

Get Me A Beer !

Official Rules

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Introduction

When the Robotics Society of Southern California (RSSC) was formed in 1989, several of us were given the task of creating a set of by-laws and a charter for the organization. During this creation process, it was decided that part of our charter would be to create a Society Robot that would be available for everyone to use. During the ensuing design discussions, we started to ask the question, "What kind of capabilities do we want the Society Robot to have?" I half jokingly said, "I want a Robot that can respond to the command, 'Get Me A Beer !', and it would do it." In at least one version, this was actually in our bylaws. It has become the single unifying goal of the society.

If you break down the simple command, "Get Me A Beer !", into its component tasks, you will find it would take a rather sophisticated robot to carry it out. First, the robot must be able to understand my verbal command and translate it into a series of sub-tasks, which roughly are:

- Determine where it was when I asked it to 'Get Beer' (e.g. room A),
- It has to know where the Beer is (e.g. room B),
- It has to plan a path from room A to room B and avoid obstacles along the way
- Once it arrives in room B, it must execute the 'Retrieve Beer' task as :
 1. move to the 'Retrieve Beer' task point which is a pre-defined position within room B.
 2. perform some action to open the refrigerator door
 3. locate the beer in the refrigerator
 4. remove the beer from the refrigerator
 5. perform some action to close the refrigerator door
- It has to plan a path from room B back to room A, still avoiding obstacles.
- Once it gets back to room A, it has to locate 'me', within room A. If I am no longer in room A, it has to find me.
- Once it 'knows' where I am, it has to plan a path to deliver the beer to 'me', while avoiding obstacles, within the room.
- When it is close enough to 'me' it hands me the beer.

If you had a robot that could carry-out this simple fetch task, how many other similar tasks could you think of that would make it a very useful tool around the house?

Once you had a robot that could navigate autonomously throughout your house or business there are a number of highly useful application possibilities. E.g. Security Patrol, Inter-family member message passing, simple fetch tasks, etc....

The Competition

To this end, RSSC is sponsoring an annual competition that encourages development of solutions to the various aspects of this problem, so that by 1999 (our tenth anniversary) we have a robot that solves the problem completely.

The First Annual 'Get A Beer' Competition will be held at Orange Coast College, in the new Technology Bldg., Sunday, October the 2nd, 1994.

We have scaled the 'Get A Beer' problem down to the following 5 tasks :

1. Starting from 'home' or the robot's charger station, search the house for a beacon,
2. Move from the beacon to the refrigerator,
3. Open the refrigerator and get the beer,
4. Take the beer to the beacon,
5. Go back to the charging station and 'plug-in'.

We want this contest to be oriented towards displaying behaviors capable of being adapted to a full scale Robot, capable of performing the ultimate task. The PRIMARY purpose of this competition is to SHOW ROBOT CAPABILITY that SOLVES some aspect of the overall problem - THIS NOT A SPEED CONTEST !

Time is not as important as using sensory data to avoid hitting objects and being able to navigate through the 'known' environment. There are essentially 3 sub-problems being attacked by this competition - Robot Planning/Navigation, Object Recognition, Robot Positioning. You may choose to attack any one or all of them.

The Teams

Each team submitting an entry shall consist of one robot and at least one human, one of which is designated the team captain. The team captain will communicate the team's intentions to the judges concerning starting procedures, which sections of the competition the robot member will be competing in, etc. For most teams the captain should be the human, as the judges WILL only communicate with the team through the team captain.

Once the team is ready to start, the human members are not allowed further communication to the robot/computer members. The robot member must run the course WITHOUT human assistance, except in the form of pre-programmed instructions that may be requested by the robot member from it's own memory or from a base station computer. Once started only, computer to computer/robot communications are allowed.

If the robot member is hard-wired to a base station computer, the team must provide instructions on what provisions are necessary to avoid cable entanglement. Each team shall provide a means for addressing this problem, and RSSC support personnel will handle any cable booms or support structures required.

The Arena

The attached room diagram shows the layout of the 'house' which is 64 ft² (i.e. 8' x 8'). It is the same configuration as was used in the Science Center of CT contest, so that if you can solve the navigation problem presented here, you also have a Bot capable of competing there with only slight modification.

Note that in the diagram the 'You' beacon is shown IN ALL 3 target rooms. This is merely to show where a beacon *might* be placed. During the competition there is only ONE 'YOU' BEACON and it will be placed randomly in ONE of the 3 rooms. Also note that there are three circles in the refrigerator, showing where the 'Beer' *may* be placed. THERE IS ONLY ONE 'BEER' CAN which will be placed on ONE of these circles.

The Contest - Judging and Points

The judges will award up to 100 points for each segment of the competition. The team does not have to complete, or EVEN COMPETE in all phases to win.

Each robot team member will have a maximum time of 10 minutes to complete as many legs as they can. If the robot has not finished in 10 minutes, points will only be given for those legs already completed.

There are several places at which accuracy becomes the quantifier for the judges awarding points., i.e. aligning and fetching the 'Beer', delivering the 'Beer' to the beacon circle, and orienting the robot at the end in the charger station.

There are 5 separate sections to the contest and the judges can award up to 100 points for each section, depending on how well they thought the robot team member completed each section.

There are an additional 100 points for the judges impression of how the team approached the overall problem, how sophisticated the robot member was, how much intelligence it displayed, how much of the problem did the team solve, etc.

Each team will be required to submit a brief description of the HW and SW aspects of their approach and the strategy they are employing to solve the problem or the portion of the problem they are focusing on. Since we intend to have technically qualified judges, the more detail the better. Excerpts from these submissions may be published in The Robot Builder, the Societies newsletter, at the discretion of the editor.

There are two types of runs that a team may make, a *Trial Run* or a *Scoring Run*

The team can run the course as many times as time permits. The team captain shall queue at the starters table whenever the team wishes to make a run. The captain **MUST TELL THE JUDGES BEFORE** a run, whether it is to be a *Scored Run* or a *Trial Run*. Teams wanting to do a *Scoring Run* will have priority over other teams wanting to do a *Trial Run*.

For each *Scored Run* the team captain will tell the judges what sections the robot team member will be attempting. Human team members can have **NO CONTACT** with the robot member during a *Scored Run*.

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Human team members may remain in close contact with the robot member during a *Trial Run*.

Each run will terminate whenever ONE of the following conditions occurs :

- the robot member finishes all the sections the team intended to run,
- human members may terminate the run manually (a human member may terminate the run prematurely because the robot member has gotten confused or lost or even worse - crashed. There is no use wasting time, waiting for the time-limit to run-out, if the human team members decide the robot member is not going to complete the run. The team captain can just tell the judges the team is through with that run).,
- 10 minutes have elapsed.

For any *Scored Run*, you will receive a score based upon the sections you completed, prior to the run terminating for whatever reason.

There are a possible 500 points per *Scoring Run*. No points may be earned on a *Trial Run*

Each team may make a maximum of **THREE Scoring Runs**.

The winner is determined by adding the points from up to two *Scoring Runs*, PLUS the design score of up to 100 points. This means the maximum possible points is 1100.

For a *Scored Run*, the team captain shall show the starter what is required to tell the robot member to start and the human team members shall move away from the arena area, into the pit area. The location for the beacon and the beer shall be determined by some random means.

After the 'Beer' is placed in the refrigerator and the 'You' beacon is randomly set in one of the 3 target rooms - the starter will tell the robot member to start. Once the team captain says the team is ready, human team members can no longer communicate with the computer/robot team members IN ANY WAY !! (including but not limited to wires, infra-red signals, hand gestures, voice, telepathy [yeah right!] - you get the idea. We don't want any team giving their robot team member additional information about where the can or beacon are and thus gain an unfair advantage over the other teams).

Trials may be run Saturday, October the 1st from Noon until 5:00 p.m. and Sunday the 2nd from 10:00 a.m. to 3:00 p.m. *Scored Runs* shall be run between Noon and 3:00 p.m. on Sunday the 2nd. The competition will be stopped at 3 p.m. and the scores calculated for the awards ceremony at 3:30 p.m.

The House

The 'house' is 64 square feet (8 feet per side). The walls are 12" high, painted WHITE. The floor will be BLACK rubber material. Each doorway will have a 1" WHITE stripe across the threshold.

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There is no restriction as to the size of your robot, but note that the corridors are only 18 inches wide. The CT contest restricted robots to a 12x12x12 size, which is almost the maximum feasible size for a course of these dimensions. If your robot is over 12 inches tall, there can be no ACTIVE sensors above 12 inches (it's illegal to look over the walls to find the beacon). Robots OVER 12 inches tall will be subject to inspection PRIOR to EACH run to insure they have no means of detecting the beacon using their extra height advantage.

You get up to 100 points for completing each of the 4 movement legs of the contest plus up to 100 points for the 'Get Beer' task. The refrigerator and home positions (see below) are at known fixed locations.

The Refrigerator

The 'refrigerator' is actually an open enclosure consisting of three 12" high by 18" wide walls with a 'door' that is an IR light beam 3 inches above the ground. There are 3 possible locations in the refrigerator where the 'Beer' may be placed and its placement will be determined randomly. Measuring from either end along the back wall the possible locations are at 6", 9", or 12" (i.e. centered, or 3" to the left or right of center).

There is a blinking beacon light 6" from the floor at each side of the refrigerator door. These are standard red blinking LEDs from radio shack. The door is 'opened' when an IR light beam is broken by the robot. Once the door is 'open' 5 GREEN LEDs at the back of the refrigerator will come on indicating the door is open. These lights are at the 3,6,9,12,15" points, 3 inches from the floor. The 'Beer' will be placed such that one of the 3 central interior lights will be obscured by the 'Beer', this may be used to determine the location of the 'Beer'.

The Beacon

The 'You' beacon will have non-blinking YELLOW LEDs at 3,6, & 9" heights on all four sides of the center pole. The base of the beacon is clear acrylic 12" in diameter. The central column is made from opaque RED acrylic and 3 inches square. There is a 1/2" white border all around the circle to aid in determining a drop zone for the 'Beer'.

The beacon will be randomly placed in one of the 3 target rooms. Additionally, there may be a piece of 'furniture' in the room, a piece of furniture is actually a 6"x6"x12" cinder block painted BLUE that may be randomly placed in a room. There will ALWAYS be at least one 18" path from the doorway to the 'You' beacon. The beacon will be able to be 'seen' from the doorway of any room it is in, whether there is furniture in the room or not.

The Can

The can will be randomly placed on one of three spots in the refrigerator. The can will be weighted in the bottom for a total weight of 8 oz. (A 12 oz can of soda weighs 1 lb. = 16 oz)

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As shown in the Can diagram, there are two 3 inch in diameter rings (at 90 degree angles from one another) on top of the can, so that you can 'hook' the can from above or you may grasp it on the lower section. The can is a standard size soda can 5" tall and 2 1/4" in diameter.

The Problem

The actual "Get me A Beer" problem is broken into the following 5 sections and are scored separately.

Section 1

Move from the Home position (the charger) and find the beacon.

The beacon has 3 YELLOW LEDs at 3,6,9" heights on four sides of the center pole. Each robot must provide some means of letting the judges know when the robot thinks it has located the beacon. This can be by visual or audio response and **MUST** be related to the judges in advance. The robot **DOES** not have to go near the beacon, it merely has to **INDICATE** it has located the room **CONTAINING** the beacon.

The judges will award up to 100 points based on such factors as how 'well' did the robot find the beacon, did it exhibit intelligence in finding the beacon, how sophisticated was the approach used, was the search directed or random, did the robot seem to 'know' where it was, etc.

Section 2

a) Move from where it found the beacon to the refrigerator.

In the real world this means the robot moving from e.g. the living room to the kitchen and positioning itself in front of the refrigerator at a predetermined location.

In the competition the 'refrigerator' is the open fronted enclosure determined by the 3 walls, with a light beam representing the door. There will be 2 flashing lights on each side of the door that may be used as navigation aids. This leg is complete when the robot breaks the light beam which turns on the refrigerator 'open' lights..

Up to 100 points will be awarded based primarily on the efficiency of the path chosen. Did the robot move directly from the room containing the beacon to the room containing the refrigerator - the best, or did it go into other rooms on its way, or did it just wander around until it 'found' the refrigerator.

b) Move from the Home position (the charger) directly to the refrigerator.

The judges may award up to 50 points for showing that the robot can 'find' the refrigerator. This is for contestants, that do not choose to work on the beacon recognition problem. They move from the Home position directly to the refrigerator 'Retrieve Beer' task point.

The refrigerator is considered 'found' when the robot breaks the light beam representing the door. The primary criteria in leg 2 (as well as in Leg 4) is to exhibit some knowledge of where things are and to react intelligently.

The judges will be informed that extra consideration should be given to a robot that gives some **UNIQUE** audio or visual indication when it thinks it has 'opened' the refrigerator

Section 3

Execute the task 'Get Beer'.

For the contest this means in addition to breaking the light barrier and indicating it has found the refrigerator, it grasps the can in some fashion and removes it from the refrigerator. The can has 2 rings on top that can be hooked or the lower part of the can may be grasped, your choice. This leg is complete when the 'Beer' is removed from the refrigerator.

There are 5 GREEN LEDs at the back of the refrigerator that 'come on' when the door is opened. One of the 3 central lights will be obscured by the random placement of the 'Beer'. This can be used to orient your robot in anticipation of performing the 'Retrieve Beer' task.

Up to 100 points will be awarded based upon the judges assessment of how well the robot performed the 'Retrieve Beer' task. For example, what kind of sensor feedback was used, did the robot use its sensor to locate the beer or did it just blindly grab, hook, etc.

Robots without a means of grasping the 'Beer' will not be scored on this section, they essentially skip directly from section 2 to 4.

Section 4

Take the can back to the room where the beacon was found and put the can inside of a the 12" diameter base of the beacon.

The beacon has 3 YELLOW LEDs at 3,6,9" heights on four sides of the center pole. There is a white 1" edge around the clear acrylic base.

Up to 100 points will be awarded, based on how directly the robot went back to the room containing the beacon and how close to the center of the beacon it placed the beer. This leg is considered complete for robots that do not choose to bring the beer back, by penetrating the 12 inch circle and indicating that it would have placed the beer in the circle if it had picked it up.

Section 5

Return to the charger station and 'plug-in' to the charger station.

This leg is also open to those contestants that did leg 2b, instead of leg 1. No points will be awarded for taking the 'Beer' back to the charger station.

The home position is a circle with orientation 'cross-hairs' representing the proper orientation for the robot to be 'plugged-in' to the charging station.

Points will be awarded for how well your robot is aligned to the original Home position. The contestant may supply their own 'charger' station to start from/return to. The only restriction is that the charger can not alter the house in any way and must be less than 12" high. The robot should signal when it is finished.

Up to 100 points will be awarded based upon how close the robot comes to being aligned with the start point (a large + at the home position) or being plugged into its charger station.

Conclusion

The team with the most points is the winner, regardless of what part of the overall problem they chose to focus on.

For example, let's say we have 3 robot/human teams A, B, & C.

Team A solves the navigation portion of the problem, using a simple wall-follower and light detector, and gets 50 points per leg, plus 40 points for design strategy. They don't even try to retrieve the can. This Bot gets a score of 240 for its 1st run. The second best run completes only 3 legs for a total of 150 points. Team A, then has a total of 390 points.

Team B, however, focuses on the 'Get Beer' aspect and moves directly from the charging station to the refrigerator, positions itself very precisely, reaches in grasps the beer and removes it from the refrigerator. The judges award 100 points for the 'Retrieve Beer' portion, 50 points for moving accurately from home to the kitchen and 60 points for going back to the charger, and 75 points for design and intelligence. This Bot gets a score of 285 on run 1. The second best run, gets 120 points for moving and 75 points for the 'Retrieve Beer'. Team B, then has a total of 480 points.

Team C, focuses on the navigation and planning aspects of the problem. The Bot moves through the house, using non-contact sensor feed-back and once it finds the beacon, it immediately goes to the refrigerator and then back to the beacon and then directly back to the charger using its 'internal' map. It gets 70 points per leg and 50 points for design, yielding 330 points for run 1. Its second best run it gets only gets 140 points in the 4 legs. Team C has a total score of 470.

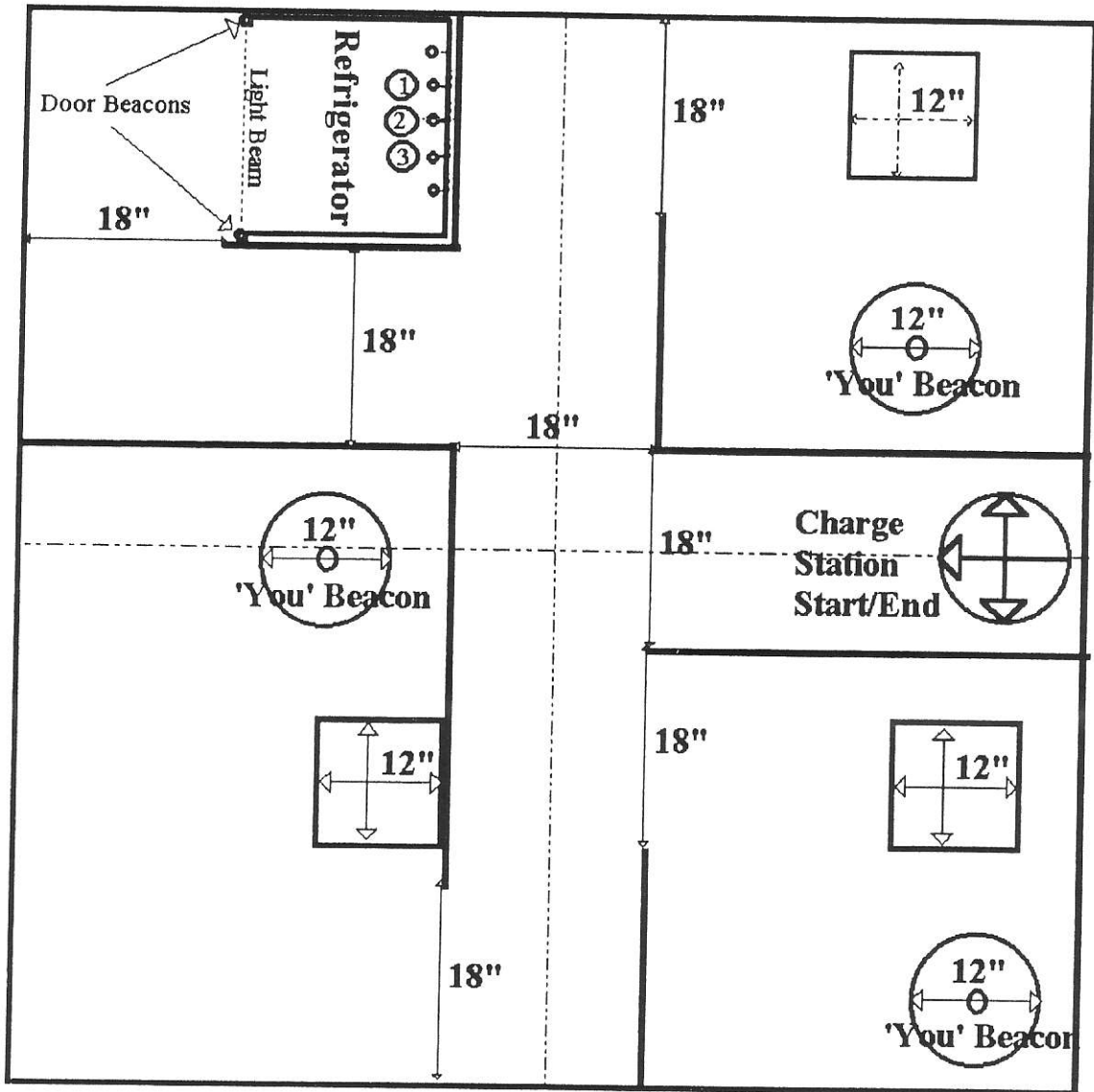
In this scenario, team B wins with 480 points., team C is second with 470 points, and team A is third with 390 points.

The point is pick some aspect of the overall problem and DO IT really well - and you could win !

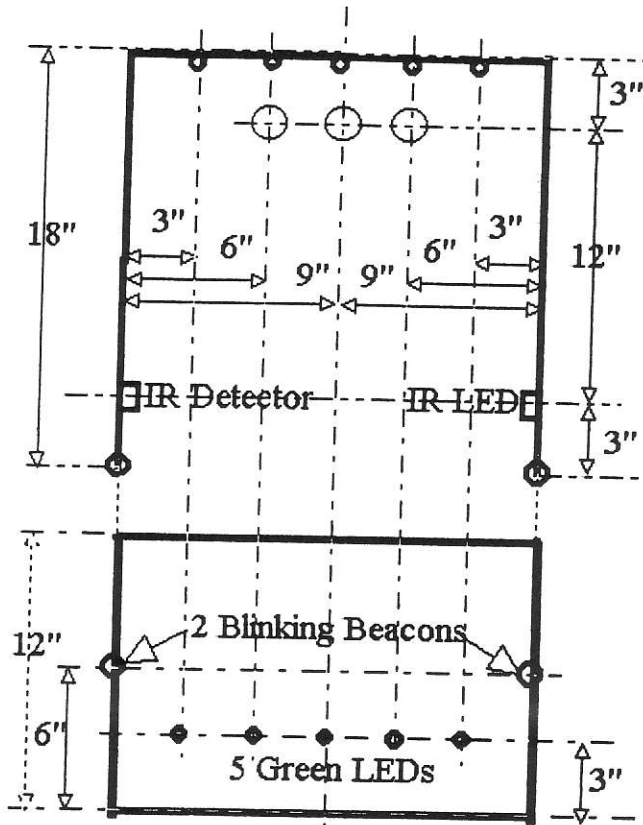
If you are the only one that can find the 'You' beacon and no one else does - YOU CAN WIN !!
Many of you have been thinking and/or working on aspects of this problem, so now is the time to put your ideas into action and win fame, glory, prizes and \$\$\$\$\$!!!

Gear-Heads of the World - UNITE !!!

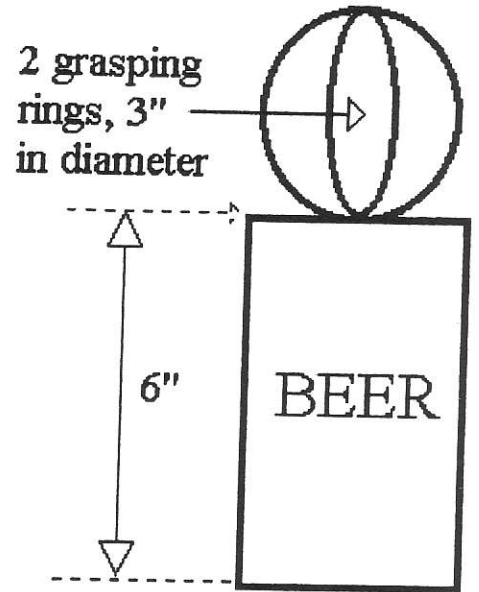
The House Diagram



The REFRIGERATOR Diagram



The CAN Diagram



The BEACON Diagram

