2010 KIPR Open Autonomous Robot Game

(Formerly Beyond Botball)

v1.5



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Update History

V1.5 : 5 Feb 2010 – Added table of contents V1.49 : 4 Feb 2010 – KIPR Open name change and reformatting of document v1.0 : 9 Sept 2009 – Game rules first released

Table of Contents

Update History	3
KIPR Open Autonomous Robot Game	5
International KIPR Open Tournament	5
This Year's Game	6
The Game Board	7
Scoring Items	7
Scoring Summary	8
Team Identification	9
Scoring: General	9
Scoring: Lemonade Stand	9
Scoring: Buckets	10
Scoring: Botguys	10
Tie Breaking	10
Game Board Construction	11
Game Surface Materials	
Game Board Setup	
Robot Construction Rules	16
KIPR Open Tournament Rules	18
Team Membership	
Seeding/Performance Rounds	
Double Elimination Tournament	
Double Elimination	
Tournament Logistics	18
Advice for Tournament Participants	21

KIPR Open Autonomous Robot Game

The KIPR Open Autonomous Robot Game (formerly Beyond Botball) is a robotics challenge designed and distributed each year by the KISS Institute for Practical Robotics (KIPR) to encourage ongoing robotics education beyond the high school level. This document presents the official game rules for the KIPR Open Game. These game rules are free for educational use and are used in college courses and robotics events throughout the country.

For the latest information on the KIPR Open Game and the International KIPR Open Tournament (see below), including updates to this rules document, go to <u>http://www.botball.org/kipr_open</u>.

For information on KIPR's Botball Educational Robotics Program for students in middle school and high school visit <u>http://www.botball.org</u>.

International KIPR Open Tournament

KIPR produces the International KIPR Open Autonomous Robot Tournament each year at the Global Conference on Educational Robotics. This year's Global Conference on Educational Robotics will be held July 7-11 at Southern Illinois University (Edwardsville). For more information GCER, please see <u>http://www.botball.org/GCER</u>



GCER 2010

Southern Illinois University Edwardsville (about 20 miles from St. Louis) July 7th -11th, 2010

Global Conference on Educational Robotics http:// www.botball.org/current-season/GCER/





This Year's Game

Robopolis' economic downturn has caught you, the Bot Stocks wonderkin, flat footed and you've been laid off from your job on Wallbot Street. Now in bankruptcy and destitute, you've vanished from the scene and all of your botpals assume you bought the farm, which literally is what you have done.

When the bucks were rolling in, you purchased a small fruit farm in central Florida as a retirement gift for your parents, Mr. & Mrs. Botguy. They have turned it into a profitable enterprise, but being up in years and knowing your situation have encouraged you to come help with operations, which amounts to running a lemonade stand out on the highway and packaging citrus fruit harvested on the farm for sale.

When you arrive at the farm you find the lemonade stand is still in the Botgrove warehouse, where your parents stored their supply of lemons and spring water for making lemonade. You need to get the lemonade stand in place, need to put lemons and water on its big board, need to get your parents there to do the marketing and selling, and need to secure your collective futures by getting citrus fruit from your farm into the warehouse.

But wait ... there's competition from your old Walbot Street mentor, Bot Bilken, the so-called Bot Bond King, who has taken over the farm next door with all of its junk. Which bot will corner the fruit market? Whose futures will profit?

Perhaps you can acquire some of Bilkin's fruit for your stand or even use some of your fruit as a poison pill to foil Bilken's attempt at a leveraged buyout of your spread? Or will your venture collapse in default, leaving the Botgrove authorities to bail your toxic fruit out of the warehouse as they attempt to restore the city's economic vitality?

The Game Board

Shoulder



Scoring Items

- 2 Botguy plush figures
- 6 Green 1.5" poms
- 6 4" green foam balls
- 6 Orange 1.5" poms
- 6 4" orange foam balls
- 8 4" blue foam balls (4 per bucket)
- 18 Yellow 1.5" poms (9 per bucket)

2 – Plastic bins (Sterilite brand 12 qt. bin - model 1843) with black duct tape border. The tape is approximately 1" from the bottom of the bin (but higher from the surface since the bin is placed upside down)

Scoring Summary

	In your bucket	In a lemonade stand on your side	On a lemonade stand on your side	On your side	In your starting box/fields	In your shoulder
Your fruit, large	10	2	3	1	0	-2
Your fruit, small	5	2	3	1	0	-2
Opponent's fruit, large	-6	2	3	1	0	-2
Opponent's fruit, small	-3	2	3	1	0	-2
Lemons	0	2	3	1	0	-2
Water	0	0	10	0	0	0
Botguy (per Botguy)	0	0	0*	2	2	0

- Botguy on a lemonade stand is also a point multiplier; x2 for one Botguy and x3 for two (on same stand) since Botguy is also on your side the * case actually yields 4 points
- Paired lemons and water on the lemonade stand get an additional 7pt. bonus per pair.
- Deploying a lemonade stand so it is touching the line that denotes the shoulder is a 10pt. bonus.

Team Identification

- A team's side is the one containing their starting box
- A team's color is given by the color of the objects in their fields
- A team's bucket is the one matching their color
- The sides are arbitrarily labeled A (green) or B (orange) to facilitate tournament logistics, and will not change during the tournament
- In double elimination, teams are assigned to a side by tournament software
- During seeding, a team may select their color

Scoring: General

- A. At the end of play judges score the match; an object receives only one score, the highest point value it attains (e.g., an object on a lemonade stand is not also scored as being on your side)
- B. The bottom rim of the lemonade stand is the rim of the opening of the container comprising the stand
- C. The top of the lemonade stand is the surface area interior to the rim around the bottom of the container comprising the stand
- D. A team's bucket is the one having the same color as the objects in the team's fields
- E. The location of poms and balls is given by the center of the object as best as can be determined by the judges
- F. To be on your side, and object must be in the vertical projection of your side and must either be touching the surface of your side or touching an object on your side
- G. Objects can be moved anywhere on the game board during play with the exception of the buckets, whose handles limit movement

Scoring: Lemonade Stand

- A. If the lemonade stand is turned over (it's bottom rim is no longer touching the surface), objects are not considered to be in or on it (you wrecked it!)
- B. If the bottom rim of the lemonade stand is not touching the tape delineating the shoulder you haven't deployed it properly (it's either too far from or too close to the highway)
- C. If the lemonade stand is not touching your side, it is not on your side
- D. An object is considered to be in a lemonade stand if it is on or above the game table surface, is below the top of the stand, and its center is in the vertical projection of the bottom rim of the stand

- E. An object is considered to be on a lemonade stand if it is touching the top of the stand, or if it is touching an object on the stand and its center is in the vertical projection of the top of the stand
- F. If both lemonade stands end up on the same side, they both score for that side

Scoring: Buckets

- A. Regardless of where a bucket ends up (it is a violation to attempt to tear loose the handle, but it is OK if they slide down the posts), its ownership is determined by its color
- B. An object is in a bucket only if its center (as determined by the judges) is within volume of the bucket as delimited by the plane marking the opening of the bucket

Scoring: Botguys

- A. There are 2 Botguys
- B. Botguy is the only object that scores in your start box or fields
- C. Botguys may be moved by the robots to any location on the board
- D. A Botguy on a lemonade stand on your side acts as a score multiplier
- E. Should the unlikely case occur of both lemonade stands on the same side with a Botguy on each, the multiplier effect is 4 (if both Botguys are on the same stand the multiplier effect is 3)
- F. The location of a Botguy is determined by any part of the Botguy (rather than a hypothetical center) note that the touching rules covered earlier also apply to Botguy

Tie Breaking

In the event of a tie, the following tie breakers will be applied to determine the winning team (in order) :

- 1. The team with the most water on their side
- 2. The team with the most fruit (including lemons) on their side
- 3. The team with the lemonade stand scoring
- 4. The team with Botguy on their side
- 5. The team with the fewest lemons in their buckets
- 6. The team with the least fruit in their fields
- 7. The team having a robot's motor power switch closest to their bucket

Game Board Construction



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Game Surface Materials

To build the Game Board surface, you will need:

- 5 pieces of 4x4' MDF (122cm x 122cm)
- 5 pieces of 4x4' Fiberglass Reinforced Panels (FRP) (122cm x 122cm) Home Depot Store SKU# 121586
- 4 4' (122cm) FRP Divider Home Depot Barcode #070673858864

NOTE: The FRP Divider comes in different widths. This is the one that is 5/8" wide on the narrow side and just over 1" wide on the wide side (the other common one is 3/4" wide on the narrow side and 11/4" on the wide side)

Game Board Setup

A team's entry must fit completely within their starting boxes.

The starting boxes have a virtual height of 15" (38cm) – a measuring stick is available at the table to allow judges to determine compliance.

Designated areas (start box, fields, shoulder, side) are delimited by interior edges of their border material (PVC and/or tape/seam).

The Starting box and shoulder are defined by 2 inch wide black duct tape as shown in slide 17.

Buckets are placed as pictured on the midpoint of the PVC pipe between center and support post of the cross beam.

The Botguys are positioned on the bucket handles as pictured with blue balls and yellow poms inside the buckets interspersed in random fashion by the judges.

For the two fields, the large and small objects are each evenly distributed between the two fields, and dispersal within the fields is done in random fashion by the judges.

All measurements on official boards, whose uncertainty is not otherwise specified will be as specified within +/- 1/2 inch (12mm) or 1%, whichever is greater. Deal with it.

Robot Construction Rules

The following rules apply to all robots to be entered in the KIPR Open Robot Game:

1. A team's entry (all materials placed on the game-board) must mass less than 10kg (22 pounds).

- 2. A team's entry (all materials placed on the game-board) must fit within their (virtual) starting box without restraint (other than pressing against interior edge of any gameboard PVC bordering the starting box).
- 3. The starting box is 52cm by 80cm (20.5" by 31.5") and is 38cm high (15"). The starting box boundaries are given by the interior edge of the PVC and tape that delineate it.
- 4. The team's entry may not contain or release pressurized materials at greater than 7 bar (100 psi).
- 5. The team's entry may not release any liquids during the game, or before, during, or after the game while the team is at the game table.
- 6. The team's entry may not release any gasses while at the game table that are considered hazardous by the judges, or are at a temperature below 0oC (32oF) or above 50oC (122oF).
- 7. Robots may not contain features (manipulators, protrusions or materials) that are designed to, or are deemed by the judges likely to, cause damage or destruction to the game board, or to game pieces, or to a reasonably constructed opponent robot.
- 8. A team's entry may not contain features (manipulators, protrusions or materials) that are designed to, or are deemed by the judges likely to, cause jamming or entanglement of a reasonably constructed opponent robot. Blocking and containing of opponent robots is allowed; strategies likely to entangle or damage opponents or the board or game pieces are not allowed.
- 9. Robots must operate autonomously (no external power or control from outside of the game board area will be allowed).
- 10. Each team may only have a maximum of four independent structures on the game board at a time.
- 11. Each robot must have a name suitable for broadcast over a PA system.
- 12. Team entries may NOT contain parts that may reasonably be confused with game pieces (entries may not contain mirrors, lights, colored objects, or tape red, green, blue, or yellow designed to confuse an opponent)
- 13. A team's entry may be made out of any materials or parts (including Botball and non-Botball kits) as long as the entry conforms to the construction rules above.

KIPR Open Tournament Rules

Team Membership

At least one team member must be beyond High School in their educational careers. College students, professional engineers, hobbyists, poets, and anyone else fulfilling the criteria above are all encouraged to participate

Seeding/Performance Rounds

- S/P Rounds take place before the double elimination rounds
- S/P rounds consist of best two out of three, unopposed rounds.
- Scoring = (your points) (their points)
- Scores of less than -1 will be counted as -1
- Passing on a round gives a score of -1 for that round
- Seed Score = average of best two rounds

Double Elimination Tournament

- A team is out of the tournament when it has lost two games
- Initial matches are decided by seeding round
- Matches are arranged using KIPR tournament software
- Judges' decisions are final

Double Elimination

- A team's robot must have broken the border of the starting box sometime during the 180 seconds of game play or they will forfeit that round. If a team has more than one robot, only one is required to break the bounds of the starting box.
- Robots must stop all motors and other actuators at the end of the round. Failure to do so will result in loss of round (unless the other team never broke the starting box.
- If neither team's robots break the starting box bounds during game play, the round will be replayed once. If neither team moves out of the starting box during the replay, the round will be decided by coin flip.
- At least one robot from a team must be outfitted and programmed to respond to the starting light. A robot team that operates exclusively on a timer triggered by a hand-operated switch is not allowed and will automatically cause that team to forfeit that round.

Tournament Logistics

- 1. Teams shake hands and visually inspect each other's robots before calibration.
- 2. If either team wants to challenge the validity of the robots they are facing, they have to do it then.
- 3. Inspection is limited to a max of 1 minute unless a specific challenge is made.

- 4. Challenges have to be of the form:
 - 1. That robot contains high explosives
 - 2. That robot's hardened steel spike is designed to damage other robots.
- 5. Judges will be the final arbiter.
 - 1. Judges can dismiss what they believe to be spurious challenges
 - 2. Teams found in violation will (unless the judge decides there have been extenuating circumstances) forfeit that round or at the judge's discretion, remove the offending pieces before the round begins.
 - 3. In no case will a robot that is determined before the beginning of the round to be in violation of the construction rules be allowed to play while in that state.
- 6. Teams may adjust starting lights:
 - 1. Starting lights must be attached to the PVC pipe of the starting box
 - 2. Starting lights may not be in physical contact with any robot
 - 3. Starting lights may not be aimed to disrupt an opponent or blind anyone (judge's decision)
- 7. Teams will set up their robots, performing any necessary calibrations. Setup time should be two minutes or less. If a team takes more than 2 minutes to set up, the judges may call a fault and specify the amount of additional setup time they will allow at their discretion.
- 8. When both teams are ready or judges decide adequate time has been allowed for calibration, robots are activated and then -- Hands off!
- 9. After Hands off, no part of a team's robot(s) may leave the starting box until the starting lights turn on. If this happens, the judges will call a fault on the team
- 10. If a team receives a 2nd fault in a round, they forfeit the round
- 11. Game duration is 180 seconds
- 12. After teams are set up, robots are to await the starting lights, which the judges will turn on to signal game start
- 13. When the starting lights turn on the robots must autonomously start
- 14. Lights will remain on for 5 seconds, turn off for 55 seconds, blink for 5 seconds, turn off for 110 seconds and flash the last 5 seconds
- 15. Once the starting lights are turned on, the round counts unless a judge rules outside interference
- 16. For the first 60 seconds of the game, a "no touch" rule is in effect; namely, a robot cannot touch the surface of its opponent's side until 60 seconds have elapsed this is signaled by the starting lights blinking after 60 seconds have elapsed

- 17. Teams cannot use infrared links to program their robots within 10 yards of the game board
- 18. Teams may not broadcast ANY physical or electromagnetic signals to their robots once the teams are in "Hands-Off"
- 19. Robots must cut power to their motors and turn off or stop issuing motion commands to servos by the end of the round or risk forfeiting the round
- 20. Scoring is based on the location of pieces at the end of the round, not how the pieces got there.
- 21. If the judges determine that a robot violates the construction rules, that robot will not be allowed to run until it has been modified to meet the rules
- 22. Construction rules apply only to what is brought to the Game Table
- 23. There are no instant replays, we do not want to see videos of questionable decisions. If a team is unhappy with a judge's decision, they should challenge it then and there. Challenges to scoring after the teams have left the table, will not be considered
- 24. Teams cannot touch, borrow equipment, modify robots or computers, or beam commands to another team's stuff (including their pit table) without the permission and presence of a member of that team

Advice for Tournament Participants

Test your robots from start to end:

- 1. Go through the entire starting sequence
- 2. Make sure you can calibrate to the starting light
- 3. Make sure the robots stop when they are supposed to: verify with a stop watch!
- 4. Does the starting sequence work with very bright overhead lights?(tournament tables will have bright lights hung about five feet above the tables)
- 5. Test the shielding of your sensors!

Check http://www.botball.org regularly for rules updates.

Check out the KIPR Open Robotics Game discussion board and FAQ at http://community.botball.org

Good Luck!