2023 4-H ROBOTICS ENGINEERING CHALLENGE

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1 Maryland 4-H Robotics Engineering Challenge

The Maryland 4-H Robotics Engineering Challenge (REC) provides an opportunity for 4-H members interested in STEM (Science, Technology, Engineering, Math) to participate in a hands-on, team-based activity where they build robots and program them to complete specific tasks. Successful teams will display technical excellence in robot design, engineering, and programming, as well as a high level of skill on the field in competition. The REC theme changes every year and integrates hot topic issues plus 4-H and University of Maryland priorities to bridge connections between youth, UMD, and industry.

Please direct questions and/or concerns to Willie Lantz, 4-H Robotics Superintendent, at wlantz@umd.edu or Mark DeMorra, 4-H STEM Specialist, at mdemorra@umd.edu.

2 The Essence of the Game

The 2023 Maryland 4-H Robotics Engineering Challenge has youth "going back to basics"… by having them play with colored blocks! Teams will have several square blocks of various colors on the field that they can score by having their robot place them in one of their team's three goals of increasing heights (low, medium, and high). There is also a "Color Selector" mechanism that teams can activate to *double* their points scored for those specific-colored blocks. The higher the goal, the more points a team can earn for their blocks placed there.

However, ***there is a catch***. At the end of each 2 minute 30 second match, a team will ONLY earn points for the blocks they scored in their goals with the specific color that appears **most frequently** in their own goals. As an example, if a team places some combination of 8 white blocks, 4 green blocks, and 3 yellow blocks in the various goals on their side of the field, the white blocks would be considered the team's "***Primary Color***" and would be what counts for their team for scoring. In addition, those blocks that a team scores in their goals that don't match their primary color, will instead add points to the opposing team!

It's a game of keen observation, high accuracy, good precision, and good planning that will challenge teams to not only pay attention to what's happening with their goals and blocks, but their opponent's goals and blocks too. Well-considered strategies and pre-game planning for various situations that might occur will be vital to a team's success.

The following is an image of the 2023 REC field with labeled field elements. Note that each team is assigned a "starting" side of the REC field, either blue or red, and most of the scoring blocks (green, white, and yellow), start the game at the front (audience side) of the field. The various goals are located towards the center of the field in front of the drivers, and the Color Selector mechanism is located directly in front of the goals, behind the tiles that contain the colored blocks.

Note that some regions of the field are obscured by the "Target Wall" and therefore the teams will need to find a creative way to be able to perform actions while in this area.

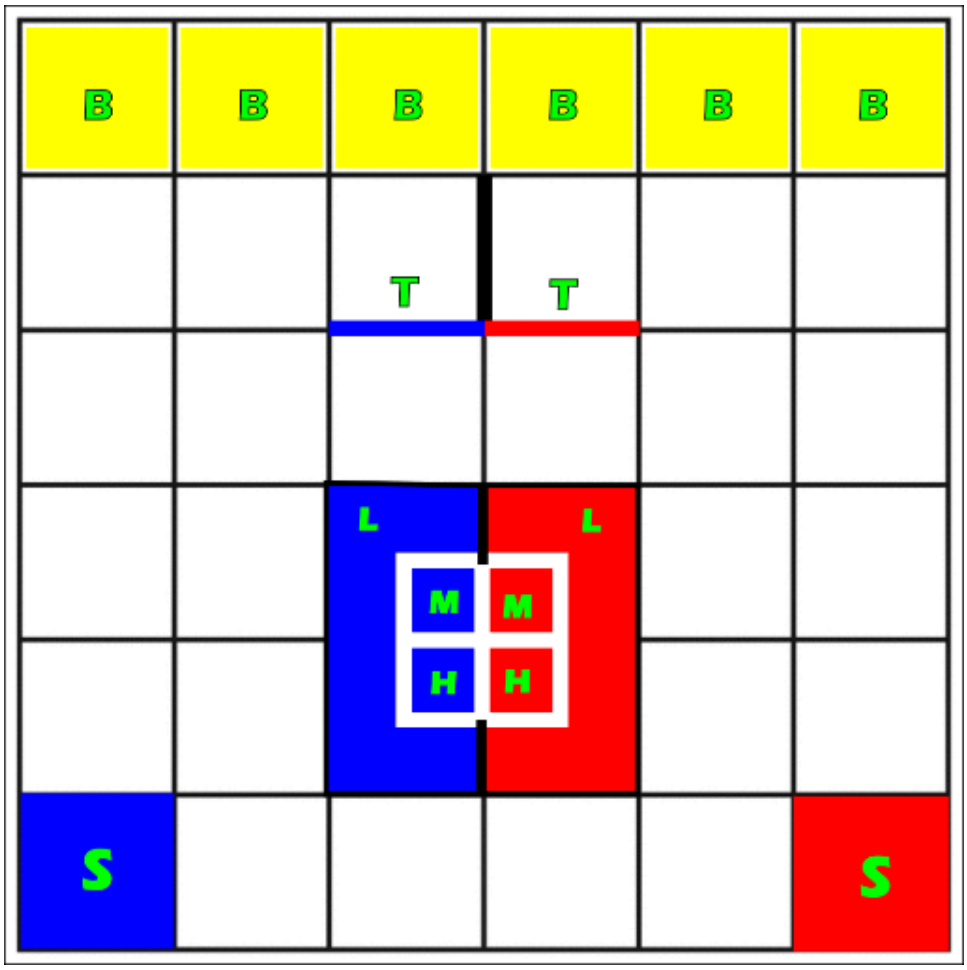


Figure 1: 2023 REC Field-Labeled

- "**S**" Start Tile: Each team's robot starts completely IN this tile (each also contains 1 black block)
- "**B**" Block Tiles: Each tile has 2 of each color block (green, yellow or white) at start of game.
- "**T**" Target Tile/Wall: Contains Random Color Selector. One for each team. A 2" wide white tape line leads up to the selector on the audience side.
- "**L**" Low Goal: Ground level area surrounding Medium and High Goals.
- "**M**" Medium Goal: Raised wooden perimeter: 12" high – 12" square.
- "**H**" High Goal: Raised wooden perimeter: 24" high – 12" square.

3 Terms and Definitions

Autonomous Period: The first 30 seconds of a REC match is called the Autonomous Period. As opposed to the *Driver-Controlled Period*, this is when a team's robot must operate on its own without the use of human input through a controller. A team will have to write an autonomous code before competing, and can have multiple autonomous codes created, but can only run one per match.

Block Control Limit: A robot can only hold and/or control a maximum of 4 blocks at any one time during a REC match. This rule is meant to allow both teams the chance to collect and deliver blocks to their goals (so one team can't just collect them all at one time), while also providing a challenge that will make youth have to plan their strategies and overall time management for their matches.

Blocking: This is defined as blocking access to scoring elements or goals. This includes the Color selector. Temporary blocking due to traversing congested areas is expected, but strategic blocking to limit the opponent's ability to score is not allowed.

Blocks (Green, Yellow, White, or Black): Scorable items that robots must place into their goals to score points. 2 Black blocks are only available for scoring during Autonomous, but the remaining 36 colored blocks can be scored at any time. There are 12 blocks each of green, yellow, and white. Each block is 1.5" by 1.5", made a standard 2x4 pine board that can be purchased at home improvement stores. Or pre-cut blocks can be purchased at Lowes or online. https://www.lowes.com/pd/Madison-Mill-1-5-Hardwood-Cubes-27-PKG/5001880823

Color Selector: Each team uses this mechanism to determine what their own "Triggered Color" will be for that REC match. The color selector, when activated, will release a "Plug" which is either Green, Yellow, or White, indicating the team's Triggered Color" for that round. Each team will have their own designated Color Selector mechanism, located closest to their starting tile.

Driver-Controlled Period: The Driver-Controlled Period follows the 30-second *Autonomous Period* and lasts 2 minutes. Teams control their robots directly using remote controls that remotely communicate with the robot's electronics to operate. The end of the Driver-Controlled Period constitutes the end of a match.

Driver-Station: The area in which drivers are required to stand during matches. This area is on the back (non-audience) side of the field and will be marked with Gaffer's tape. The area will extend the full width of the field and extend back three feet. One half of this area will be allocated for each drive-team. If a drive-team member leaves this area during a match they may forfeit subsequent points scored.

Drive-Team: Up to three youth team members may be active "at" the field for any one match. This is the active Drive Team. These members must stay in the Driver Station area for the duration of the match, and they are the only people able to handle the robot controls or provide any coaching during the match.

Event Official: Any individual who is leading or assisting with the operation and execution of refereeing, judging, scoring, and officiating a REC tournament is considered an Event Official. Decisions made by them are believed to be unbiased and done using their best judgment. These individuals have been asked to assist in some manner with a REC tournament by, and report to, the 4-H Robotics Superintendent and 4-H STEM Specialist. Questions about decisions made by robot game referees must be brought to their attention immediately following a match when a referee asks a team to review and sign-off on their score sheet. After a match's scoring has been posted, it is considered final and CANNOT be changed.

Field: The 12ft by 12ft playing area for the REC game. The field consists of 6x6 grid of 24" foam tiles and all game elements that are located within the *Field Perimeter.*

Field Perimeter: The 1ft tall black aluminum and clear acrylic border of a REC Field, whose purpose is to keep all *Field* elements contained within its borders throughout the game. The Field Perimeter is 12ft in length on each side and can be a VEX VRC Field Perimeter or FTC Field Perimeter from Andymark.

Goals (Low, Medium, and High): Six goals (three for each team) are located towards the center of the field. Robots can place blocks into these goals to score points. Each team has 3 goals (low, medium, high). Each goal is 12" by 12" in length and width but are different heights.

Matching Color or Matching Primary Color: This condition is when a team's "Primary Color" is the same as the team's "Triggered Color." In this desirable situation, any "Matching Color" block will score double.

Non-primary Color: Blocks that are not black nor a team's "Primary Color" are called "Non-primary Color"

blocks. Any of these Blocks a team places in their goals will score points for the OPPOSING team.

Parking: Termed use to describe a scorable "mission" in the REC game where a robot has to be maneuvered to specific location on the REC field by the end of the match in order to score points. In the 2023 REC game, a team can score parking points if their robot is at least partly inside their designated "Low Goal" at the end of the Driver Controlled period.

Penalties: Penalties will be assessed for behavior which typically provides an unfair advantage or prevents an opponent from actively attempting to score. Penalties are defined throughout this document, and when applied will be added to the opponent's score.

Pinning: This is defined as contact with another robot and not allowing the opposing robot to move. This typically applies to holding an opponent against the field perimeter or another field element. It is not allowed.

Primary Color: A team's "Primary Color" is determined by referees at the end of the match by counting the numbers of each block color (Green, Yellow, or White) scored. The "Primary Color" is the color block that appears the most in the team's 3 goals. ONLY "Primary Color" blocks will add to the team's score. If more than one color could be the Primary Color, then the team can designate which color will be counted as the primary. When a choice is required, the goal will be to give the team the maximum points available by choosing the best color.

Starting Tile: The designated tile, colored red or blue, which a team's robot must start in at the beginning of every REC match. The starting tile also has one black block on it at the start of the match that can be scored during the Autonomous period.

Teleoperation: **See Driver-Controlled Period.**

Triggered Color: This refers to the color which is exposed by activating the Color Selector mechanism. Note: Opposing teams cannot expose the same "Triggered Color" in a match. If a team's "Primary Color" ***matches*** the "Triggered Color," blocks of that color will have their point values doubled at the end of the game.

4 Challenge Overview

4.1 Robot Game Structure

During each match, two teams will compete head-to-head, and teams will be competing in multiple matches throughout the day. The objective is for a team to score the most points by completing game tasks. Points are primarily scored by delivering specific-colored blocks to the various goals before time expires. Other scoring mechanisms also exist, and missions have a range in their difficulty, intended to challenge veteran teams while also allowing for new teams to have a chance to compete.

Each match will last for a total of 2 minutes 30 seconds, and will be divided into two separate timed periods, as follows.

1. The Autonomous period: Teams will have 30 seconds to score points with their robot using only code previously installed on their robot, and without any operator control. Remote controls must be out of the drivers' hands during this period. The robot must remain in its final resting position at the end of the Autonomous period and cannot be moved until the start of the Driver Control period.

2. The Driver Control (Teleoperation) period: Shortly after the conclusion of the Autonomous period, Teams will have 2 minutes to operate their robot by remote control.

Scores will be tallied by referees and other event officials at the end of the Driver Control period. Scores may not immediately be revealed to teams, but will be posted shortly after a match's conclusion, after scoring officials have verified and entered them into the system.

4.2 Judging and Engineering Notebook

During the season, teams should document their work in an Engineering Notebook, which should summarize the team's entire process of designing, building, programming, and testing their robot. It is expected that teams update their Engineering Notebook *every meeting*. At State Fair, on the morning of the REC Tournament, each team must submit their Engineering Notebook when they check-in that morning. The judges will *not* review Engineering Notebooks before judging rounds begin.

During the day of the REC tournament, each team will have a scheduled time to give a presentation about their work during the season, both technical and non-technical, to a panel of judges. These sessions will last approximately 10 minutes, but teams must leave time for judges to ask questions at the end. It is recommended teams aim to have their presentations last approximately 5 minutes with 5 minutes left for questions. If the judges feel a team's presentation is running too long, they reserve the right to stop the team at whatever point deemed necessary, and the judges will score the team on what they heard and what questions they're able to ask with the time left. The team's Engineering Notebook and their presentation will determine their final judging score. The rubric used by judges to score notebooks and presentations can be found in the appendix of this document.

4.3 State Fair Competition Structure

Overall Ranking

There are two components that combine equally to form a team's overall tournament score and subsequent ranking: Robot Performance and Engineering Interview. The percentage score for these two activities is added and the resulting sum is used to rank the teams.

Robot Performance

During the State REC Tournament, REC teams will compete in at least 3 matches. A team's overall Robot Performance is the average score of all their scheduled matches. If a team does not participate in a scheduled match, or if it is disqualified from a match, it will receive zero points for that match which will reduce their average score. A team's average score will be then turned into a percentage of the competition's highest top score.

Engineering Interview

The engineering journal will be used to document the team's design process in building the robot from design concepts to finished product. Team members should document your work in the journal each time your team meets to work on the robot. Record your obstacles, lessons learned and successes of your designs. Place information in the journal about testing procedures and results of tests. Any format may be used for the journal.

The Engineering Journal will be presented and evaluated during a Judge Interview. The interview will last 10 minutes. The team should be prepared to present their design, team activities and other items of interest, but also allow time for the judges to ask questions during the interview period.

5 The Field and Field Elements

5.1 The Field

Matches are played on a standard 12' x 12' VEX/FTC field, with perimeter walls 12" high, and a field surface of standard foam VEX or AndyMark FTC tiles approximately measuring 24" x 24". There are two colored starting tiles on opposite sides of the field. One red, one blue. Field tiles are installed with their smooth side up.

5.2 Field & Scoring Elements

Starting Tile: Each team has one 24" by 24" foam tile (colored red or blue) where their robot must be placed completely inside when the match begins. The starting tile also has one black block in it at the start of the match that can be delivered to one of the goals for points during the Autonomous period. The Starting tiles are located on the rear wall of the field in opposing corners.

Blocks: The scoring elements for this game are Thirty-Eight (38) 1.5" colored cubes/blocks. Thirty-six (36) blocks (12 Green, 12 White & 12 Yellow) are placed at the front (audience side) of the field. These are used to score points by being placed in a team's goals. Two blocks of each color are placed on each front tile. One (1) black block is also placed in each team's Starting Tile at the start of the match and can only be used during the autonomous period to score points.

Goals: Six goals (three for each team) will be located in the center of the field near the driver stations. The robots can place the colored blocks in these goals to score points. Each team has 3 goals (low, medium, high, representing increased difficulty via different heights) that blocks can be placed in to score points depending on their height:

- Low Goal (Ground level) = 2 points
- Medium Goal (12" high) = 4 points
- High Goal (24" high) = 6 points

Target Wall: There is a four-foot long "Target Wall" towards the front of the field. This wall holds the "Color Selector" mechanism for each team. The "Color Selector" mechanism, when activated correctly, will push a small colored "Plug" out of the selector towards the driver station. The plug must be touching the field mat to count. Since the color sector MUST be activated from the audience side of the "Target Wall" it is not a simple task, and it will require teams to be creative in finding alternate ways to guide the robot to trigger the mechanism. Activating the color selector in any other way (banging or grasping from the wrong side) will not result in doubling of points.

More information on the materials used to build the REC game field components can be found in the REC Build Guide on the MD 4-H STEM Website, including websites where items can be purchased.

6 Challenge & Game Rules

6.1 Robot Rules

1. Robots can weigh a maximum of 20 lbs. (including batteries). A scale may be used at inspection to ensure the robot meets this requirement.

2. Robots may be constructed using a wide variety of materials. Creativity is encouraged! Legos, VEX robotics parts, FIRST components, plastic, cardboard, duct tape, fasteners of various types, etc. are all permitted.
3. Components that pose risk of harm to an opponent's robot are not permitted, even if the risk is unintentional or rare. This includes, but is not limited to, sharp, explosive, radioactive, or liquid components. Robot inspectors, judges, and referees all will be monitoring for these potential risks and have the authority to disqualify a robot from competing until identified issues are fixed.
4. At the beginning of a match, robots must be able to fit inside a 18"x18"x18" sizing box. Robots identified as being too large will be required to reduce their size before being able to compete.
5. Once a match begins, a robot may expand in size. Teams are urged to use common sense when designing their robot expansions.
6. No component of a robot may be intentionally detached during a match. This can present a safety hazard.
7. The robot's power source CANNOT exceed a total of 12 nominal volts.
8. The total capacity of the robot's power source CANNOT exceed 6000 mAh.
9. During a match, robots MUST be controlled wirelessly. No tethered or wired connections are allowed.
10. A robot's Autonomous program, if it has one, MUST be able to be started remotely by a team. After being placed in its starting position on the field, touching the robot or its components in any way to start it, change its programming or operation, or otherwise physically control it by hand in some manner, is not allowed until after event officials signal it is clear for robots to be removed. Starting and/or controlling robots by hand in this manner could present safety hazards.
11. Any microprocessor may be used in the robot's design.
12. Any wireless controller may be used, as long as the setup allows for the robot's operation in Autonomous and Driver Control to be done remotely, in accordance with Robot Rule 10 above.
13. A robot can have a MAXIMUM of 10 motors and/or servos total.
14. On Challenge Day, all robots must be inspected before they will be permitted to compete in any match. Any issues the inspection judges find with a robot design or setup must be rectified first before it is allowed to compete.

6.2 Participation Requirements

1. 4-H REC Teams may consist of between 3-8 4-H youth members.
2. All team members MUST be enrolled in 4-H Online by July 15, 2023 in order to participate in REC at State Fair. Failure to be an enrolled 4-H member, paid in full, and in good standing will result in those individuals not being able to participate in the challenge in any form.
3. Each group of youth must have two certified 4-H volunteers established to compete and remain in compliance with established 4-H program rules and protocols.
4. Coaches and Mentors **are** allowed to run, assist, and/or oversee more than one 4-H REC team.
5. The 4-H division a REC team competes in is determined by the oldest member of the team. The 4-H age divisions are as follows (Note: 4-H age is determined by a child's age as of 1/1/2023)
    - Senior Division 14+ years
    - Intermediate Division 11 through 13 years
    - Junior Division 8 through 10 years

6.3 Safety Rules

1. Each team in the pit areas and/or at the field during a match must wear safety glasses. NO EXCEPTIONS!
2. If a robot becomes disabled or behaves erratically, an event official may authorize a team member to enter the field of play and shut off the robot. This is the ONLY time a team member may be allowed to enter the field while play is ongoing. Penalties may be applied if team

members enter the field without permission by an event official, while a match is ongoing.
3. Robots that repeatedly or purposefully damage other robots and/or the field or field elements may be removed from the tournament by an event official.

6.4 General Robot Round Rules

1. All decisions regarding scoring and rules violations are made by event officials. Every effort will be made to ensure matches are fairly and evenly officiated. Concerns about match scoring, penalties, and violations must be brought to the attention of event officials at the end of the match in question, and before the robots are removed from the playing field.
2. Unless given explicit permission by an event official, team members must remain in the designated driver station area for the duration of a match.
3. At no point during a match may anyone other than an active drive-team member give coaching or instruction.
4. Each match will last a total of 2 minutes and 30 seconds: 30 seconds for Autonomous and 2 minutes for Driver Control.
5. After robots have been set up on the field and event officials have given the “ready” signal, team members CANNOT enter the field or change the position of their robots without explicit permission from the officials.
6. During each match, a countdown timer will be clearly visible to all teams competing in the current match.
7. Event officials may be encouraged, but are not required, to give a countdown in the closing seconds of each match.
8. A buzzer sound plus a signal from an event official will indicate time has expired for each match. At this point, teams must IMMEDIATELY set down their controller to make it obvious they are no longer operating their robot. Any missions completed after the 2.5 minute period will not count towards the scoring.
9. If a robot malfunctions at the conclusion of a match such that the robot continues to operate, teams must receive an “OK” from the event official before manually disabling their robot
10. If a team continues to operate their robot after time has expired, an event official will give a **Warning** for the first violation. Additional violations may result in a team being disqualified from the current match and subsequent matches.
11. If and only if extreme circumstances arise that compromise the integrity of the game, as decided by event officials, the decision to replay a match or a portion of it may be made.
12. Egregious and Unsportsman-Like Conduct: If the referee determines that a team’s behavior or actions, on or off the field, is meant to damage another team’s robot or is unsportsman-like conduct, the team will be issued a warning and a (if the robot is in a match). The referee will explain the warning to the team. If the behaviors or actions continue, the referee may disqualify the team from the competition.

6.5 Autonomous Period

1. The Autonomous period will last for the first 30 seconds of the match.
2. Teams are recommended to use a VEXNET match controller or the FTC Robot Controller app to stop their Autonomous program or must have another pre-approved method to stop their robot’s Autonomous function immediately upon expiration of the 30-second Autonomous period.
3. **Incidental** contact between robots will be excused during the Autonomous period. **Intentional** contact is not permitted in any form and may result in penalties being applied.
4. During the Autonomous period, a team must not handle their remote control.
5. Once the Autonomous period has begun, teams may not touch their robot for any reason unless they have received explicit approval from an event official.
6. If a robot continues operation past the end of the Autonomous period, any missions it completes

after the 30-second time will NOT be counted for points. The first time a team's robot does this, they will be given a Warning. At the 2nd instance, their robot will be disqualified from scoring in the Autonomous portion of matches for the rest of the competition.

7. At the conclusion of the Autonomous period, event officials will calculate the score of each team.

    - It is during this time that teams may ask permission to enter the field if manual switching from Autonomous to Driver Control modes, if required. **Teams must declare this requirement to the event official prior to the start of the match.** After Autonomous has concluded, those teams may not enter the field to perform this switch until permission is granted. The teams may not reposition the robot or touch any other game piece.

6.6 Driver Control (Teleoperation) Period

1. The Driver Control period will last for 2 minutes.
2. During Driver Control, each team must control their robot exclusively through wireless controllers.
3. Controlling the robot using wired or tethered means is not permitted.
4. During the Driver Control period, teams may not touch their robot for any reason unless the team has received explicit permission from an event official to do so.
5. During Driver Control, incidental contact between robots is expected, but this is not *Battle-Bots*, so behavior which causes damage to another robot (either intentional or accidental) will be penalized.
6. On the first violation of rules regarding robot contact and/or damage, the referee will issue the offending team a **Warning**. Subsequent infractions by the same team will result in disqualification from a match.
7. At the conclusion of Driver Control, teams may not touch, move, or otherwise handle their robot until granted permission from an event official. This is to ensure final scoring is done accurately.

7 Match Scoring

7.1 Scoring Summary Table

Action	Auto Score	TeleOp Score	Points for Opponent
Trigger Colored Selector	10	5	
Black Block in Low Goal	2		
Black Block in Mid Goal	4		
Black Block in High Goal	6		
Primary color block in Low Goal		1	
Primary color block in Mid Goal		2	
Primary color block in High Goal		3	
Matching color block in Low Goal		2	
Matching color block in Mid Goal		4	
Matching color block in High Goal		6	
Non-Primary color in Low Goal			1
Non-Primary color in Mid Goal			2
Non-Primary color in High Goal			3
Parking in Low Goal (bonus)		5	
Any Penalty			5

7.2 General Scoring Rules

1. Any blocks in contact with the robot at the end of Autonomous or Teleoperation will not count.
2. Once the signal is given for robots to be removed from the field, all scoring decisions are **final.**
3. Teams may ask for scoring or rules clarification before removing their robot from the field of play.
4. During a match, a team may choose to de-score the opposing team's blocks from the low goal only.
5. Teams are able to move and engage with the colored blocks during Autonomous (including attempting to score them in the goals) but scoring for these blocks is only calculated at the end of the Teleoperation period (aka, the end of the full 2 minute and 30 second match).
6. Endgame Parking - If a team's robot is parked (partially) in their low goal area on the field at the end of the 2.5 minutes they will receive the parking bonus.

7.3 Penalties

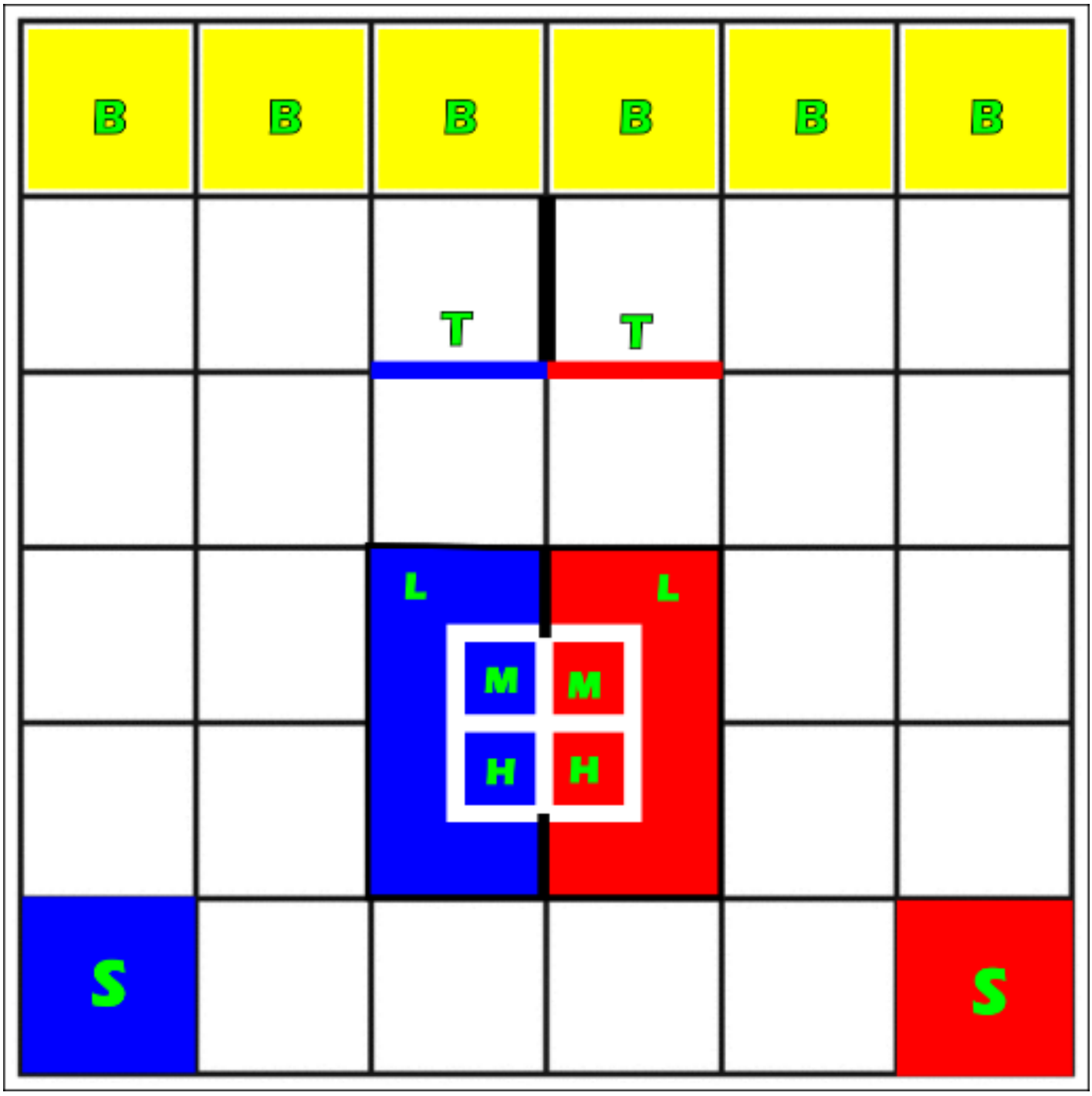
1. A robot may NOT exceed the Block Control Limit. Attempting to control more than the allowed number of blocks will result in a Penalty per block over the limit for each 5 seconds the robot controls the blocks. Controlling a block will include pushing any colored block in an intentional direction either for scoring or for moving blocks out of the path of the robot.
2. A robot may **not** Pin or Block another robot for over 5 seconds. The referee will indicate when they observe blocking or pinning to be occurring and the offending team will be given 5 seconds to move away from their opponent's robot by at least 2 feet. If the referee determines a robot is blocking or pinning (after the 5 second count) a penalty will be administered, with an additional penalty for every 5 additional seconds the robot has not moved at least 2 feet away. **All penalties will be awarded to the opposing team.**

Appendix A TENTATIVE Referee Scoring Sheet

TEAM NAME_____ MATCH NUMBER_____ **RED or BLUE**?

MISSION	DONE? YES/NO	QUANTITY (IF APPLICABLE)	POINTS +/- AUTO	POINTS +/- TELEOP	TOTAL	OUT OF (MAX)
BLACK BLOCK SCORED IN AUTO? (LOW=2 POINTS, MEDIUM=4 POINTS, HIGH=6 POINTS)						
Black Block		1				/ 6
COLOR SELECTOR TRIGGERED? AUTO=10 POINTS, TELEOP=5 POINTS						
Color Selector		1				/ 10
If Color Selector was triggered, what was the "Triggered Color?" GREEN WHITE YELLOW						
PRIMARY COLOR (CIRCLE PRIMARY COLOR & PUT NUMBER OF BLOCKS FOR EACH)						
GREEN = WHITE = YELLOW =			Only count Primary Color Blocks in this section!			
LOW GOAL		X1				/ 12
MEDIUM GOAL		X2				/ 24
HIGH GOAL		X3				/ 36
GOAL TOTAL	Sum the totals of the previous three boxes here =>				=	/ 36
"TRIGGERED COLOR" DOUBLING BONUS						
Does Primary Color match the Triggered Color?	YES NO	If "YES," copy "Goal Total" sum here => If "NO" put 0.				/ 36
HOW MANY POINTS DID TEAM EARN FROM THEIR OPPONENT'S NONPRIMARY BLOCKS IN THEIR OPPONENT'S GOALS?						
Opponent Points for "Nonprimary Color"						/ 36
ROBOT PARKED IN LOW GOAL AT END OF MATCH						
Parking		1				/ 5
Penalties?						
Sum of All Penalties		X5				-
TEAM MEMBER INITIALS		**TOTALS:**				**/ 129 (MAX)**

Appendix B 2023 REC Field Layout



Appendix C Presentation & Notebook Judging Rubric

		Awarded Points	Possible Points
Quality of Display Elements			
	Visual elements were well organized.		5
	Visual elements were helpful (i.e. not just "eye candy").		5
	SECTION TOTAL:		**/ 10**
Quality of Presentation			
	Each team member spoke, and information presented matches what is recorded in Engineering Notebook.		5
	Team clearly presented overview and technical information on major subsystems of robot (scoring mechanisms, drivetrain, battery/power supply, choice of materials, gear ratios, etc.).		10
	Team provided clear and detailed explanation of code and programming.		10
	Team provided an explanation of design process, problem solving process.		10
	Clearly demonstrated understanding of game, rules, and strategy.		5
	SECTION TOTAL:		**/ 40**
Quality of Engineering Notebook			
	Each team member has a brief biography in notebook.		5
	The team includes information, matching what is in their presentation, about their service projects throughout the year that align with the goals & priorities of 4-H and REC.		10
	The team clearly demonstrates & records their process of robot design, building, programming, and testing, including goals, important milestones, significant changes, evaluation and testing methods, etc.		20
	The team clearly demonstrates the problems they identified, the work they did to solve each particular problem, the testing methods used to verify the solutions, and adequately explained the resolutions.		15
	SECTION TOTAL:		**/ 50**
	GRAND TOTAL		**/ 100**