6328

2020 Engineering Notebook

1.) Introduction

This engineering notebook will be used to document the process of building a robot to compete in the FIRST Robotics 2020 game, Infinite Recharge. FRC6328, Mechanical Advantage is based out of Littleton, MA and is going on it's 4th year competing. The team is comprised of 42 FRC Students and 18 Mentors and builds out of their shop at 20 Harvard Road, Building D, Littleton, MA.

2.) Game Analysis

This section will be about the team's game analysis broken down into phases of the match.

- a.) Autos
  - i.) Auto lasts for 15 seconds
  - ii.) Teams start with 3 balls
  - iii.) Robots must be touching INITIATION LINE
  - iv.) Driving off INITIATION LINE is 5pts
  - v.) Scoring in INNER PORT is 6pts per ball
  - vi.) Scoring in OUTER PORT is 4pts per ball
  - vii.) Scoring in BOTTOM PORT is 2pts per ball
- b.) Teleop
  - i.) Teleop lasts the remaining 2 minutes and 15 seconds of the match
  - ii.) Scoring challenges
    - (1) Scoring in INNER PORT
      - (a) 3 pts per ball
    - (2) Scoring in OUTER PORT
      - (a) 2 pts per ball
    - (3) Scoring in BOTTOM PORT
      - (a) 1 pts per ball
    - (4) CONTROL PANEL
      - (a) Rotation Control
        - (i) After you have scored 29 balls, you must spin the Control Panel 3 times
          1. 10 pts
      - (b) Position control
        - (i) After you have scored 49 balls, you must spin the CONTROL PANEL to land of a color that is specified
          1. 20 pts
- c.) Endgame
  - i.) The last 30 seconds of the match is considered the END GAME
  - ii.) Scoring challenges
    - (1) Parking in RENDEZVOUS ZONE
      - (a) 5 pts per robot
    - (2) Robot is hanging

(a) 25 pts per robot

(3) Hanging bar is LEVEL

(a) 15 pts

d.) Ranking Points

i.) Ranking points are extremely important as they have been in previous years, they are the top ranked for the sorting criteria that determines the overall team rank at the competition.

ii.) There are four ways to obtain ranking points

(1) SHIELD GENERATOR OPERATIONAL

(a) earning at least sixty-five ENDGAME points

(i) 1 RP

(2) SHIELD GENERATOR ENERGIZED

(a) Stage 3 ACTIVATED (49 balls and color match the Wheel of Doom)

(i) 1 RP

(3) Tie

(a) Completing a MATCH with the same number of points as your opponent

(i) 1 RP

(4) Win

(a) Completing a MATCH with more points than your opponent

(i) 2 RP

3.) Strategy decisions

a.) Auto

i.) During auto, each team can hold 3 balls and needs to start on the initiation line. There are 5 additional balls placed in the TRENCH, and 5 balls placed inside the BOUNDARIES inside each ALLIANCE'S RENDEZVOUS POINTS.

ii.) Initial breakdown states that for week one we will have three different auto options.

(1) Stay on the initiation line and shoot with our intake down with the option to collect the balls from our alliance partner

(2) Shoot 3 balls, collect balls in TRENCH, shoot 5 balls at the end of the trench

(3) Shoot 3 balls, collect balls at RENDEZVOUS POINTS, Shoot 5 balls back near initiation line

iii.) Week 5 and beyond autos will be added to this document as the season progresses.

b.) Shooting

i.) The team has decided that in order to give ourselves the best possible opportunity to make as many shots as possible, we will work to position the robot up against as many, "hard stops" as possible. This means that

the robot will be pushed up against something to ensure the robot is properly aligned before shooting so we can get a consistent shot.

ii.) Three major positions
   (1) Up against driver station wall in protected zone
   (2) End of Trench still in protected zone
   (3) INITIATION LINE

iii.) Be able to get all 5 shots off with 3 seconds

iv.) Aim for the 3pt goal, be happy with 2pts

c.) Hanging
   i.) The team has decided that hanging is a must
   ii.) Balancing will be critical but initial analysis leads the team to believe that the robot should be able to balance the rig without an additional mechanism on the climber hook
   iii.) Have the ability to hang anywhere on the bar
   iv.) In order to secure a ranking point, putting a lot of effort into developing a buddy hang will be important to have early in the season, will likely matter less towards the end of the season as more teams gain the ability to climb

d.) Wheel of doom
   i.) This is the lowest priority for the team
      (1) Reasoning is the team is under the impression that 49 balls will not be scored before the end of the match, so that ranking point will be hard to get and the time can be used to do more important tasks

e.) Controls
   i.)

f.) “Playbook”

4.) Design Requirements Questions and Prototypes
   a.) Short vs Tall
   b.) Over bumper vs through bumper
   c.) Linear dual wheeled shooter vs hood shooter
   d.) Turret vs no turret
   e.) Pneumatic Hood vs Motor Driven
   f.) Shoot same side as intake vs opposite
   g.) Open hopper vs ball tunnel

5.) Robot Layouts
   a.) Open Hopper
   b.) Ball Tunnel

6.) Hanging
   a.) 254 2013
   b.) Buddy Climb?

7.) Controls
   a.) Vision Tracking
   b.) Motion Profiling

c.) Ball sensing
d.) Auto hang leveling
e.) Drivers station

8.) Final Design Decisions
a.) Layout
b.) Drivetrain
c.) Shooter
d.) Intake
e.) DJ wheel
f.) Ball organization system
g.) Hanger

9.) Manufacturing resources
a.) CNC router
b.) Bridgeport
c.) Turning
d.) Sheet metal
e.) CNC Milling

10.) Branding
a.) Powder
b.) Sponsor Vinyl
c.) Bumpers
d.) Apparel
e.) Pit

11.) Competition performance
a.) Northern CT - Week 1
b.) Ottawa, CA - Week 3
c.) Greater Boston - Week 5

12.) Student Reflections