Vcc Vision Centric Challenge 2018

FCO: Find & Count Objects

A Robofest® (www.robofest.net) Challenge for Pre-college and College Students
Lawrence Technological University, Southfield, Michigan

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Computer vision gives robots the ability to see. In order to learn and promote research & development on computer vision and autonomous mobile robotics, we challenge college students as well as talented high school students with the following vision based robot competitions during the Robofest® 2018 season.

1. Team Age Divisions

- Senior (Advanced High School): maximum 3 members per team
- College: maximum 2 members per team

2. Challenge Synopsis

A maze is constructed by using unknown number of dark color floor mats. Unknown number of objects are placed outside maze as shown in Figures 1~3. The robot is shown a target object by a human player in the beginning of a run. There is a start object which is unique and unveiled 30 minutes before official runs. The robot is supposed to visit all the objects, stop on the map in front of the start object and display the number of target objects after spinning around 360 degrees. If there is no target object, -1 should be displayed.

As an example using Figure 1, if the start object is a pink color paper and the target object is a letter size yellow paper, the robot must display 2 at the pink paper, since there are two yellow letter size papers around the mats.

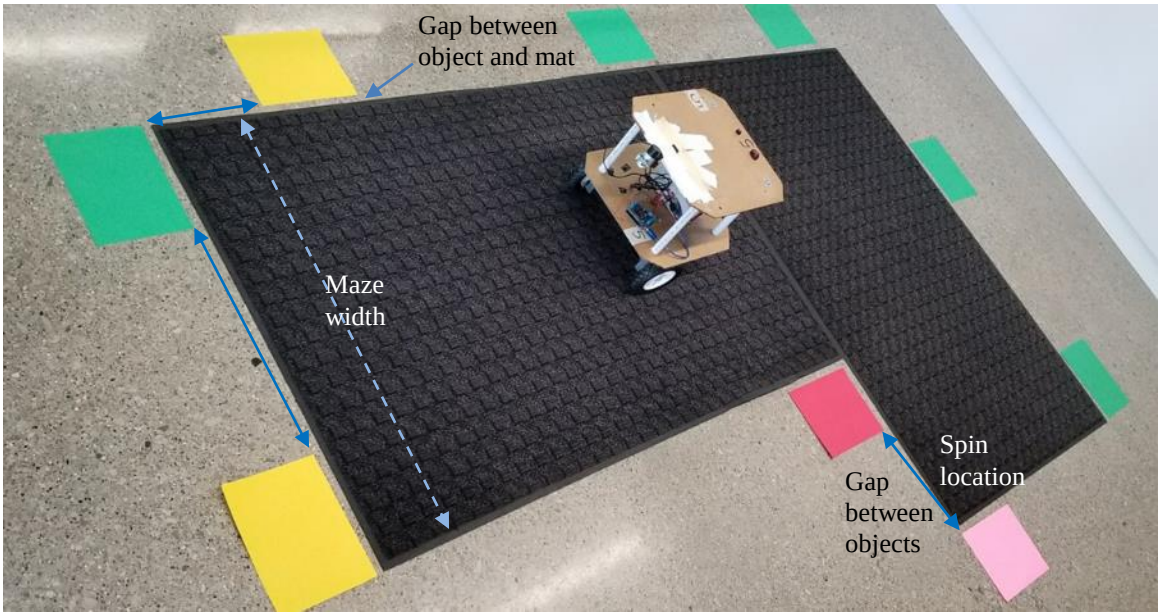

Figure 1. Letter size color papers as objects (for High School teams)

3. More Examples

In Figure 2, if the start object is a white circle shape and the target object is a white square, the robot must display 2 at the circle, since there are two identical square shapes.

Figure 2. Different shapes (circle, triangle, square, and rectangle) as objects

As another example using Figure 3, if the start object is a hammer and the target object is a blue plastic cup, the robot must display 1 at the hammer, since there is a blue cup.

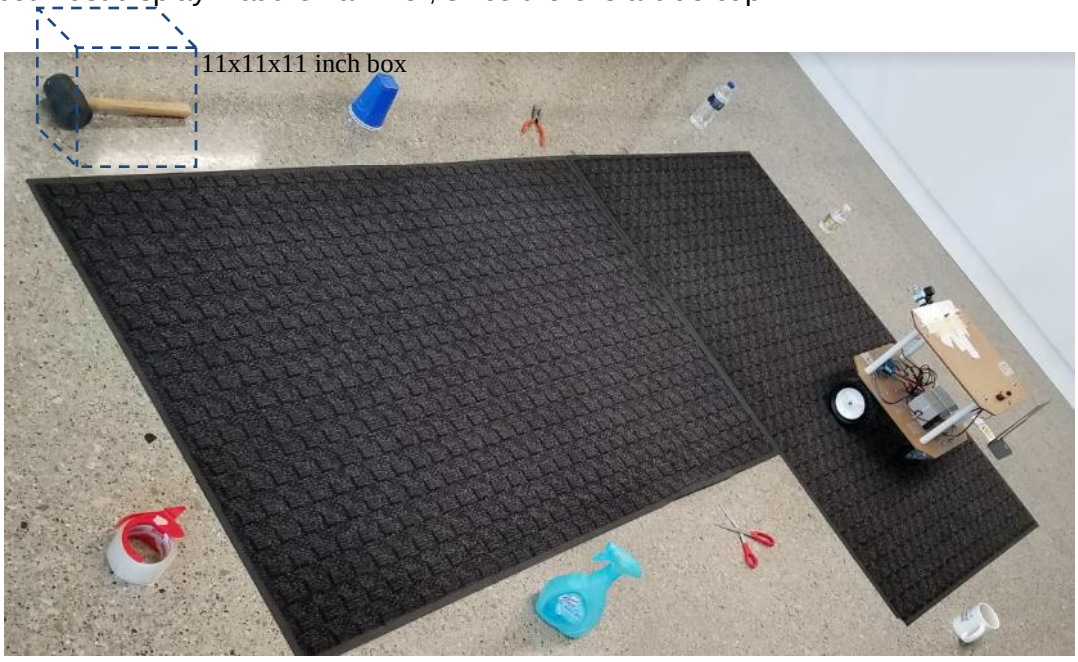

Figure 3. Real-world objects

As another example using Figure 3, if the start object is a hammer and the target object is a soccer ball, the robot must display -1 at the hammer, since there is no soccer ball.

4. Difference Between Age Divisions

- Senior (Advanced High School): Only letter size color papers will be used.
- College: any objects including letter size color papers can be used. Note that same object means same size and same color. For example, blue cup and red cups are different objects even if the sizes are the same. Some shapes may be changing. For example, the angles of two scissors will be different, but they are considered as same object.

5. Unveiling Items and Procedures

- After check-in and before starting a round: unveiled are floor, floor color, mat, mat size, mat color, *some* sample objects used, and lighting condition.
- There will be 3 rounds. For each round before starting 30 min work-time, Judge will unveil the following items for each age division:
  - all the objects used,
  - a start object,
  - a target object (target object cannot be the start object), and
  - starting location and orientation.
- Setup after impounding: maze, location & orientation of each object

6. Course Setup Instruction

- Maze width: at least 4ft. (see Figure 1)
- Color of the floor mat is dark. Website links of sample mats will be posted later on this document.
- Letter size color papers used **as samples**: www.officedepot.com/a/products/170719/Neenah-Astrobrights-Bright-Color-Paper-8
- Orientation of objects: unveiled after impounding.
- The gap between an object and mat is at least one inch. (see Figure 1)
- The gap between edges of two neighboring objects is at least a foot. (see Figure 1)
- The maximum size of the object is 11 x 11 x 11 inches. (See Figure 3)
- If an object is paper, will it be taped on the floor? Possibly yes, but it does not matter, since robots are not supposed to touch objects.
- Start the robot at the root node with any orientation the team wants
- Lighting conditions on the course are unknown and possibly dynamic.

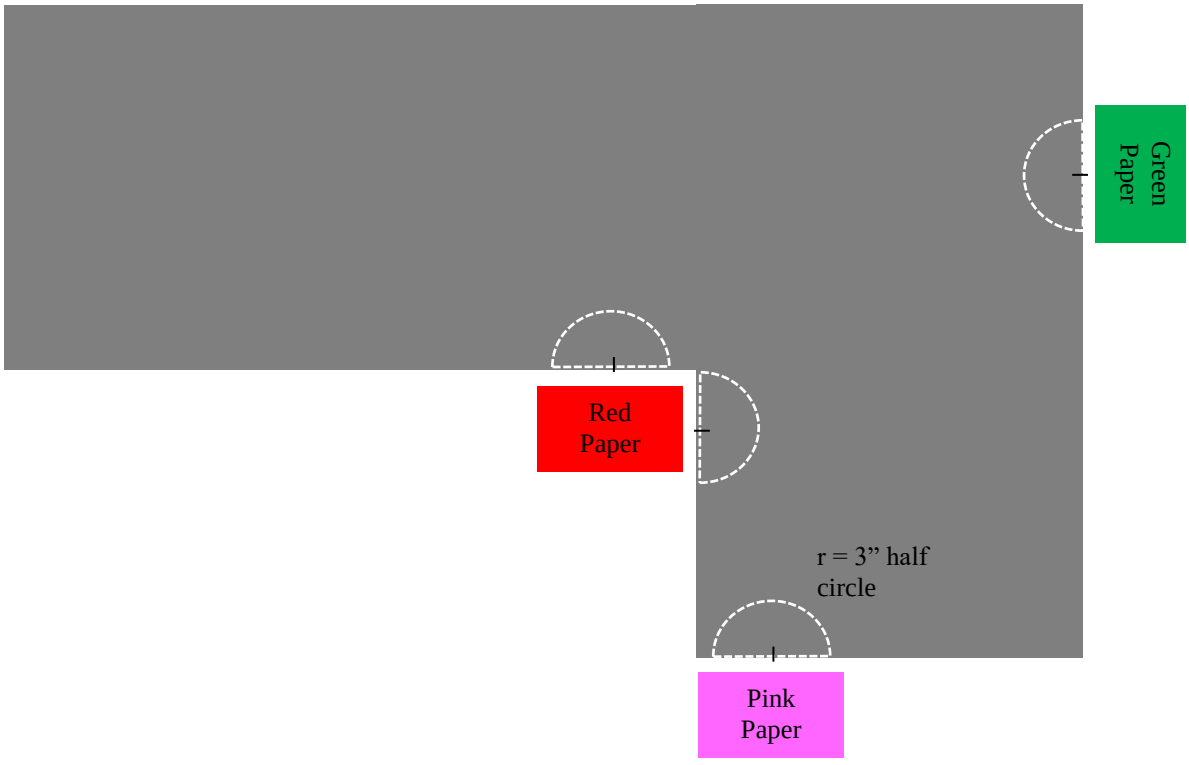

Figure 4. How to determine stop locations

7. Competition Rules

- Each team will run 3 rounds.

- For each round there will be at least 30 min. work-time after unveiling items described in Section 3.
- All robots will be impounded (quarantined) before starting each “round”.
- After all the robots are impounded, real competition field will be setup: See section 3 above.
- For each round, each robot has a maximum of **2** minutes to complete the mission.
- The Judge will start the robot at the starting location. Teams are NOT allowed to touch the robot after impounding. The team must provide verbal or written instruction to the Judge indicating how to start the robot. Note that Judges will not calibrate the vision system. Robots must be calibrated before impounding or have a means of dynamic calibration.
- A team member is supposed to show the target object to the robot after the program is started. The team member should not touch the robot.
- Violations that will terminate the run:
    - Human touch of the robot
    - Robot is completely out of the maze
    - Robot touches the object outside the maze
    - Illegal signal to the robot
- To complete a successful round, the robot must spin about 360 degrees at the start object and then display a correct number to the Judge. When the robot stops after spinning, any part of the robot must be on the radius 3” half circle center at the target object as shown in Figure 4.
- The winner will be decided by the number of successful rounds. If multiple teams tie for the number of successful rounds, the teams will rerun with more difficult objects until a winner is decided. Tie breaking rules will be added later.

8. Robot Requirements

- Must be completely autonomous. (No remote control by human driver or remote computer is allowed). Main controller can be a laptop, notebook, tablet, Raspberry PI, or even a smart phone.
- Any robot platform with up to 2 cameras is allowed. No other external sensors are allowed. Internal encoders for motors are permitted to use.
- Any programming language can be used.
- Width must be less than 2ft.
- Length: less than 3ft
- Height (including camera): maximum 2ft
- Weight: no limit
- Can robot automatically expand its dimension larger than the specified max values? No
- Camera angle: no restriction. You may use motors to move the camera. Wide angle lens can be used.

9. Prize: Winners receive trophies. Each high school team member of the winning team may receive $2,000 LTU renewable scholarship. Monetary prizes for college students - 1st place: $200, 2nd place: $100, 3rd place: $50

10. Competition Dates

- World Championship at LTU in Michigan
    - Saturday, May 19, 2018, 8:00am ~ 4:30pm
    - Practice field will be setup on May 18, 2018, afternoon. Exact time: TBD
- Other locations/dates: To be announced at www.robofest.net

11. Miscellaneous Information

- Go to https://www.robofest.net/index.php/current-competitions/vision-centric-challenge for more info and possible rule updates
- Questions regarding rules, registration, or L2Bot lease: Contact Prof. Chung at cchung@LTU.edu
- The event is open to the public. Admission is free. Parking is free.