

# GREEN MARS

## PROBLEM STATEMENT

10 years after the Mars Rover successfully landed on Mars, NASA has started efforts to colonize the planet. The most difficult task is of the Terra-forming Unit and since the artificial atmosphere is not entirely breathable, and the operation is of a huge scale, all efforts have to be done exclusively by satellite imaging and autonomous robots, which are trained extensively before deployment.

The 'Seeder' is an autonomous robot capable of dispersing large amounts of seed, water, and fertilisers as it explores the surface of Mars. If deployed at very specific areas, the Seeder will lay a framework of green plants capable of producing oxygen, resulting in a breathable atmosphere, putting the human race one step closer to colonisation.

With your efforts, humans can make Mars a second Earth! Can you help the human race reach the stars?

## OBJECTIVE

Create an autonomous robot that can traverse straight line 'paths' on an arena and visit specific nodes from any starting position.

## GAMEPLAY

### First round:

1. An arena, with an overhead camera, will be provided to the participants where a few line segments (representing paths) are missing from the physical arena. These missing paths will be provided in a digital image of equal scale.
2. The participants have to combine the two images to get the complete path.
3. The robot will have to traverse the entire path and stop after doing so to obtain maximum possible scores.

### Second round:

1. Participants will be provided a different arena (as per the round 2 specifications).
2. A digital image of equal scale, marking specific nodes with RED, BLUE and GREEN coloured tags will be provided.
3. The robot will have to visit these marked points and blink an LED. Bonus points will be awarded if the points are visited in the order RED, BLUE and GREEN.



## Arena 2

1. The arena will consist of rectangular regions of alternating backgrounds (black or white) with black paths on white backgrounds and white paths on black backgrounds.
2. The robot will always start on a black path on a white background.



Fig 1 : Arena provided

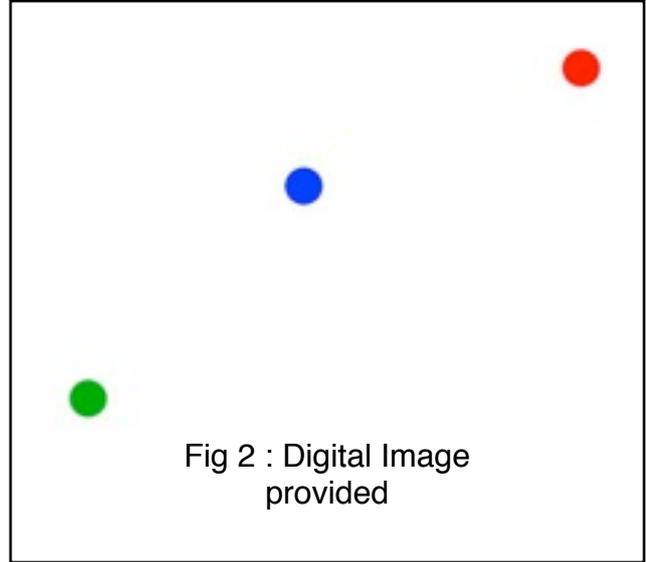
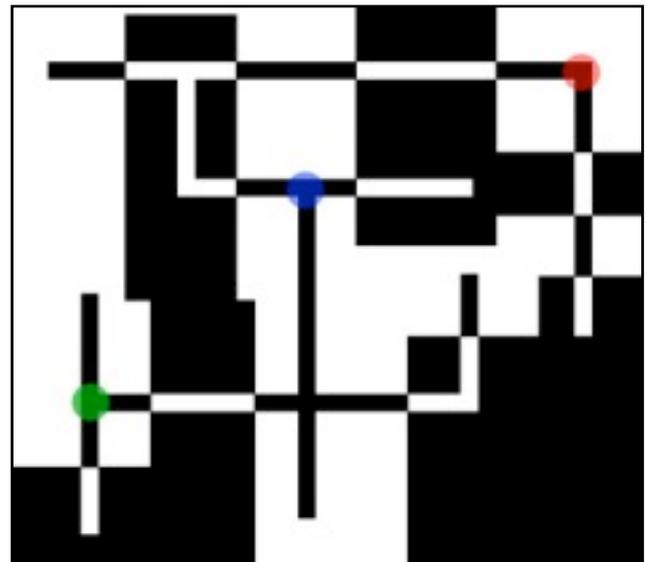


Fig 3 : Your arena for Round 2



## CAMERA

1. There will be only one overhead camera kept at the center of the arena.
2. † The cameras will be model "iBall c8.0".
3. The camera will be placed at a height such that only the arena is visible in the feed.

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† Subject to change

## ROBOT

1. ‡ The bot must fit into a cube of **25 x 20 x 20 cm** (l x b x h) at all times.
2. The max potential difference between any two points on the bot should not exceed **24 V**.
3. The bot must be fully independent, with powering and motoring mechanisms self-contained. However, it can communicate only with the computer using wired/ wireless data transfer.
4. The robotic equipment is to be fully autonomous. Human operators are not permitted to enter any information into the equipment during a run. The human operator should not directly control the motion of their robots with a joystick or by keyboard commands under any circumstances.
5. It will be the participant's responsibility if there is any data misinterpretation of the arena image taken by the overhead camera due to obstruction by the body of the bot.
6. The bot cannot be constructed using ready-made Lego kits or any ready-made mechanism. But you can make use of ready made gear assemblies and ready made wireless modules. Violating this clause will lead to the disqualification of the machine.
7. All the bots have to work on the principle of image processing. Any sort of ambiguity will lead to immediate disqualification. In case of doubt please confirm with the organisers about the validity of your procedure beforehand, via email.
8. The bots are only allowed to use the overhead cameras feed that will be placed by the organisers, as specified.

### Team Specifications:

Minimum : 1 member

Maximum : 4 members

## SCORING

**Extra run penalty** : 50 points for each extra run taken.

For both rounds, if two teams have identical scores, then time will be considered as a deciding factor to rank the participants.

If two teams have identical scores and times (down to the millisecond), then the teams will be given a treat at the night mess, and will have to play a game of stone paper scissors.

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‡ Subject to change

## Round 1:

Base score: 500

### Penalties:

1. **While traversing** :  $10 \times (\text{Number of nodes not reached})$
2. **If the bot does not stop after traversal**:  $5 \times (\text{Number of nodes retraced})$ -- Up to a maximum of 25 points
3. Beyond which an extra penalty of 50 points will be imposed. (Adding up to 75 points)

Some teams will be eliminated based on their score.

## Round 2:

Base Score: 500

### Penalties:

Missing a marked node: 100 points.

### Bonus:

Visiting the nodes in the order RED, BLUE, GREEN: 150

Taking the path with minimum number of nodes: 50 per path

## CONTACTS

For any queries or clarifications, kindly drop us an email at [greenmars@bits-quark.org](mailto:greenmars@bits-quark.org), or get in touch directly with the Event Managers :

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