



SPOT-IFY

GC Points: 350

Venue: Robotics Club Room, New SAC

Date : 31/10/19

Contact Details

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With many online and offline channels of sales available and various services offered like same-day-delivery or store pick-up, customer preferences have evolved. This has forced companies to improve efficiency and reduce the order-to-delivery time. The sheer volume and mix of orders mean that warehouses across the world are under increasing pressure to deliver in the shortest possible time. Traditional rigid warehouse automation fails to deliver and flexible automation is the only viable solution for warehouses to gain a competitive advantage. In these situations cooperative multi-robot systems come into play. Several autonomous mobile robots work in a coordinated fashion to organize these large warehouses, each robot running highly advanced algorithms to efficiently pick, place and deliver packages. Some of the companies working on this are Amazon Robotics, Grey Orange and Waypoint Robotics, just to name a few.

In this problem

- We challenge you to build a system of 4 robots, capable of communicating with each other and aligning themselves according to given patterns with as much accuracy and speed as attainable.
- Each bot will be required to detect its initial coordinates and orientation and reach the final position (in any orientation). On reaching the final destination, your bots should provide an indication/signal.
- All the bots will be placed a square plane with dimensions **225 cm x 165 cm**.
- To test the system, there will be 4 stages. At the end of each stage, the bots should arrange themselves according to the specified pattern. The pattern would be specified in terms of 4 coordinates by the club at the beginning of each stage. You will be allowed to proceed to the next stage only if you are able to complete the previous stage.
- A camera will be placed above the testing setup at a constant height, providing raw images of the plane from the top.
- The controller device(laptop) for operating the system will not be judged, however, the bots will be indirectly judged for its accuracy and speed.

Basic Specifications of Bots

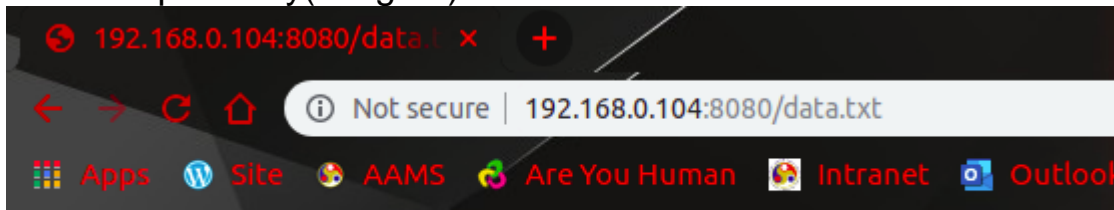
- Bots should be autonomous; they should be able to extract the data(coordinates and orientation) from the provided HTTP server running on a Router.
- The details will be provided in the following format -

X1,Y1,A1-X2,Y2,A2-X3,Y3,A3-X4,Y4,A4=Xg1,Yg1-Xg2,Yg2-Xg3,Yg3-Xg4,Yg4

Where,

Xi,Yi,Ai represents X and Y pixel coordinates and Angle(in degrees wrt horizontal) respectively(integers).

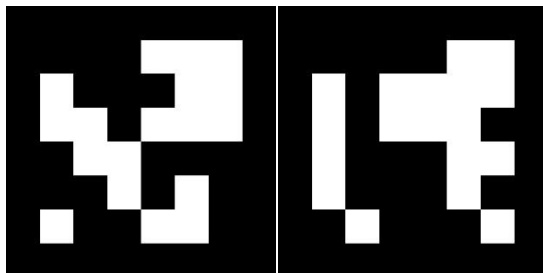
Xgi,Ygi represents goal X and Y pixel coordinates respectively(integers).



123,56,180-12,12,90-408,201,0-45,35,120=15,92-68,95-289,148-356,254

Eg- -

- Dimensions of each bot: **20 cm x 20 cm x 15 cm**
- If the bot goes outside specified dimension then 5% deduction will be done per centimetre from the total marks they have gained.
- Each bot will be required to detect its initial coordinates and orientation and reach the final position (in any orientation). On reaching the final destination, your bots should provide an indication/signal.
- Each robot will be provided with ArUco markers with specific IDs to be stuck on the top for identification.

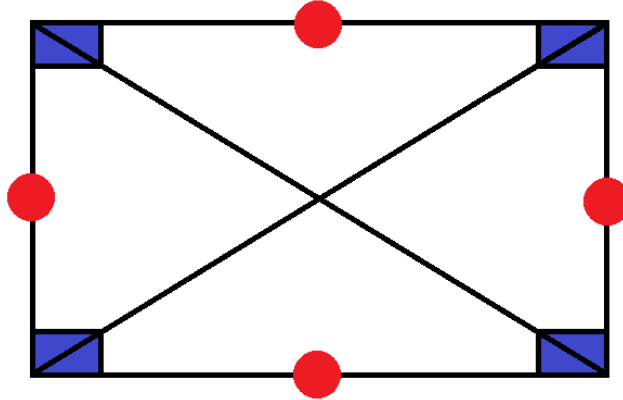


Aruco Marker with ID 0 and 1 respectively

(EXAMPLE) Stage 1:

Blue: Initial Pattern of Bots, the orientation of each bot would be provided during the event by the club.

Red: Final Pattern to be achieved



Marking Scheme

A. Initial Scrutinization (Each bot will be checked, Each bot will be required to detect its initial coordinates and orientation and reach the final position (in any orientation). On reaching the final destination, your bots should provide an indication/signal.) : 20

B. Presentation: 50

C. Stage 1: 30

D. Stage 2: 70

E. Stage 3: 140

F. Stage 4: 40

G. Bonus Stage: 40

- You have to clear A to proceed to B, and so on.
- Partial marks will be awarded in stage 1-4 (that is, C to F) according to the formula:

Marks Awarded=

0.25(Total Marks for Stage)*(Number of bots that are able to reach their destinations)*

- In case of a collision you can choose between the following 2 options:

- Exit the competition at this stage with the current point total.
- Accept deduction of 50% of the current stage (the one you failed to complete due to collision), reset to the previous stage (manually), try again. You can choose to take this option maximum 2 times for a particular stage. After this, you will be forced to exit.
- In case two or more teams score the same points:
 - First, the number of stages cleared would be compared.
 - If both teams cleared n stages and the tie persists, then the following quantity would be compared:

$$\text{Time Term} = (T_1 + T_2 + \dots + T_n)/n$$

$$T_i: \text{Time taken to clear stage } i$$
 The team with lower time term wins.
 - If the tie still persists, both teams get the same rank.

Marking Scheme for GC

- For this event, the GC Point distribution will feature a different structure.
- All hostels clearing A and B (but get 0 points in Stage 1) will be given 70 GC points.
- All hostels who are unable to clear stage A but have built 4 bots will be given 35 GC points.
- All hostels clearing A and B and scoring some marks in stage C will be included in the ranking (tie-breaking for these teams will be done according to the aforementioned marking scheme).
- The hostel coming first will be given 350 GC points, second will be given 300 points, third will be given 250 points, fourth will be given 225 points and fifth will be given 200 points.
- After that, all the teams in the ranking will be given 100 GC points.

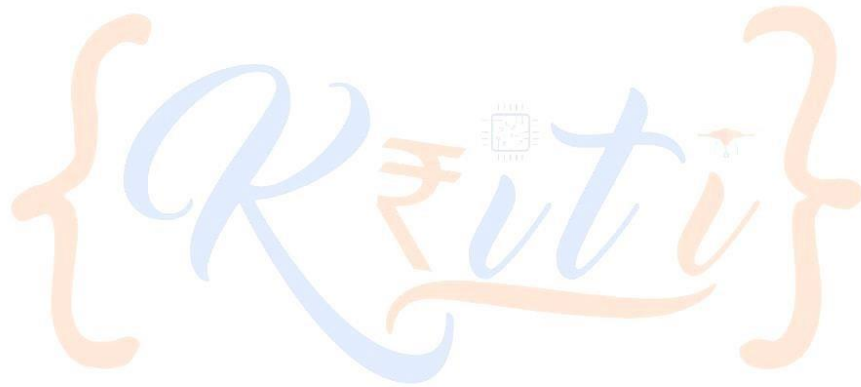
Important Instructions

- Hardcoding would lead to immediate disqualification.
- Once stage C begins, no manual intervention will be allowed. The final position and orientation of the previous stage would be the initial position and orientation of the next stage.
- Error bound within 1 cm of Radius of Final spot.

- The final verdict will be of the club secretary and the team behind the problem statement.

People who cannot Participate:

- Rohit Kumar
- Guining Pertin
- Vaibhav Singh
- Tanvi Ohri



12 Hostels, 7 Days, 1 Title!