



MINESWEEPERS

TOWARDS A LANDMINE-FREE WORLD

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Minesweepers History

Minesweepers: Towards a Landmine-free World as the first international outdoor robotic competition on humanitarian demining [<http://www.landminefree.org/>].



The banner features a Lockheed Martin Insitu Quadcopter drone flying over a desert landscape with several landmines scattered on the ground. The text reads: "Landmines Detected! Be a part of the solution". It includes the event details: "Register NOW!", "August 19 - 21, 2015", and "Antofagasta, Chile". The Minesweepers logo is in the top left corner.



Minesweepers 2014 – Portugal



Minesweepers 2013 - Egypt



A graphic featuring a map of Egypt with the Egyptian flag colors. A tracked robot is shown on the right. Text boxes provide event details: "Classification Round Sept 16 - 17, 2012", "Final Round Sept 18, 2012", and "Registration Due Date 15 Feb. to 31 Mar. 2012".

Minesweepers 2012 - Egypt

Minesweepers 2016

ORGANIZERS    TECHNICAL SPONSOR 

LANDMINES DETECTED !

27-30 OCTOBER 2016
ZEWAIL CITY FOR SCIENCE AND TECHNOLOGY, EGYPT

LANDMINEFREE.ORG

مدينة زويل
ZEWAIL CITY
ESTABLISHED 2000
INAUGURATED 2011



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Organizers

- International Organizers



- Latin America Organizers



- Technical Sponsors



- Community Partners



LA FONDATION DES MINES TERRESTRES DU CANADA



- Media Partner



RST 2016

International Workshop on Recent Advances in Robotics and Sensor Technology for Humanitarian Demining and Counter-IEDs.



www.rstech.org



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Objectives

- ◇ Putting into practice the new strategic mission of IEEE, “...**to foster technological innovation and excellence for the benefit of humanity**”.
- ◇ **Raising the public awareness** of the seriousness of the landmines and UXOs contamination and the role of science and technology in solving this problem.
- ◇ **Motivating** professors, engineers and students working on **innovative solutions** for this serious problem.
- ◇ Serving as an **educational and a research forum**.
- ◇ Motivating the participants to create **new companies** and industries geared towards **minefield reconnaissance and mapping technologies**.
- ◇ The applicability of the robotic systems presented in this competition can be **extended to a wide range of other applications** such as security and surveillance, search and rescue, health monitoring of civil infrastructure, pipeline monitoring, and environment monitoring.



Local Rounds

Egypt

With the international finals, Oct 27-30



Latin America

July 13-15, Antofagasta, Chile



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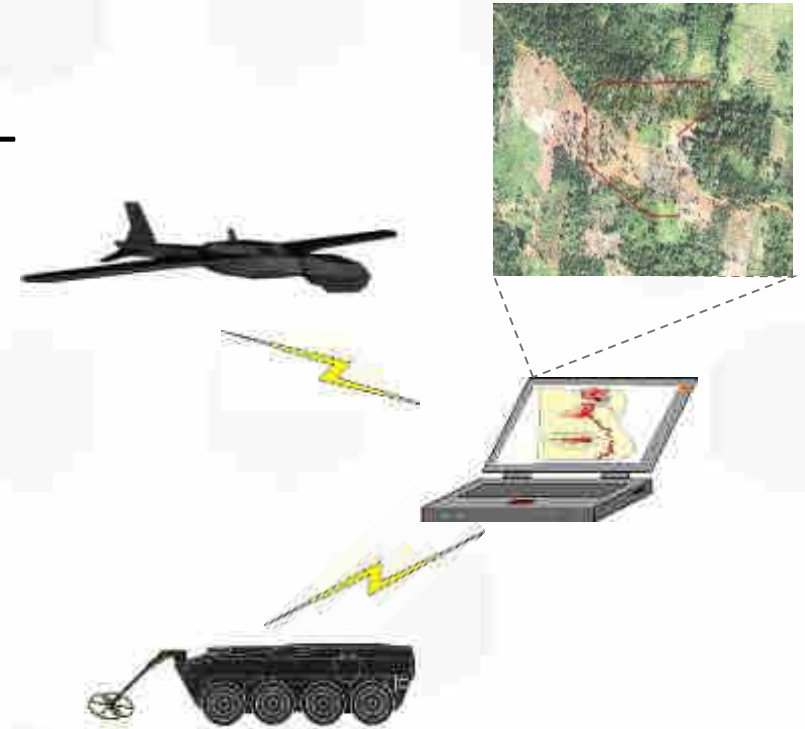
Competition Timeline

Competition Registration	15 March to 15 May 2016
Video Submission Phase	1 Aug 2016
Notification of Acceptance	15 Aug 2016
International Competition	27-30 Oct. 2016



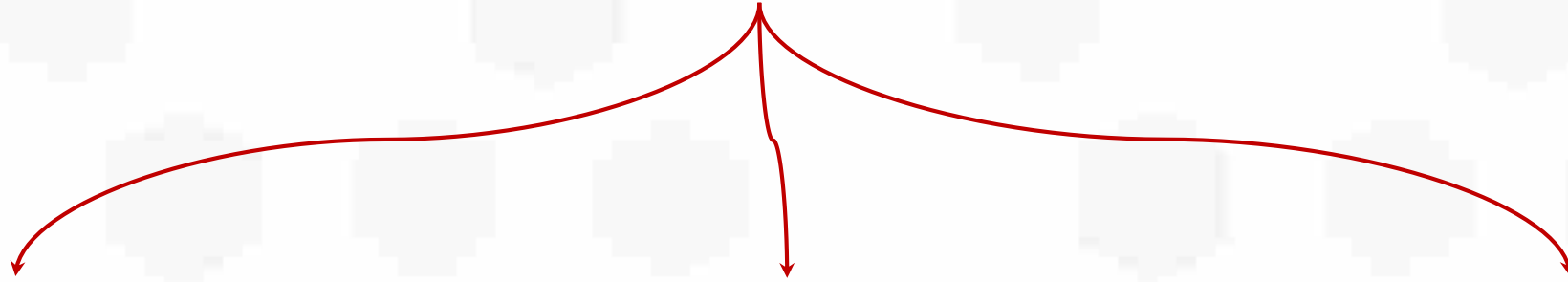
Mission

- ◇ Each participating team constructs a **teleported/autonomous unmanned ground/aerial vehicle** that must be able to search for underground and aboveground anti-personnel landmines and UXOs.
- ◇ The position and the type of each detected object are visualized and overlaid on the **minefield map**.
- ◇ The robot must be able to navigate through **rough terrain** that mimics a real minefield.



Categories

Minesweepers



Minesweepers-Juniors

Target: elementary and high school students

Objects: only metallic objects

Mission: landmine detection

Minesweepers-Academia

Target: undergraduate and postgraduate students

Objects: only metallic objects

Mission: landmine detection and mapping

Minesweepers-Industry

Target: professional companies

Objects: metallic and non-metallic objects

Mission: landmine detection, imaging and minefield mapping



Special Categories

Minesweepers

Multiple Minesweepers

A robot team of at least one deminer and one supervisor is used to mimic the conventional mag-and-flag approach or standard operating procedures commonly used in humanitarian demining. Deminers have to be teleoperated unmanned vehicles and supervisor or team leader has to be autonomous vehicle.

ROS Minesweepers



The software systems of the robots participating in this category have to be built using Robot Operating System (ROS).

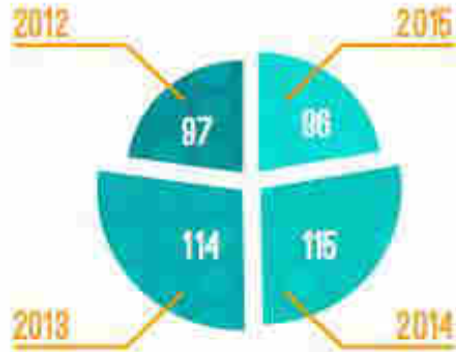


Competition Rounds

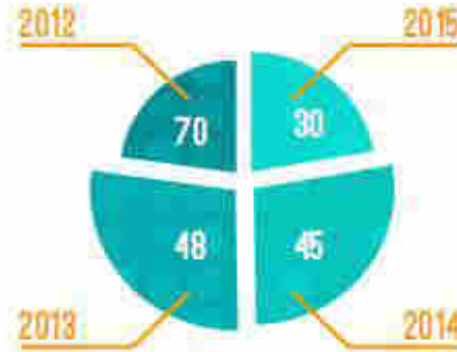
Minesweepers		
Eligibility Round A technical report 3-minutes video showing the design and the operation of the robot.	Classification Round Local rounds take place in different countries. The 9 best teams (3 in each category) are classified for the final round in the international venue.	Final Round 15 min technical presentation Robot performance in the field.



Minesweepers Statistics



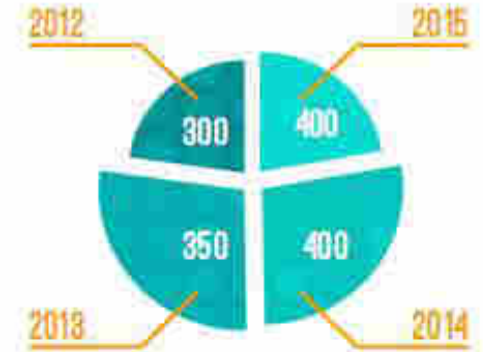
REGISTERED TEAMS



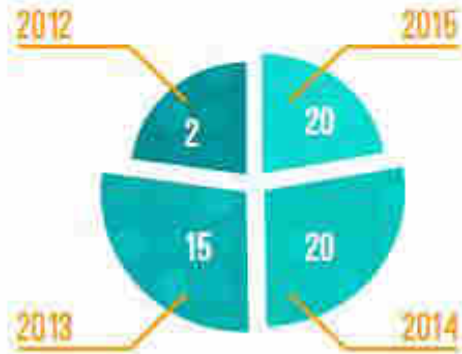
QUALIFIED TEAMS



FINAL TEAMS



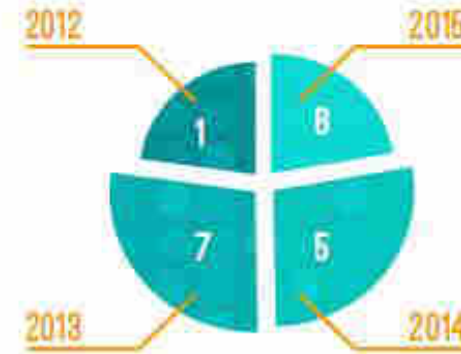
NUMBER OF PARTICIPANTS



JUNIOR TEAMS



ACADEMIA TEAMS



NUMBER OF COUNTRIES



Arena

The competition arena is an open desert/wood area with dimensions 20x20 meters.



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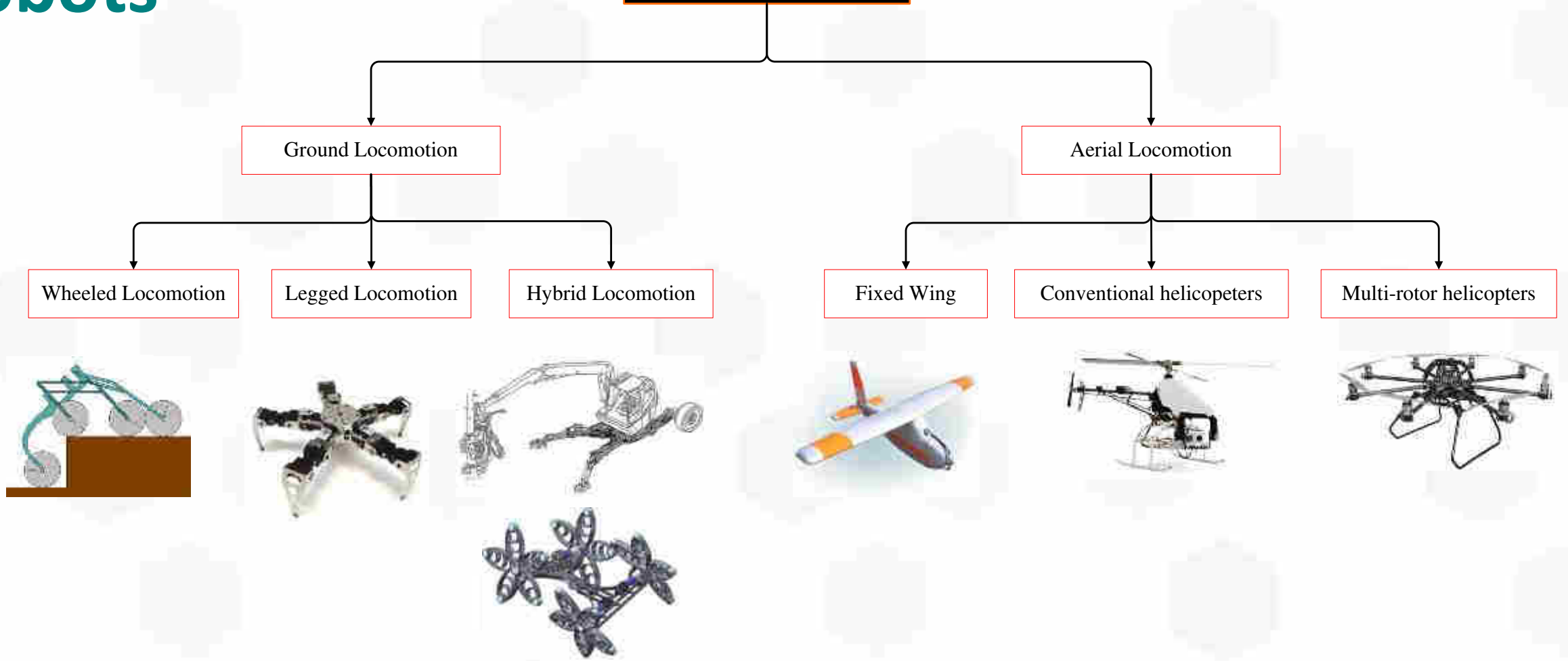
Robots

- ◇ Each team must use a tele-operated or an autonomous robot per game.
- ◇ Autonomous robot will be rewarded a 40% bonus over tele-operated robots.
- ◇ Both unmanned ground vehicles (UGVs) and unmanned aerial vehicles (UAVs) are allowed.



Robots

Vehicle Locomotion Systems



Robot can be actuated using electric, pneumatic or hydraulic actuation system, Diesel/Petrol engine or using solar energy



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Mines

- **Buried Mines**

- ◇ made from a metallic cube.
- ◇ dimensions of 10 x 10 x 10 (L x W x D).
- ◇ mines are buried underground with maximum depth 10 cm.



Buried and Surface Mine
10x10x10 (LxWxD)

- **Surface Mines**

- ◇ made from a metallic cube.
- ◇ dimensions of 10 x 10 x 10 (L x W x D).
- ◇ labeled in black color.
- ◇ These mines are visible and are located on the surface of the competition area.



Mines in Industry Category

These mines are metallic and minimum metal objects of different dimensions and shapes.



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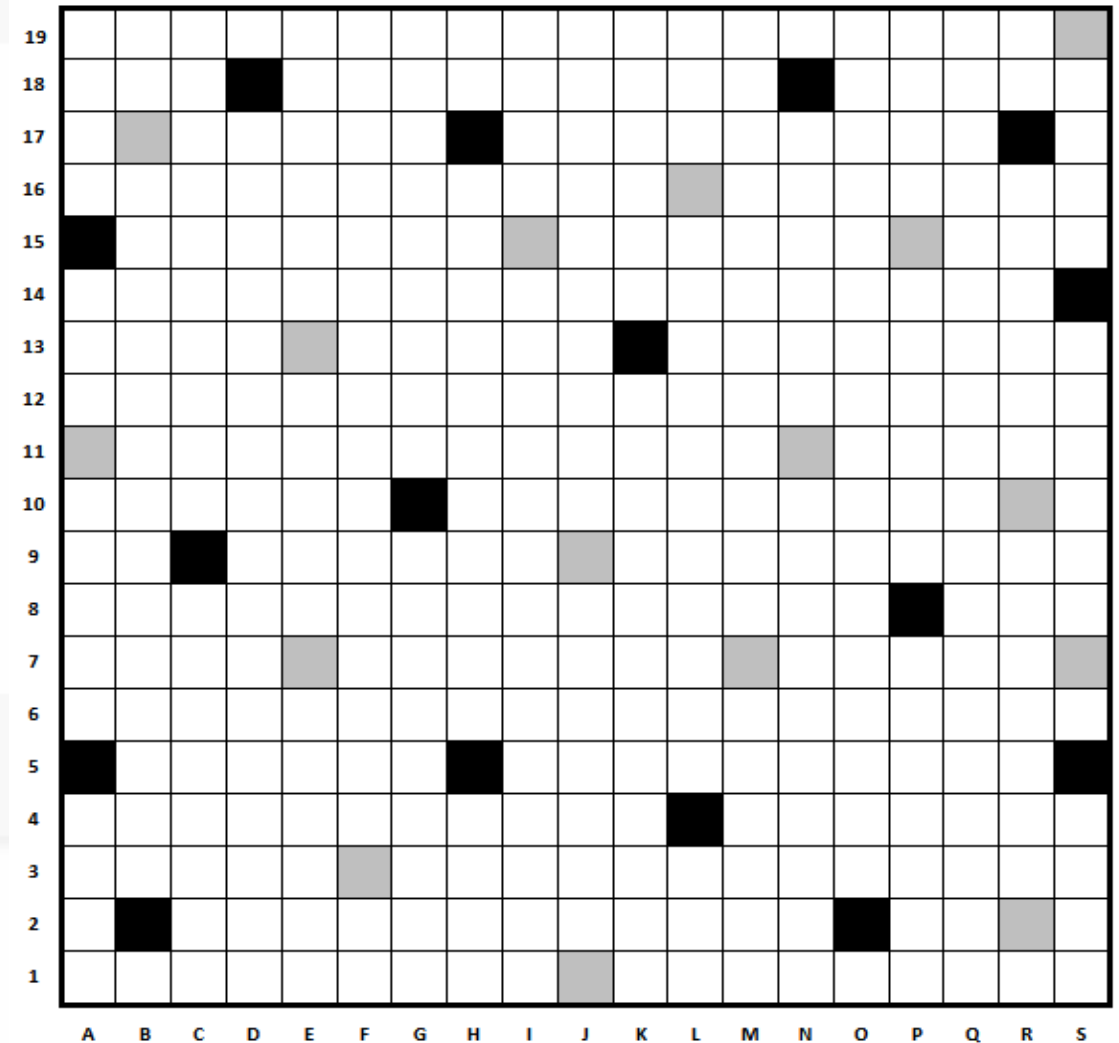
Mine Detection

- ◇ When a robot detects a mine, it has to report this event using a light **blinking signal** and a **warning siren** for at least **2 seconds**.
- ◇ Teams have to correctly position the alarm device on their robot.



Mine Map

- ◇ Each deminer robot has to provide map of the detected mines when its competition time slot finishes.
- ◇ This map can be simply a text file or text shown on the display of the robot. The sequence of the positions has to be the same as the detected mines.
- ◇ This mine map can be represented graphically or using vector format.



Graphical Representation of the Mine Map [Black: buried mine, Gray: Surface Mine]



Scoring Sheets

Action	Count	Score/Unit	Subtotal
Arena Score: The following score will be based on the performance of the robot in the competition arena and will be observed and calculated by the In-field judge.			
Detected Surface Mines		5	
Detected Underground Mines		10	
Completely Scan the field and 80% of Mines Detected (Systematic Motion)	Yes	30	
	No	0	
Wrong Detection of a Mine		-5	
Passover Buried Mine without Detection		-10	
Touching Surface Mine		-5	
No light signal and/or a siren	Yes	-3	
	No	0	
Reset Time (-2/1min)		-2	
Mine Map Score: A mine map (in vector or graphical format) must be created automatically by the robot system and presented to the out-field jury committee by the team representative to calculate the following scores:			
Mine Map True Positive for Surface Mines (a minefield cell contaminated by surface mine is labeled in the map as a cell with surface mine)		5	
Mine Map True Positive for Buried Mines (a minefield cell contaminated by buried mine is labeled in the map as a cell with buried mine)		10	
Mine Map False Negative for Surface or Buried Mines (a minefield cell contaminated by surface or buried mine is labeled in the map as a clean cell)		-5	
Mine Map False Positive for Surface or Buried Mines (a clean cell in the minefield is labeled as contaminated by surface or buried mine in the mine map)		-5	
Total Score:			
Autonomous Robot	<input checked="" type="checkbox"/> YES (Multiply by 1.4)		<input type="checkbox"/> NO
Final Score:			

Academia Category Sheet

Action	Count	Score/Unit	Subtotal
Arena Score: The following score will be based on the performance of the robot in the competition arena and will be observed and calculated by the in-field judge.			
Detected Surface Mines		5	
Detected Underground Mines		10	
Completely Scan the field and 80% of Mines Detected (Systematic Motion)	Yes	30	
	No	0	
Wrong Detection of a Mine		-5	
Passover Buried Mine without Detection		-10	
Touching Surface Mine		-5	
No light signal and/or a siren	Yes	-3	
	No	0	
Reset Time (-2/1min)		-2	
Total Score:			
Autonomous Robot	<input checked="" type="checkbox"/> YES (Multiply by 1.4)		<input type="checkbox"/> NO
Final Score:			

Junior Category Sheet



Technical Support

- Unmanned Ground Vehicles, April 22, 2016 at 8:00PM (Cairo Time)
- Unmanned Aerial Vehicles, May 8, 2016 at 8:00PM (Cairo Time)
- Robot Operating System (ROS), May 13, 2016 at 8:00PM (Cairo Time)
- Landmine Detection, May 20, 2016 at 8:00PM (Cairo Time)
- Wireless Communication for Tele-operated/Autonomous Vehicles, May 27, 2016 at 8:00PM (Cairo Time)
- Multi-robot Systems, June 5, 2016 at 8:00PM (Cairo Time)



Webinars



Website

- ◇ Resources
- ◇ Frequently Asked Questions



Social media



Previous Minesweepers



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Registration & Contact

- **For international teams, You can register now online through the website before 15 May 2016**

<http://www.landminefree.org/home/index.php/registration/international-registration>

- **For Latin America teams, register before 29 April 2016**

<http://minesweepers.ucn.cl/>

- **Contact**

world@landminefree.org



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Reference

Most of the slides are based on material from Dr. Alaa Khamis, “Humanitarian Demining: Facts, Technology Enablers and Initiatives”, IEEE Region 9

SAC Talk, available at:

http://ras-egypt.org/reading/Humanitarian_demining_IEEE_R9.pdf, Last

Accessed: April 2, 2016.



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Thank you 