No Man's Land

Introduction

"Unless mankind redesigns itself by changing our DNA through altering our genetic makeup, computer-generated robots will take over our world."
- **Stephen Hawking**

Moria is renowned for its diversity and also for it being dangerous. After a successful rescue operation of 2 men to the CORE army bases, the team didn't know they had a bigger volcano underneath waiting to unleash itself. The enemy was well prepared than expected. They had all sorts of weapons in their repertoire, the crusading bazookas, the fiery Kalashnikovs and the state of the art laser tag missile guidance system to avoid any interference from the skies.

Just a day after the rescue operation, CORE team gets news of an attack operation being planned on them. There was just enough time left to run. But a far more bitter truth lay in their way. A long *No Man's Land* stayed in their path. There was the the great river of Kha'zaDuum on one side and the everlasting Andirondack Mountains on the other. Now there was a choice what to choose, the pathway through the sharp Andirondacks or the pathway through the fiery and the gushing white water rapids. The team had to conquer the NO MAN'S LAND or perish in to the forest's of Moria.

Techfest brings to you this life threatening mission for iNexus in which the teams have to make a series of bots which can rescue the team through the No Man's Land and the enemy area and bring back safely to the extraction point. In the competition, the central part of the arena is the No Man's Land and blocks represent the trapped team. The nodes in the maze are the enemy bases and have to be bypassed.

Task

- Teams must build a maze solving autonomous bot and a grid solving autonomous bot(s) and a manual bot (optional).
- The grid solving bot must be capable of transporting the blocks from the grid arena to the maze with/without the help of manual bot.
- The maze solving bot is then required to traverse the maze and deposit these blocks in the three different zones in minimum possible time by avoiding nodes and moving through bridges and then returning back to the starting position.

Arena

1. **Grid** – indicated by yellow colour in figure 2.
    * This zone will consist of a **7 x 7** squares grid of white lines on a black surface. The lines will be equally spaced. Each cell of the grid will be a square with inner dimensions **270 mm x 270 mm**. The thickness of each white line is **30 mm.**
    * Two starting points for the grid solving bots are shown in the figure 2. If the team uses only one autonomous grid solving bot, then their bot will be placed in starting point 1. If the team uses two autonomous grid solving bot, then their bots will be placed in starting point 1 and starting point 2.

    At the start of run, the bot(s) must be placed at the starting point within a horizontal square of **240 mm x 240 mm**.

2. **Maze** – indicated by black colour in figure 2.
    * This zone will consist of a **7 x 7** squares grid of white lines on a black surface. The lines will be equally spaced. Each cell of the grid will be a square with inner dimensions **270 mm x 270 mm**.The thickness of each white line is **30 mm.**
    * There are nodes and bridges on the arena.
      Nodes will be present at the intersection of two white lines. The node will be of the size of 30mm x 30mm and will be black in colour. Please note that the nodes will not be present at all the intersection points.
      The bridge will be a white line of thickness of 30mm and will be joining the centres of two adjacent sides. The bridge lines will be white in colour.
    * There are three deposit zones in the maze marked red in the figure 2.
      Please note that the colour of the deposit zones in the arena will be black in colour. The starting point for the maze solving bot is shown in the figure 2. At the start of each run, the bot must be placed at the start zone within a horizontal square of **240 mm x 240 mm** (Starting Point).

3. **The central zone (no man's land)** - indicated by blue colour in figure 2.
    * There are two routes connecting the grid and maze.
      Route 1 - Uneven Terrain (shorter route)
      Route 2 - White line on a black surface(longer route)
    * These two routes will be present in the central zone. The teams can choose either of / both the routes to transfer the blocks from the grid to the maze.
    * The white lines present in the central part will have a thickness of 30mm.
    * The turns of this white line will be of 90 degrees.

- **Uneven Terrain** - The uneven terrain (indicated by brown colour in figure 2) consists of a ramp and an extended flat portion. The ramp is a right angled triangle with base and height of size 750mm and 350mm respectively. The extended flat portion is of length 300mm.

4. Manual bot can be placed anywhere on the uneven terrain.
5. A "Block" is a **100 mm x 100 mm x 100 mm**. There will be 2 types of blocks(see figure 3).

- **Block Type A** - The colour of all the 6 sides of the block will be white. 2 such blocks will be placed randomly in the grid.
- **Block Type B** - Each of its 4 vertical faces will be divided into 2 equal halves. The colour of the upper half will be black. The colour of the lower half will be white. Its 2 horizontal faces will be white. 1 such block will be placed randomly in the grid.
- Thus there will be a total of 3 blocks. The block is made of non-magnetic material and will have a maximum weight of **60 grams**. The pictures of the block are given below. Each block will be placed such that it coincides with the centre point of a grid intersection as closely as possible.

6. The blocks will be placed randomly in the **grid** zone. The dimensions of the arena would be accurate to within 5% or 20 mm, whichever is less. Assembly joints on the arena floor will not involve steps greater than 0.5 mm.
7. **Light conditions at the venue might not be uniform.**
8. **The actual arena will be similar to figure 1. Figure 2 has been coloured just to specify the various zones.**
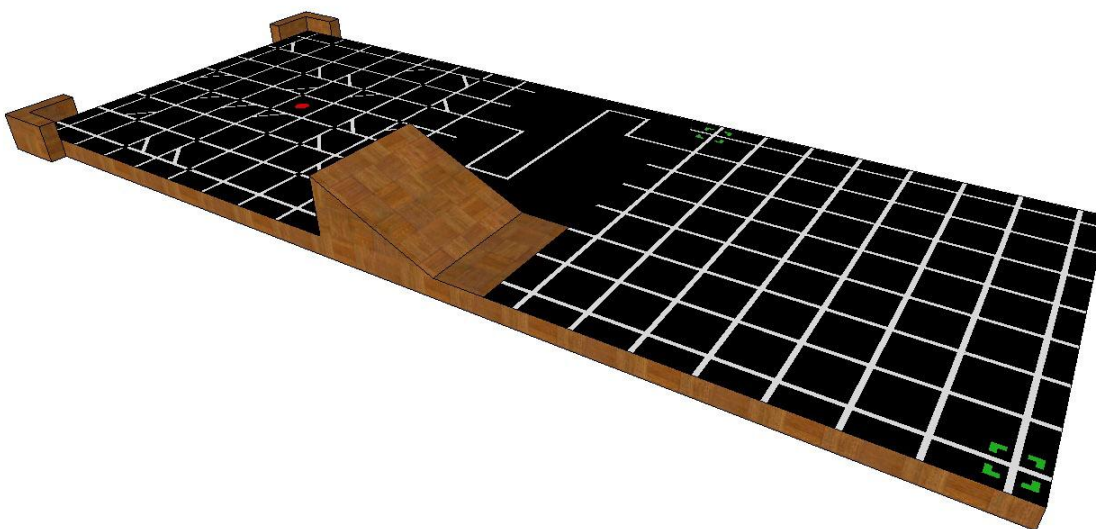

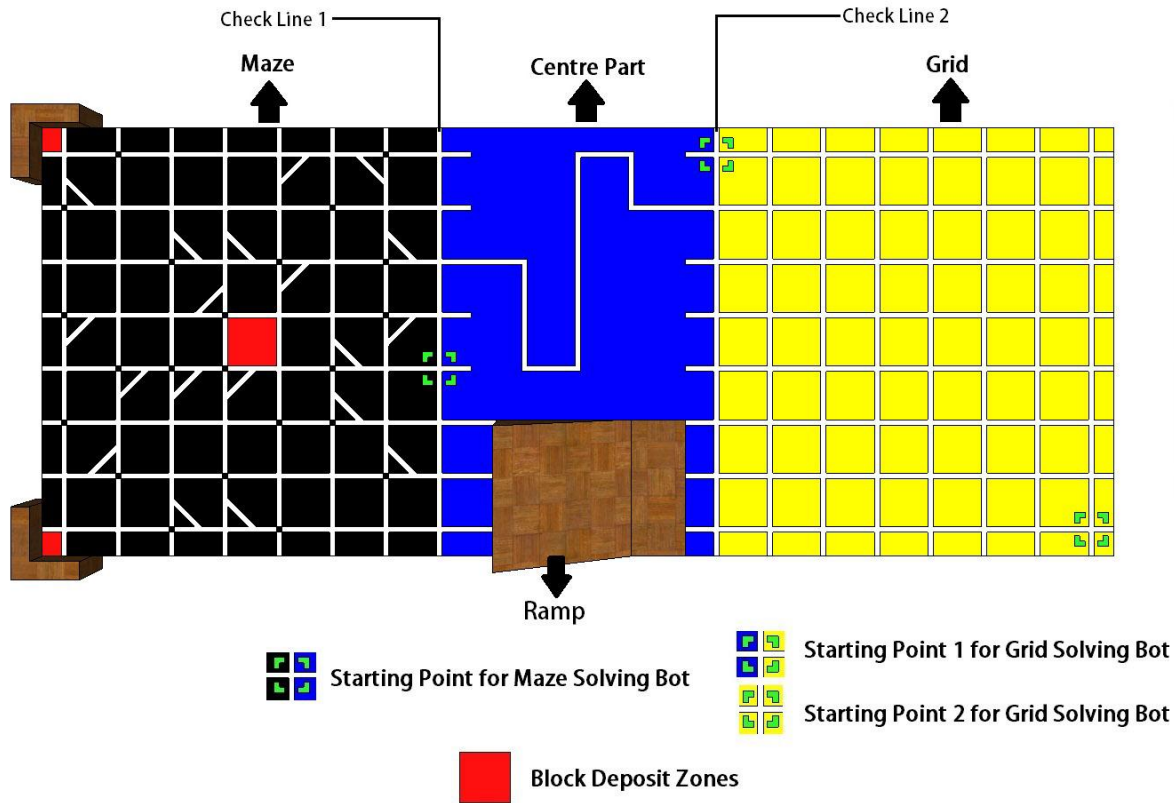Figure 1 : 3D view of the arena
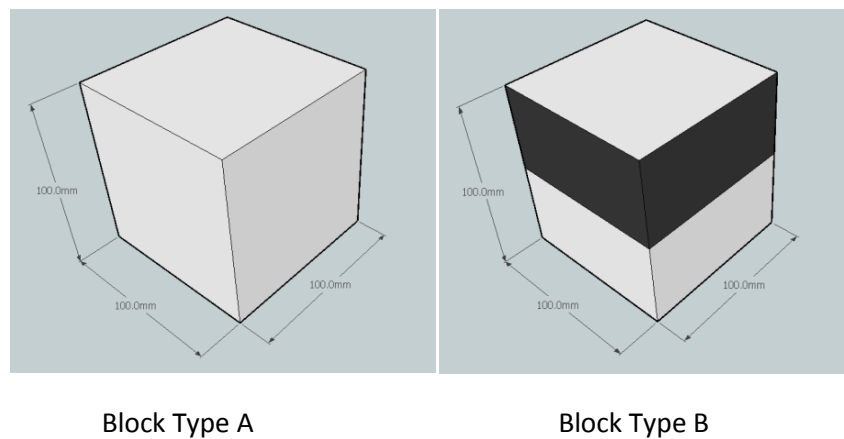
Figure 2 : Arena with different zones

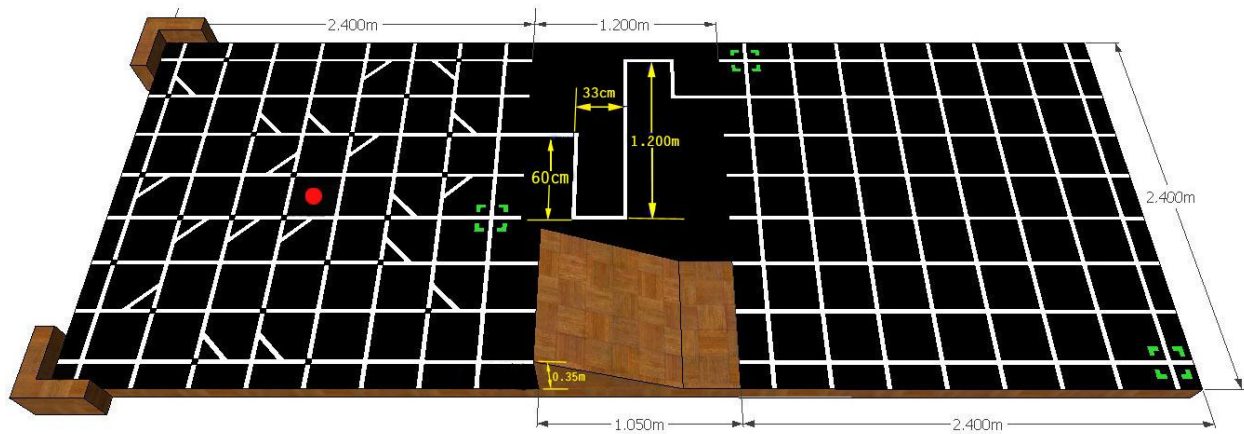Block Type A   Block Type B

Figure 3 : Blocks

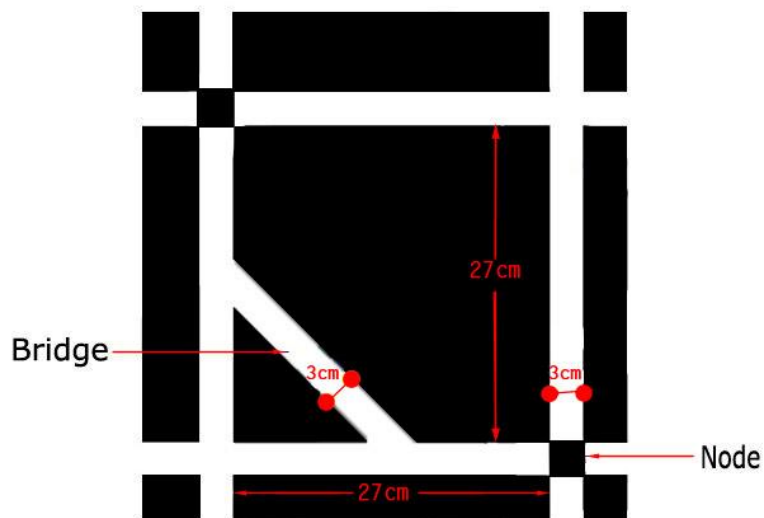Figure 4 : 3D view with dimensions marked

Figure 5: Enlarged View of Square Section

Bot Specifications

- **Dimensions and Fabrication**

Grid solving autonomous bot -

1. Maximum 2 autonomous grid solving bots per team are allowed. A team may enter with only 1 autonomous bot.
2. The top view of each autonomous bot must fit within a square of dimensions **240mm x 240mm** (l x b).
3. Bot must be started individually by only 1 onboard switch. However, a team may have a separate onboard switch for restart.(refer pt.10 of Rules)
4. The autonomous bot(s) must be stable and must stand on its own at the beginning of the run when put in the starting point. Bots not fulfilling this criterion will be disqualified.
5. During the run, the autonomous bot can expand itself provided it does not damage the arena in anyway. However, it is not allowed to leave anything behind or make any marks while traversing the grid. All bots found damaging the arena will be immediately disqualified. The final decision is at the discretion of the organisers.
6. The autonomous bot should not separate or split into two or more units. All bots/units which are touching each other or are in the starting point will be considered as one bot.

8. The methods of collection and delivery of the blocks are at the discretion of the builder. However, the teams damaging the blocks will be disqualified. **The teams are allowed to use ready-made wireless modules/ready-made micro-controller boards/ready-made sensor kits. However they are not allowed to use lego kits or any similar assemblies.**

Maze solving autonomous bots –

1. Only one maze solving autonomous bot per team is allowed.
2. The top view of the bot must fit within a square of dimensions **240mm x 240mm** (l x b).
3. This bot must strictly work on the principle of line following.
4. The bot must be stable and must stand on its own at the beginning of the race when put in the starting point. Bots not fulfilling this criterion will be disqualified.
5. During the run, the bot can expand itself provided it does not damage the arena in anyway. However, it is not allowed to leave anything behind or make any marks while traversing the maze. All bots found damaging the arena will be immediately disqualified. The final decision is at the discretion of the organisers.

6. The autonomous bot should not separate or split into two or more units. All bots/units which are touching each other or are in the start zone will be considered as one bot.

7. The methods of collection and delivery of the blocks are at the discretion of the builder. However the teams damaging the blocks will be disqualified. **The teams are allowed to use ready-made wireless modules/ready-made micro-controller boards/ready-made sensor kits. However they are not allowed to use lego kits or any similar assemblies.**

Manual Bot (optional) -

1. Only 1 manual bot per team is allowed.

2. During the start of the run the manual bot must fit within a cube of dimension **300 mm x 300 mm x 350mm** (l x b x h).

3. Bot must be started individually by only 1 switch.

4. At the start of the run and during restarts the manual bot can be placed anywhere on the **uneven terrain**.

5. The bot must be stable and must stand on its own at the beginning of the run when put in the starting point. Bots not fulfilling this criterion will be disqualified. The bot should not split up into 2 or more parts during the run.

6. The external wired remote control used to control the bot is not included in this size constraint.

7. The onboard power supply on the bot must fit within this size constraint.

8. Manual bot cannot be constructed using readymade Lego kits or any readymade mechanism. But you can make use of readymade gear assemblies. Violating this clause will lead to the disqualification of the team.

9. The manual bot cannot deposit/collect any blocks/bot outside the central part, i.e. at any point of time, the top projection of the manual bot must be in the central zone.

• <u>Power Supply and Propulsion</u>

1. The bots have to use an on-board power supply. No external power supply will be allowed.

2. Each team shall bring its own power supply for all its bots.

3. The potential difference between any two points on any of the bots must not exceed **24 V DC**.

4. In case the bot is using a non-electric power supply, kindly get it approved from the organisers beforehand via email. Organisers are not responsible for inconvenience if approval is not sought.

5. The method of propulsion is at the discretion of the builder, provided that the power

source is non-polluting.

- ## Controls

1. Both the grid solving autonomous bot and the maze solving autonomous bot should not receive any input from outside the arena. They are however encouraged to communicate wirelessly with the other autonomous bot in the arena for cooperative benefits.
2. The manual bot should not receive any wireless input from outside the arena. It can be controlled using a wired remote control.
3. No wireless communication between autonomous bot and manual bot is allowed. The team is responsible for proving this to the organisers.

Rules

- **Game Rules**

   NOTE - The teams will have to submit their maze solving bot before the start of the competition. Only those teams which submit their maze solving bot will be allowed to participate.
   The maze solving bot will be handed back to the team during the time of their run. They'll be given 2 minutes to do any hardware changes if they wish. Under no circumstances will they be allowed to make changes in their code.

1. The maximum time given for completing the task is **6 minutes**. Only **one run** will be given to a team.
   Before the start of the run, a **dry run of 5 minutes** will be given to the maze solving bot. During this run the maze solving bot can explore the entire maze to find the position of the nodes and the bridges. The bot should give a visual/audio signal at the end of dry run.
   If the time for the dry run exceeds 5 minutes, then the extra time taken for dry run will be deducted from the allotted run time of 6 minutes. No advantage will be given if the dry run ends before 5 minutes. At the end of dry run the bot will be placed at the starting point.
   NOTE – No penalty will be awarded during a dry run if the bot crosses a node.
2. **Type B** block has to be deposited in the block deposit zone which is at the centre of the

maze. **Type A** blocks have to be deposited in the block deposit zones in the corners.

3. Starting Procedure –
   - The starting procedure of the bot should be simple and should not involve giving bot any manual force or impulse in any direction.
   - Teams can have a separate onboard switch for restart. This switch will have to be shown before the run to the organisers.

4. The manual bot should not deliver/collect the bot/blocks beyond the central part, i.e. at any point of time, the top projection of the manual bot must lie in the central zone.

5. If any part of the block is in contact with the autonomous bot, the autonomous bot is said to carry that block. During the run, every bot can carry only one block.

6. During the run if any block gets displaced from its original location and lies somewhere else in the grid or central zone, it will be picked up and put back to any other random grid point. If the block gets displaced in the maze then, it'll be placed anywhere on the **check line 1** as per the convenience of the participant.

7. The maze solving bot must strictly use the principle of line following.

8. Throughout the run, the manual bot should lie on the uneven terrain. This means that the point of contact of the manual bot with the arena must lie on the uneven terrain. It is however allowed to expand even beyond it in the central zone.

9. Checkpoint –
   - There will be two checkpoints during the run.
   - **First Checkpoint** - Once the bot touches the second block or crosses the check line 1 after depositing the first block, it will be counted as a first checkpoint.
   - **Second Checkpoint** - Once the bot touches the third block or crosses the check line 1 after depositing the second block, it will be counted as second checkpoint.

10. Restarts –
    - The teams are given 3 restarts each for every autonomous bot and the manual bot. However, there are no restrictions on the number of restarts for the dry run.
    - For every restart for the manual bot, the manual bot has to be put back on the uneven terrain. If the teams opt for a restart for the manual bot which carries the block, then the bot has to be put back on the ramp and the block will be placed back randomly on the grid. In a restart, the timer will not be set back to zero.
    - During a restart for a grid solving autonomous bot, the bot will have to be restarted by putting it back in the grid starting point. In a restart, the timer will not be set back to zero.

- During a restart for a maze solving autonomous bot, the bot will have to be restarted by putting it back in the maze starting point. In a restart, the timer will not be set back to zero.
- During restarts for autonomous bot(s), a contestant cannot feed information about the grid to the bot. However, contestants are allowed to: Adjust sensors (Gain, Position etc.), make repairs. However, a contestant may not alter a bot in a manner that alters its weight (e.g. removal of a bulky sensor array or switching to lighter batteries to get better speed). The organisers shall arbitrate.
- All restarts for autonomous bot(s) and the manual bot require the approval of the organisers before the bot(s) can be removed from the arena. If the bots were handled within the arena without approval, the run will be terminated.

11. A block is said to be deposited if any part of the block is in contact with the block deposit zone. Note that the bot should deposit all the three blocks in the three different zones.

12. If after the checkpoint, a team opts for a restart, the blocks that have been deposited before the checkpoint(s) won't be placed back on the check line 1.

13. General Rules –

- Team members will not be allowed to handle the blocks. Only organisers are allowed to handle the blocks in any situation. The team will be disqualified if the blocks were handled within the arena without approval of the presiding organisers.
- The bot is not allowed to leave anything behind while traversing the grid. It should not make any marks on the floor of the arena. Any bot found damaging the arena will be immediately disqualified.
- Only two members of the team are allowed to handle the bots.
- Participants are not allowed to keep anything inside the arena other than the manual bot and autonomous bots.
- Laptops/personal computers are not allowed near the arena. Other Wi-Fi, Bluetooth, etc. devices must be switched off. The organisers hold the right to check for these devices and their usage.
- The organisers may stop any bot at any time if they feel that it is performing, or is about to perform, any action that is dangerous or hazardous to people or equipment. No robot is allowed to use any flammable, combustible, explosive or potentially dangerous processes.
- The time measured by the organisers will be final and will be used for scoring the teams. Time measured by any contestant by any other means is not acceptable

for scoring.

- In case of any disputes/discrepancies, the organisers' decision will be final and binding. The organisers reserve the rights to change any or all of the above rules as they deem fit. Change in rules, if any will be highlighted on the website and notified to the registered teams.

- **Judging-**

  Scoring System

1. The task is considered to be completed when all the three blocks are deposited in the respective zones and the maze solving bot returns to its starting point or the time for the task reaches **6 minutes**.
2. Whenever a block crosses the check line 2 **for the 1st time** it will be awarded 10 points. If the teams use a manual bot to transport blocks from the grid to the maze and the transported block crosses check line 1, 15 extra points will be given for each block transported.
   Note – Teams which are not using a manual bot for transporting the block from the grid to maze, won't be awarded any extra points.
3. Teams will be awarded 50 points each for completing the first and the second checkpoint.
4. The teams will be awarded 50 points for depositing the third block and an extra 100 points for returning to its stating point after depositing the 3rd block.
5. The timer will stop as soon as the task is considered to be completed.
6. **Every time the bot crosses a node, it incurs a penalty of 25 points.**

   The team's score will be equal to:
   Score = (360 – T) + 50*C + 50*B + 100*F + W – P

   T= the total time taken to complete the task in seconds or T equals 360 if the team is unable to complete the entire task in 6 minutes.
   C=Number of checkpoints cleared
   B= 1 if the teams deposits the third block
      0 otherwise
   F= 1 if the maze solving autonomous bot returns back to its starting point after depositing the 3rd block

0 otherwise

P=Penalty

W= Points collected when the block crosses the check line 2 and the points collected on account of using the manual bot.

Certificate Policy
All teams which will have a score > 30 will be awarded a Certificate of Participation.

Team Specification
A team may consist of (a maximum of) 6 participants. Students from different educational institutes can form a team.

Eligibility
All students with a valid identity card of their respective educational institutes are eligible to participate in *"No Man's Land"* at above-mentioned iNexus Centres.