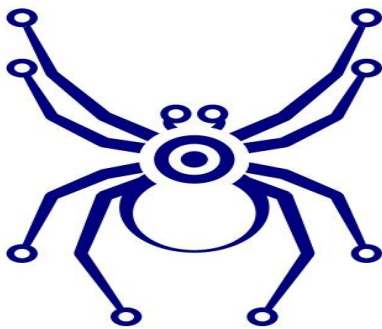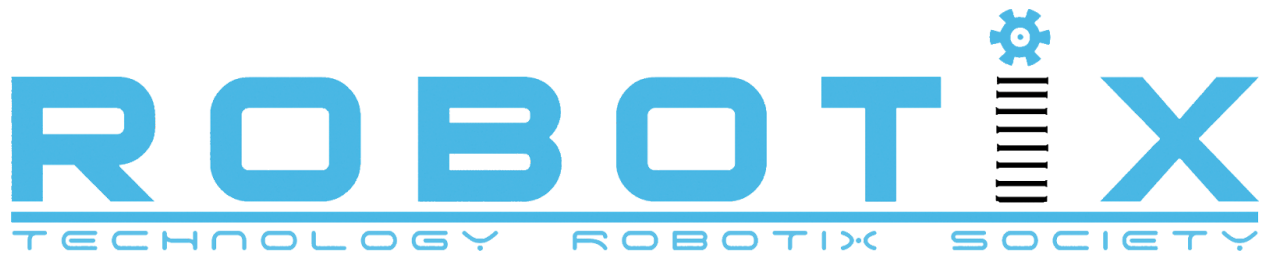# INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
KSHITIJ 2016

ANTI-VIRUS

Autonomous robotics

USP: Encryption and Circular unexplored grid following.

Introduction

Security is everything. What if every bug can be removed autonomously?

Problem statement

A nano bot is instructed to remove the bug in the hard disk and it has to travel along specific paths to remove it.

USP:

- **Path Planning and optimization.**
- **Picking and placing mechanism.**
- **Circular Grid following.**

General Arena Description & Event Setup

1. The autonomous robot movement and traversal there has to be no **control** over the traversal once the run is started.
2. There will be multiple **2 cm blocks**, each with a particular **combination of the led blinking.**
3. The "center arena" consists of the various path to different sub arenas. There are the LED raised to **10 cm** height showing that the given arena in front of which it is blinking contains a bug to be removed(i.e.the bug box has to be placed in the centre of sub arena).
4. The location of the bug by **decrypting** the encrypted data it receives from the the Blinking LED before entering the respective sub arena.
5. The "bug" is said to be removed when it is placed in the centre of the required sub arena.
6. The "bugs" are on the specified location in sub arena. The bot will recognise the bug by sensing the led on the block and sensing the the frequency of it to decide the sector in which the block has to be placed. For example: if 2 led blinks with the frequency of 3 per second that means that the block has to be placed in the sector 3 in the sequence of 2,that means the block will be placed after the bug of the sequence 1 has been placed thus till it has not been placed it can be placed in the central main arena.
7. The bot must have a gripping mechanism which is capable of accessing blocks placed. It must be able to pick and drop blocks on any the location of the block in grid.
8. Each block will have three LED's ,giving information about the sub arena in which it has to be kept and later the dependencies(i.e the order in which it has to be kept in the respective center.
9. There will be a safe zone in the center main arena where the bot can place the bug if it is of different sub arena.While placing the block on any shelf the bot must ensure that the block is kept within the safe zone.
10. Some blocks will have LED's that do not correspond to any of the six sub arena and these blocks are to be placed anywhere on the "center-arena". If they are already on the center-arena then they can be ignored.
11. The event ends when the user has placed **all the bugs correctly** on their corresponding shelves and leaving those bugs which do not correspond to any sub arena on the central arena.
12. Some blocks will be placed on centre at the start of the event and they must be **checked if they are on the correct sub arena.**

Rounds

Round 1

1. The Bot will start from the Start zone which will be a **centre circular area** of the arena.
2. The bot then has to pick and place all the **4** given blocks from their initial position to whichever centre of sub arena it belongs to.
3. The information about the location of the "bug" is provided as the encrypted data through the

blinking LED ,placed in front of each sub arena, encountered by the bot before entering he sub arena.

4. The blocks in round 1 will belong to respective sub arenas only. No block will belong to sub arena other than in which it is placed.

5. There will be **one** dummy blocks which won't be transmitting any sub arena id and hence must be placed **anywhere** on the center arena. If those blocks are on a centre of a sub arena , then they must be picked and placed on the center platform.

6. Then the bot will move to the bug through the concentric paths using the shortest possible paths.

7. The bot will then pick the bug and place it in the centre of the arena following the same instructions which were their to reach the bug.

8. Then the bot will come out of the sector and switch off the blinking led in front of the bugged path by standing their in front of the led for 3 seconds.

9. A maximum of **2** timeouts and **2** restarts can be taken in this round. However a restart will be granted in the event of a technical failure only and will be based on Team ROBOTIX discretion.

10. A maximum of **5** minutes will be given to complete this round. The restart will only be given before **3** minutes into the round.

11. The round ends when the bot **returns** to the start zone after completing the task.

Round 2

1. The Bot will start from the Start zone which will be a **centre circular area** of the arena.

2. The bot then has to pick and place all the **6** given blocks from their initial position to whatever sub arena it belongs to.

3. The Blocks may belong to **any** of the sub arena.

4. The information about the location of the "bug" is provided as the encrypted data through the blinking LED ,placed in front of each sub arena, encountered by the bot before entering he sub arena.

5. There will be **2** dummy blocks which won't be transmitting any sub arena id and hence must be placed **anywhere** on the center arena. If those blocks are on a centre of a sub arena, then they must be picked and placed on the center arena.

6. Upon reaching the block the bot must pick it up.

7. Then the bot has to read the information received from the LED ,and then proceed towards depositing the block to its corresponding sub arena.

8. There will also be dependencies(i.e. The order in which the bug can be placed).For Example - If the LED says that the "bug" can be removed only by removing the "bug" of the sub arena 2.Then the bot has to first place this bug in the centre arena and move to sub arena 2 to remove its "bug", then it will come again and remove this respective bug.

9. Then the bot will move to the bug through the concentric paths using the shortest possible paths.

10. The bot will then pick the bug and place it in the centre of the arena following the same instructions which were their to reach the bug.

11. Then the bot will come out of the sector and switch off the blinking led in front of the bugged path by standing their in front of the led for 3 seconds.

12. A maximum of **2** timeouts and **2** restarts can be taken in this round. However a restart will be granted in the event of a technical failure only and will be based on Team ROBOTIX discretion.
13. A maximum of **10** minutes will be given to complete this round. The restart will only be given before **7 minutes** into the round.
14. The round ends when the bot **returns** to the start zone after completing the task.
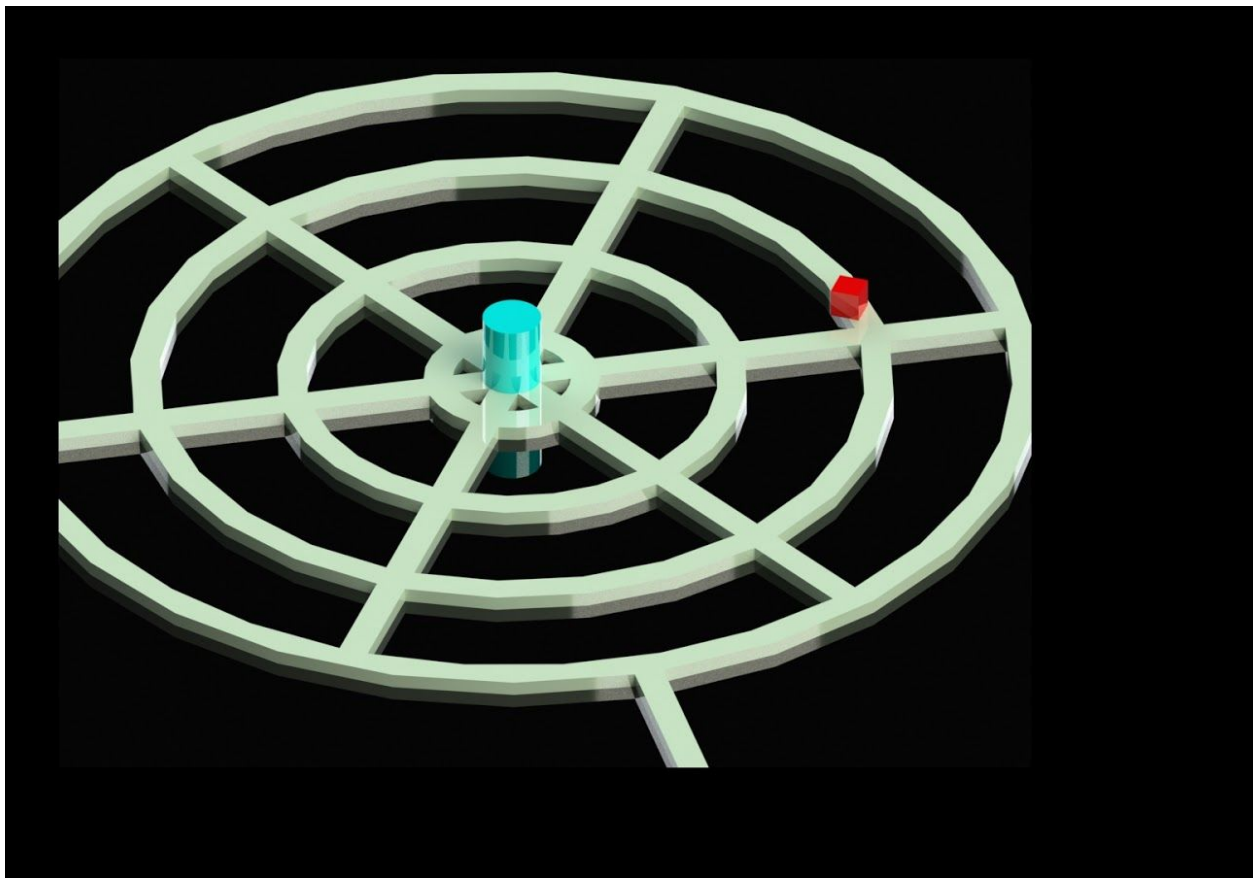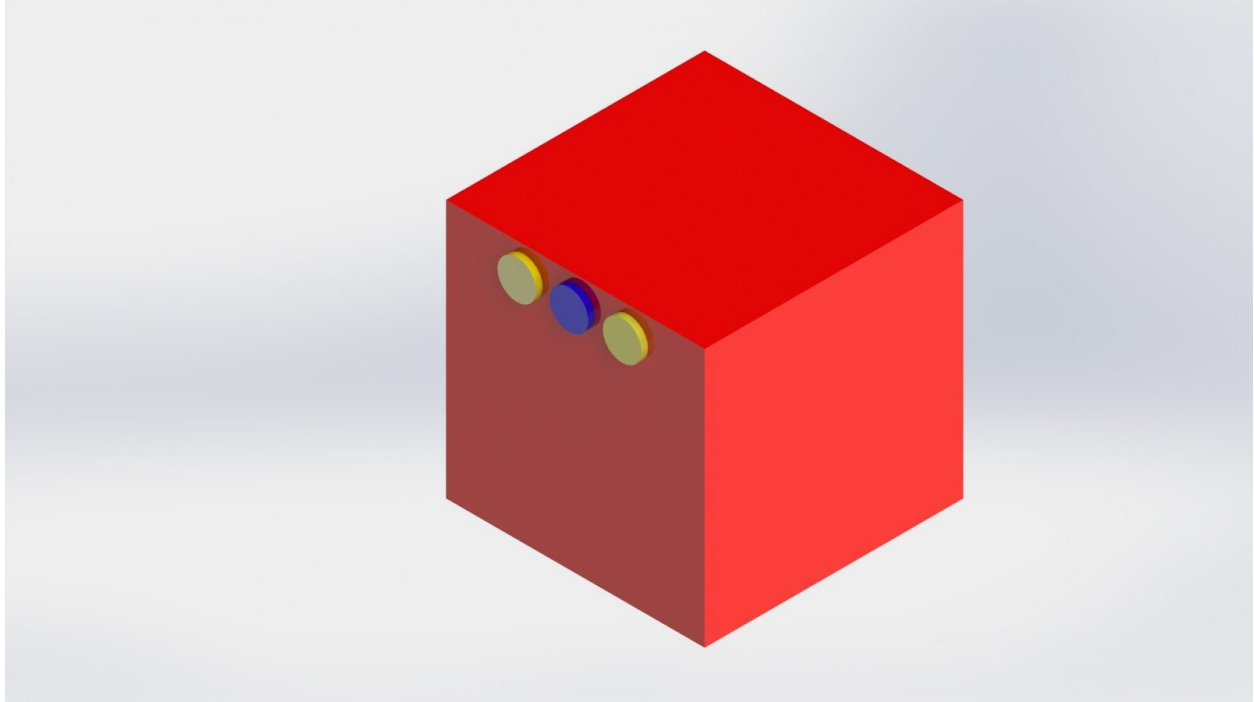
Arena

Descriptive View
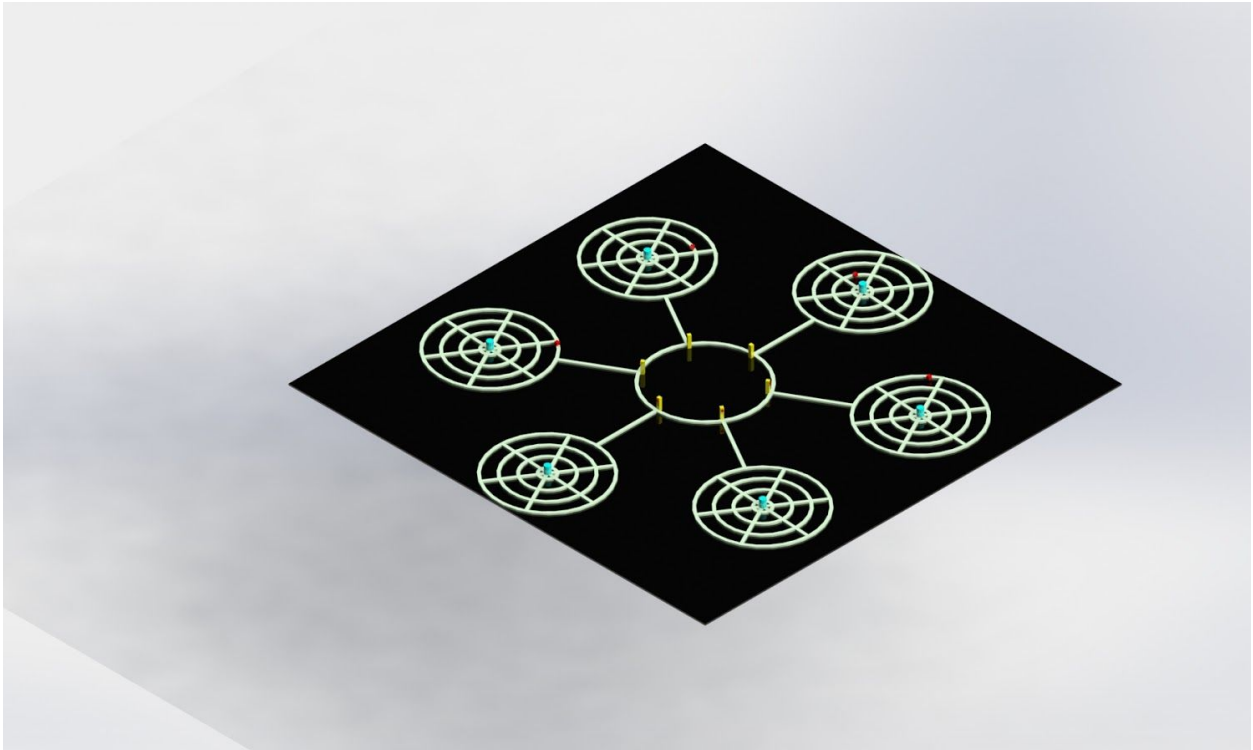
Isometric View
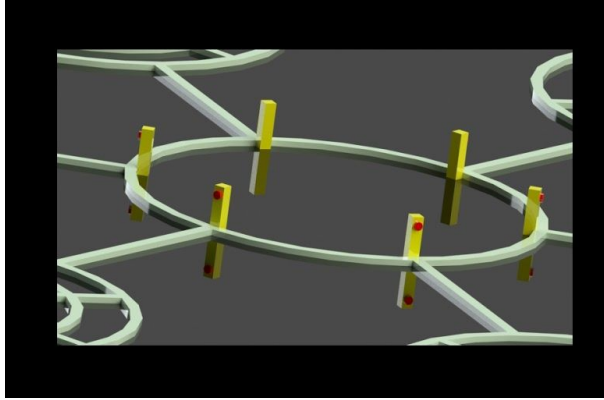
Centre arena

Sub Arena

Block("BUG")

Rules And Specifications

General Rules

1. All arena dimensions may have a tolerance (error) of up to 10%.
2. Each team can consist of a maximum of 4 members.
3. Only **2** members per team will be allowed to control the robot.
4. The participants will be provided with 220 volts, 50 Hz standard AC supply.
5. Each team should have unique participants i.e. no two teams can have even a single participant common.
6. The team members can be from different institutes or colleges.
7. Teams qualifying the first round will go into the second round and the second round performance will determine the winner.
8. The teams cannot touch their bots during the course of the run, unless timeout is taken.
9. The right spirit of participation is expected from the participants.
10. **The decision of Team ROBOTIX will be final and binding.**

Event Rules

Block

1. The Blocks will be made of Hollow wood.
2. The tolerances in all dimensions are 10%.
3. The weight of the block will not exceed 50 gms.
4. The position of all the blocks will be decided by Team ROBOTIX.

Picking and placing up the Block

1. The blocks have to be picked from the shelves as **neatly** as possible and dragging must be avoided if possible.
2. If the block falls down, there will be **penalties** and unless it has been replaced onto the sub arena , no points for placement will be given.

Arena and Locomotion

1. The robot has to start from the **Start Zone,** which will be central arena.
2. The bot has to go to complete the tasks as specified above. Any discrepancies will be handled by Team ROBOTIX and their decision will be final and binding.
3. The bot must **follow the grid** if the bot in any case leaves the grid penalties will be their.
4. The Block must be placed on the centre of the sub arena or the central arena. Sliding the block on the platform is allowed but if the block falls while picking or placing, it will incur negative points.
5. Time will be kept by Team ROBOTIX and their decision will be final and binding.
6. There will be a **Wall** surrounding the arena from all four sides

Initial Orientation of Robot

1. The participant is allowed to decide the initial orientation of his robot on the start zone.
2. Team ROBOTIX reserves the right to disallow any initial orientation of the robot inside the starting zone if it gives the participant an undue advantage, solely based on the judge's discretion.

Restarts and Timeouts

1. A maximum of 2 Timeouts of **1 minute** each may be taken. Penalty will be awarded for each timeout and robot will start from its last position on the arena.
2. The participant's robots can have a maximum of 2 restarts. A penalty will be imposed on the team for every restart that they take.
3. After the restart, the participant's robot will be set to its initial position. Timer will be set to zero and the run will start afresh with the addition of the penalty for restart.
4. A timeout can be taken anytime at the user's discretion.
5. A restart can only be taken if there is a genuine technical fault in the bot. Team ROBOTIX may refuse a restart if the reason is not genuine, and their decision will be binding and final.

Technical Rules

1. All Circuitry and sensory equipment placed on the robot should be adhering to the ROBOT SPECIFICATIONS.
2. Participants will have to bring their own programmers, cables and software. No Programmers will be supplied.
3. Hard Coding (http://en.wikipedia.org/wiki/Hard_coding) is not allowed.
4. A 220V 50Hz power source will be provided.
5. All on board processing must be done on a 16 bit microcontroller or less. The robots cannot be controlled by a remotely kept computer.
6. A laptop will be allowed to be connected with the microcontroller and the bot during the run only if the user is using the laptop camera for the gesture recognition. However the user must ensure that all on board calculations except the gesture recognition are done on the 16 bit microcontroller.
7. Processors of more than 16-bits are not allowed. ARM processors are not allowed.

Robot Specifications

1. Each robot can have maximum dimension of 30 x 30 x 30 cubic cm (L x B x H) respectively.
2. No part/mechanism of/on the robot should exceed the given dimensions before the commencement of the event run. The robots can exceed their respective dimensions once the event commences, due to elongation of arms/gripper/forklift.
3. There is no weight restriction on the robot.
4. LEGO kits or its spare parts or pre-made mechanical parts are not allowed. (http://en.wikipedia.org/wiki/Lego_Mindstorms)
5. Ready-made gearboxes, sensors, development boards can be used but no other part of the robot should contain any ready-made components. Simple car bases with no extra features may be used.
6. The bots should not damage the event arena in any way. If it does so, a penalty will be imposed on the team. The magnitude of the penalty will be decided by Team ROBOTIX.
7. Ready-made gripper is also allowed .

Scoring

Round 1

Positives

1. Base score: 1000
2. For each block picked/gripped (given only once for each bug): 100 (**L**)
3. For successful LED (the one giving the location of bug in sub arena) reading 150 (**S**)
4. For placing the block on the correct sub arena: 150 (**P**)
5. Time bonus: time left in seconds (provided the task is complete)(**B**)

Negatives

1. For incorrect LED (the one giving the location of bug in sub arena) reading : -50 (**NS**)
2. For placing block on an incorrect subarena: -50 (**NP**)
3. For dropping the block each time: -50 (**D**)
4. Collision with the walls each time: -50 (**W**)
5. Negative marks for each timeout: -100 (**T**)
6. Negative marks for restart: -150 (**R**)

Scoring Formula

1000 + 100 x L + 150 x (S + P) + B - 50 x (NS + NP + D + W) - 100 x T - 150 x R

Round 2

Positives

1. Base score: 1000
2. For each block picked/gripped (given only once for each bug): 100 (**L**)
3. For successful LED (the one giving the location of bug in sub arena) reading : 150 (**S**)
4. For successful LED (the one on the bug) reading : 150 (**S**)
5. For placing the block on the correct sub arena : 150 (**P**)
6. Time bonus: time left in seconds (provided the task is complete)(**B**)

Negatives

1. For incorrect LED (the one giving the location of bug in sub arena) reading :50 (N**S**)
2. For incorrect LED (the one on the bug) reading : 50 (N**S**)
3. For placing block on an incorrect sub arena: -50 (**NP**)
4. For dropping the bug each time: -50 (**D**)
5. Collision with the walls each time: -50 (**W**)
6. Negative marks for each timeout: -100 (**T**)
7. Negative marks for restart: -150 (**R**)

Scoring Formula

1000 + 100 x L + 150 x (S + P) + B - 50 x (NS + NP + D + W) - 100 x T - 150 x R

Note

- It is suggested that the participant try to make a wireless robot. In which case the wireless bot should be battery powered on-board.

Tutorial & Resources

Visit _____to check out the latest Event Updates.

Read our Tutorial for Anti Virus.
Get our DIY for Anti Virus.
Watch the Demonstration Video for this event.

Contact