A FRC GAME?

What is a FRC Game?

- Every year on Kickoff, a new game and its accompanying game manual is released with different objectives, point systems, and gamepieces.
- Teams play against each other in a 3 v 3 format in each match.
- A typical FRC game is structured with matches of 2 min. 30 sec.:
 - First 15 seconds: Autonomous period (no direct human control)
 - Bonus points are typically awarded for specific tasks
 - Remaining 2 min. 15 sec: Tele-op period
 - Final 30 seconds of Tele-op: Endgame period
 - Typically robots would have to climb/park in specified areas

Qualification Matches and Playoff Matches

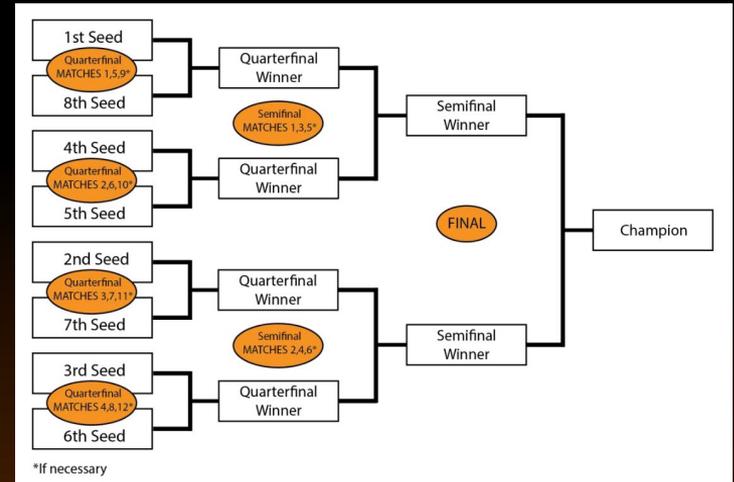
- Each event will have two sets of matches called Qualification Matches and Playoff Matches
 - Qualification Matches allow each team to earn Ranking Points which determine their seeding position and may qualify them for participation in the Playoff Matches.
 - Alliance partners and opposing alliance teams are randomly selected for each match
 - Each teams plays ~10-12 qualification matches
 - Playoff Matches determine the event Winners through a bracket tournament.

Ranking Points

- To determine the seeding for Playoff Matches, teams are able to earn Ranking Points in each Qualification Match based on their alliance's performance.
- Max of 4 ranking points per match based on match performance and completing game routines
 - Match performance
 - 2 for winning a match, OR
 - 1 for tying match
 - Completing game routines (2 max.)
 - 1 for each specific routine completed

Why are Ranking Points Important?

- At the end of the Qualification matches, the top eight seeded teams become the Alliance Captains. Each Alliance Captain chooses two other teams to join their Alliance.
- More ranking points → higher seed in playoffs → earlier picks on high-scoring and compatible alliance partners → play against “weaker” alliances in bracket system
 - #1 alliance vs. #8 alliance, #2 vs. #7, #3 vs. #6, #4 vs. #5
- If you want to go to Championships, being in a higher-seeded alliance increases your chances significantly.



2. ANALYZING THE NEW GAME

Kickoff

- Every year on the first (non-holiday) Saturday of January, a new FRC game is released with its own new objectives, point systems, and gamepieces.
- You will have 2-3 months to work on the robot to design, build, and test a robot within size and weight limits and to complete the game objectives.

Step 1: Identifying the Game Objectives

- Once kickoff is complete, it is critical to determine what components of the game you want to complete before even working on the chassis.
- Read all of the rules and examine every possible way to score points. At the minimal level, a robot is expected to:
 - Pick up gamepieces
 - Move the gamepieces around and deposit them at scoring locations
 - Move autonomously (often, there are bonus or multiplier points in the autonomous period)
- In addition, you should also examine ways to stop your opponents from scoring (e.g. defense or descoring gamepieces)

Step 2: Create a Decision-Making Matrix

- Once you know all of the potential ways to score points and prevent opponents from scoring, compare the difficulty and time taken of each objective to the reward
- The best tasks are those that are easy to perform and provides big points

Step 2: Create a Decision-Making Matrix | A Case Study on the 2019 Game

- To score a Cargo Ball, you needed a Hatch Panel placed first.
- High, middle, and low holes



Task/Strategy	Difficulty (1-10)	Points Per Cycle	Cycles can Complete	Points Available
<u>Autonomous-Specific</u>				
Driving off from starting platform	1	Level 1: 3 Level 2: 6	1	3 or 6
<u>Main Objectives</u>				
Scoring a Hatch Panel	Lower Holes: 3 Middle Holes: 5 Higher Holes: 6	2	20	40
Scoring a Cargo Ball	Lower Holes: 3 Middle Holes: 5 Higher Holes: 6	3	20	60
<u>Endgame-Specific</u>				
Climbing on Low Platform	1	3	1	3
Climbing on Mid Platform	5	6	1	6
Climbing on High Platform	10	12	1	12
<u>Ranking Points</u>				
Getting at least 15 Endgame Points	8 (Very Reliant on Partners)		1 RP	
Filling a Rocket with 6 Cargo Balls and 6 Hatch Panels	10		1 RP	
Tie			1 RP	
Win			2 RP	

Step 3: Identifying the Most Effective Roles

- The Mainstream Scorer:
 - This team wants to get many Ranking Points to seed high for the playoffs
 - Usually teams with more resources and money
- The Defense Robot:
 - This team wants to play defense and prevent their opponents from scoring (e.g. blocking areas and pushing)
 - Does not focus on scoring any sort of objectives
 - Good choice for teams with low resources
- Niche Robots:
 - Depending on the year's objectives, there are some robots that are very specialized in certain tasks.
 - 2018: "Exchange" robot, focused on exchanging cubes for power ups to help the alliance
 - 2019: Ramp robot, had a giant ramp on its body to help others drive up to the highest platform

Step 3: Identifying the Most Effective Roles | A Case Study on the 2019 Game

- The Mainstream Scorer
- To get the most amount of points and as many Ranking Points as possible, this team will focus on:
 - Scoring both Hatch Panels and Cargo Balls
 - Building a mechanism that can reach the high holes
 - Have a climbing mechanism that can reach the highest platform

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Step 3: Identifying the Most Effective Roles | A Case Study on the 2019 Game

- The Defense Bot
- This team focuses on playing defense on the opposing teams. So, a good driver is needed to be effective.
- Because scoring potential is low as you are not scoring game pieces, higher-tier defense robots still try to implement autonomous programs and climbing mechanisms to make up for points lost

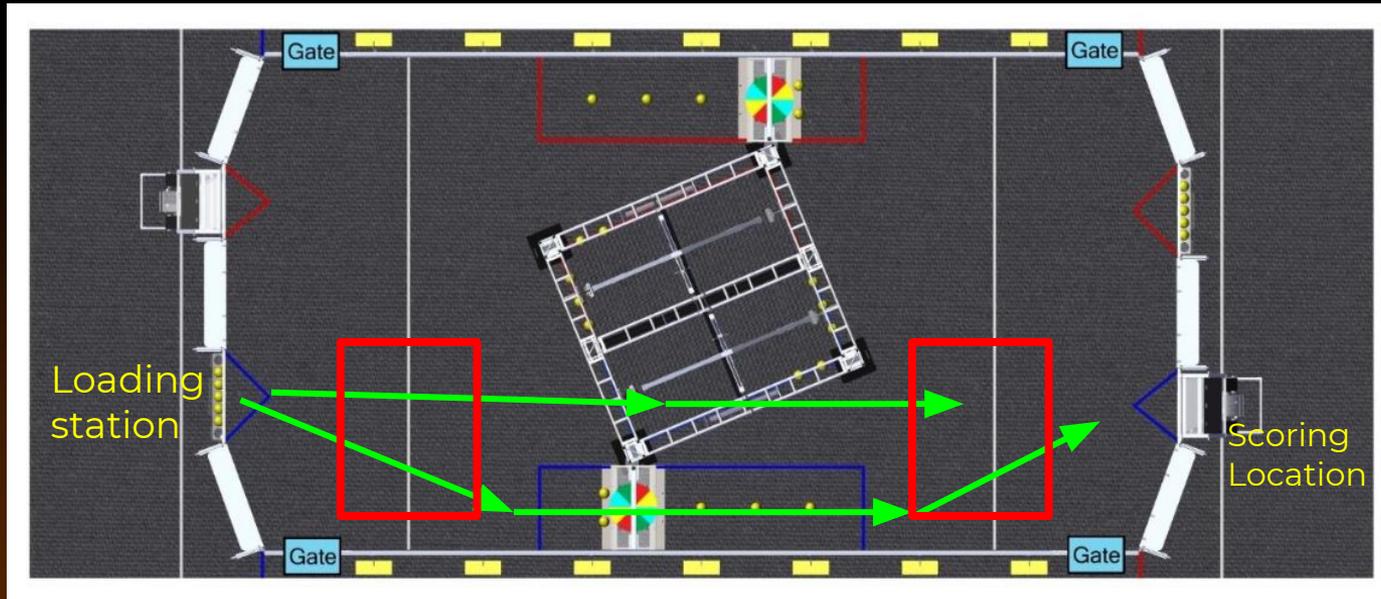
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Step 4: Identifying Flow and Chokepoints

- In each FRC game, there are certain paths that robots will take to collect gamepieces and score those gamepieces.
- In addition, depending on the structures on the field, tight spaces, called chokepoints, can occur where defense bots often lurk.
 - Also usually occurs where common paths intersect
- Identifying flow and chokepoints becomes important when avoiding defense robots

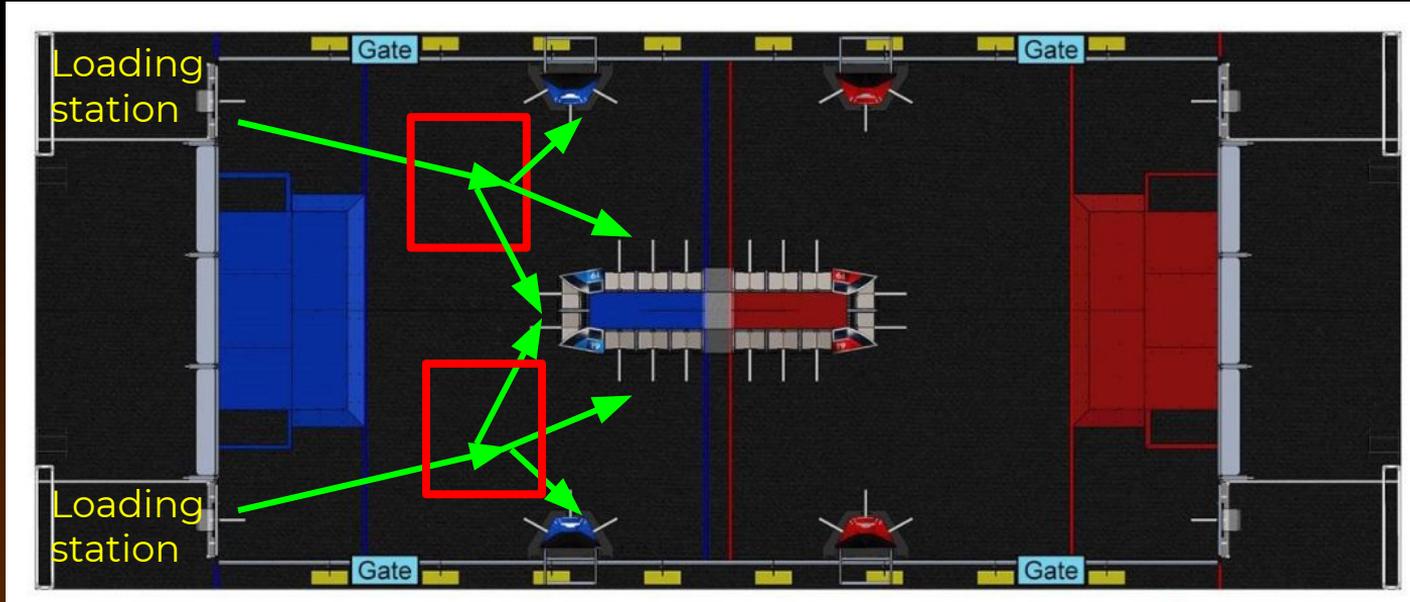
Step 4: Identifying Flow and Chokepoints

2020/2021:



Step 4: Identifying Flow and Chokepoints

2019:



Step 5: Choosing the Perfect Combination

- After identifying the most effective roles and the flow and chokepoints of the game, you will need to figure out what is the best combination of three robots to create for the Playoffs?
- In games with tight spaces and lots of chokepoints, a defense bot was basically required to win games
 - In 2019, it was inefficient to have three robots trying to score as there was only two loading stations. So, a defense bot was perfect to reduce the crowd from your side and stress the opponents instead.
- Should always have at least two high scorers on a Playoff alliance to maximize scoring output.
- Think of different combinations of alliances, how well would each alliance do if they played against each other?
- What would your team do if you're playing against robots of similar abilities?

Step 6: Determining your Robot's Role

- What are your goals this year?
 - Do you want to go to Houston or just have fun at the regionals?
- Based on your resources, do you want to be a mainstream scorer, a robot that wants to get ranking points and seed high, or a niche robot that hopes to get picked by a captain?
- What do you think high-caliber teams will do? How many of these teams are at your regional?
- Focus on autonomous and endgame objectives

Bonus Step: Identifying an Overpowered Strategy

- Such a strategy, when executed, guarantees victory despite of any actions your opponents make.
- Although it rarely happens, there are some games where a strategy is developed.
 - In 2018 POWER UP, there was time-based objective scoring (the longer you control a scale, the more points you get).
 - Team 254 created a 4-cube autonomous program, which gave them a tremendous advantage in controlling the scale right from the beginning of the game
 - Team 254 won all of their official matches and were Houston Champions that year
- When the new game comes this year, can you identify an overpowered strategy???



Keep it Simple, Silly (KISS)

- Always build the robot within the team's limits.
 - Evaluate your resources and abilities realistically
 - How many member do you have? What is the budget this year?
How many members are new to the team?
 - Avoid building complex unnecessary mechanisms
- “A jack of all trades is a master of none”
 - A robot that tries to do everything is likely to do nothing well, while a robot that focuses on fewer capabilities is more likely to do them well.

THANK YOU