

**SPEARHEADING INDIA'S PARTICIPATION AT THE WORLD
SKILLS COMPETITION 2015, BRAZIL IN THE SKILL OF
MOBILE ROBOTICS**



Technical Description

REGIONAL SELECTIONS 2014
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National Skill Development Corporation,
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1. INTRODUCTION

1.1 Name and description of skill

1.1.1 The name of the skill is Mobile Robotics.

1.1.2 Description of skill

The theoretical and practical training of the Mobile Robotics technician is concerned with the mechanical and control systems of mobile robots.

Mobile Robotics technicians design, manufacture, assemble, set up, programming, manage and maintain mechanical, electrical and control systems within a mobile robot as well as install, operate and trouble shoot mobile robot control systems.

1.2 Scope of application

1.2.1 Every Expert and Competitor must know this Technical Description.

1.2.2 In the event of any conflict within the different regional centre the decision of jury takes precedence.

1.3 Associated documents

1.3.1 As this Technical Description contains only skill-specific information it must be used in association with the following:

Regional - Competition Rules

Regional - Competition Manual

Regional - Online resources as indicated in this document

Health and Safety regulations

1.4 Number of Competitors per team

Mobile Robotics is a team skill with 2 Competitors per team.

2. Competency and Scope of Work

The Competition is a demonstration and assessment of the competencies associated with this skill. The Test Project consists of practical work only.

2.1 Competency specification

Prototyping Knowledge and understanding:

Knowledge of designing, fabricating, assembly and commissioning of a Material Management System

Competitors shall be able to:

Analyse a mobile robot work application to identify the specific robot performance capabilities required to meet the needs of the work application.

Identify the specific information gathering hardware (camera, various sensors) required to support the robot performance.

Design a Material Management System including the structural frame work, mechanical, electrical and information gathering systems capable of meeting the needs of the work application.

Integrate their Material Management System onto the mobile robot's base unit in a manner that does not compromise the robot base's mobility capabilities.

Identify appropriate materials and processes for fabricating the structural and mechanical elements required for their Material Management System.

Identify appropriate hardware (motors, sensors) to support the performance requirements of their Material Management System.

Identify the Target Object Characteristics (surface texture, degree of fragility, overall shape, starting and ending locations, etc) that define the performance parameters their Material Management System must address.

Design the electronics control systems for their material management system.

Elaborate strategies to solved mobile robotics tasks including: navigation and orientation techniques using the provided actuators and sensors.

Design considering of safety issues [ie: Competitor's robot does not damage opponent's robot. Competitor does not hurt him/herself with their robot. (avoid the mechanism easily to hurt oneself)]

Fabricate the structural and mechanical elements required for their Material Management System.

Fabricate electronics control circuits to control their material management system.

Install, setup and make all necessary physical and software based adjustments, required for effective use all manufacturer provided equipment related to the mobile robot.

Install, setup and make all necessary adjustments to the mechanical, electrical and sensor systems of their Material Management System.

Knowledge and understanding:

Understanding of manufacturer provided control software

Competitors shall be able to:

Use the manufacturer provided control software to assert effective autonomous control over the robot's movement.

Use the manufacturer provided control software to assert effective autonomous control over manufacturer provided object management systems.

Use industrial standard programming software (like C++) to assert effective autonomous control over the robot's movement.

Implement programming methodologies to the control systems for the material management system.

Target object handling

Knowledge and understanding:

Knowledge of target object handling Competitors shall be able to:

Address the object handling needs identified in the Test Project documents.

Integration of any kind of actuator.

2.2 Theoretical knowledge

2.2.1 Theoretical knowledge is required but not tested explicitly.

The Competition Tasks will consist of practical work only.

Theoretical knowledge is limited to that necessary to carry out the practical work related to installation and operation of mobile robot mechanical and control systems. This may include the reading and interpreting of manufacturer's drawings, sketches or schematic diagrams.

Knowledge of rules and regulations related to the field of mobile robotics will not be examined.

2.2.2 Knowledge of rules and regulations is not examined.

2.3 Practical work

There will be two Competitors per team. Team composition may include a mechanical/electrical systems specialist and a control systems specialist or involve Competitors with Expertise in both areas.

3. THE TEST PROJECT

3.1 Description of the Game.

- 3.1.1 The level 1 of the competition tests the programming skills related various sensors.
 - 3.1.2 The game field is shown in Fig. 1.
 - 3.1.3 The start point is highlighted with Flag and annotated at start.
 - 3.1.4 The robot has to follow the path of 1 to 21.
 - 3.1.5 The path from 22 to 23A, 23B, and 23C shall be decided by the dice value that is allotted to the team before the start of game and preparation time.
 - 3.1.6 Switch over from path 17 to 19 is vide a obstacle object1. The robot shall not touch the object 1.
- 3.2 If the dice value is 1 & 3 then, the robot shall take a left turn after detecting one horizontal line. The robot shall stop at the centre of Finish 23 A.
- 3.3 If the dice value is 2&4 then, the robot shall take a left turn after detecting two horizontal lines. The robot shall stop at the centre of Finish 23 B.
- 3.4 If the dice value is 5&6 then, the robot shall take a right turn after detecting three horizontal lines. The robot shall stop at the centre of Finish 23 C.

Test Project for Regional Selections – Mobile Robotics

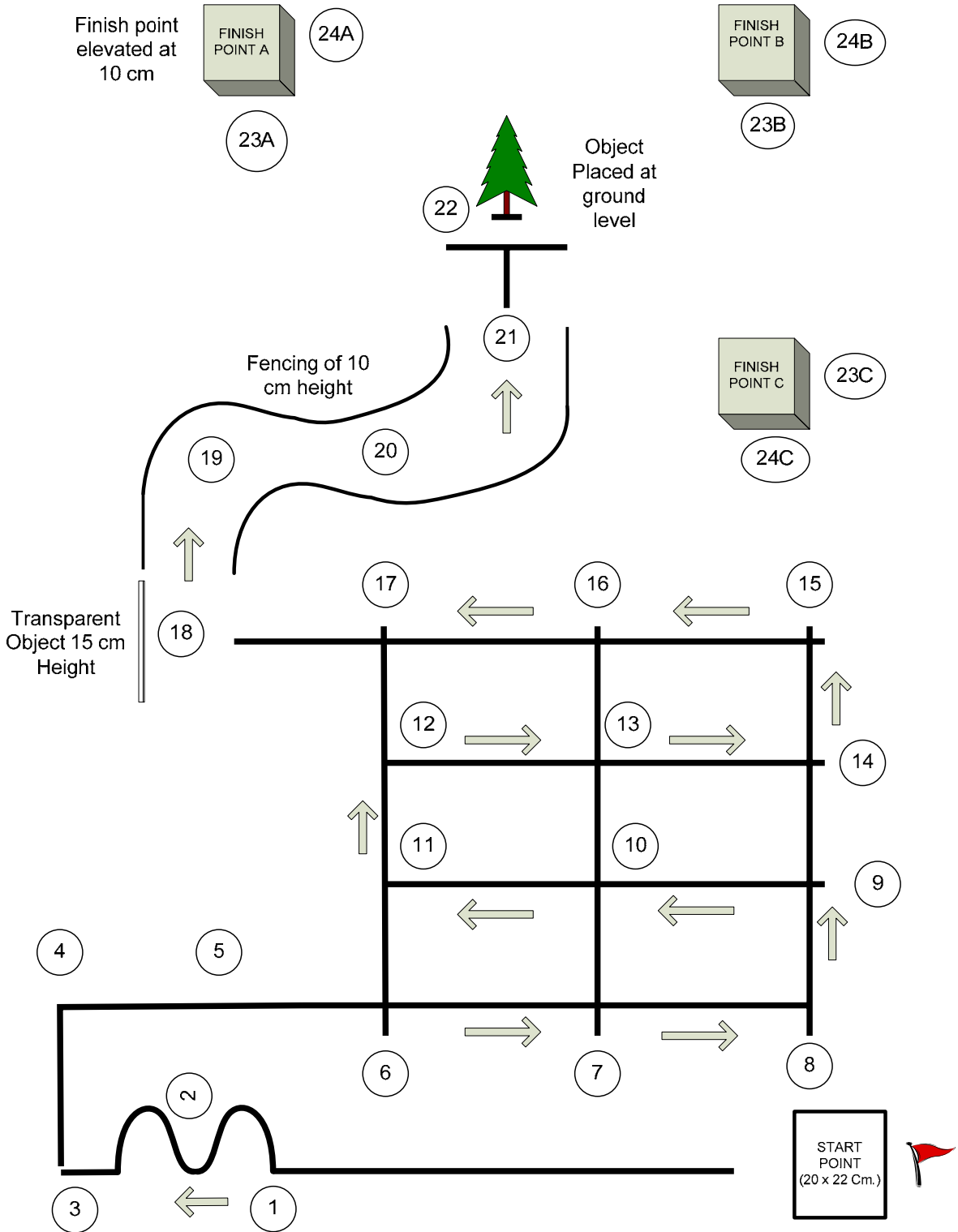


Fig. 1 – Lay out of the Test Project

3.5 Scoring Points

The scoring method is as follows (Refer Fig. 1)

- 3.5.1 The scoring points are shown along the path of the track S1 to the end S24A, S24B and S24C.
- 3.5.2 Crossing each scoring location from S1 to S17 shall fetch you 10 points each. Crossing each scoring location from S18 to S22 shall fetch you 30 points each.
- 3.5.3 Reaching Location S23A, S23B and S23C shall fetch you 20 additional points.
- 3.5.4 Reaching location S24 A, 24B, 24C shall fetch you a maximum of 50 if the object is placed correctly deduction of points in terms of % for protruding outside the platform.

3.6 Violation's

- 3.6.1 For each restart of the robot 20 points shall be deducted.
- 3.6.2 For not following the specified path 10 points shall be deducted.
- 3.6.3 Restart can be taken from any scoring point before the location the robot has reached.
- 3.6.4 10 points shall be deducted for robots touching the object 1 or object 2 (Fence).
- 3.6.5 The above task shall be programmed and completed and demonstrated within 8 hours. (4 hours – point 1 to 18, 4 hours for point 19 to 24A, 24B or 24 C)

3.7 Deciding the winners.

- 3.7.1 The teams shall be ranked on the highest score and minimum time required to complete the task.
- 3.7.2 In case of tie, the winner shall be decided by following sequence of criteria
 - 3.7.2.1 The team with minimum time to complete the complete task.
 - 3.7.2.2 The team which has covered maximum distance.
 - 3.7.2.3 The team with minimum number scoring violation.

3.8 Test Project change at the Competition

Final Test Project details (Robot Court Layout and surface / Target Object Selection) will be set by the Mobile Robotics Experts during their pre-competition meetings and is subjected to 15 to 20 % changes.

3.7 Material or manufacturer specifications

Sponsorship, specifications, supply and support for the selected hardware and software will be coordinated by the host Member Workshop Supervisor and the Chief Expert. Details are finalised at latest 7 days prior to the Competition.

4. Tools and Resources

- 4.1 The tools and resources required for the competition shall be provided by the host institute.

- 4.2 Level 1 competition shall be conducted with robots – Fire Bird V 2560, with Gripper and the gripper shall be designed and fabricated by the candidates.
- 4.3 One Desktop shall be provided by the host institute. However participants are allowed to bring one laptop.
- 4.4 The competitors shall bring their own robots which shall be reset at the start of the competition. The competitors shall write their own function blocks.

5. Safety and Changes

- 5.1 Teams are required to pay sufficient attention to the safety of the robots. The participating teams are responsible for the safety of the robots while programming.
- 5.2 Teams that will not satisfy above conditions or teams that are considered dangerous by the Contest Committee will not be able to participate in the contest.
- 5.3 The legitimacy of any actions not provided in this rule book will be subject to discretion of the referees.
- 5.4 Rules are subjected to modification to align more closely with the World Skill India Competitions.