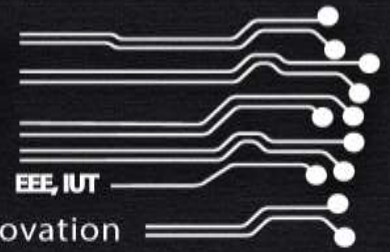


ESONANCE
2015

resonance of engineering innovation

EEE, IUT



Unmanned Rescue Mission (URM)

COMPETITION GUIDELINES

Organized By:

Department of Electrical and Electronic Engineering (EEE)
Islamic University of Technology

Technical Support:

IEEE IUT Student Branch



IEEE

IUT Student Branch

Unmanned Rescue Mission (URM) at a glance

Unmanned Rescue Mission (URM) is the biggest event of 'ESONANCE 2015' featuring a robotic competition on "Rescue Operation during natural Disaster". Here, participants have to solve a scaled down version of a problem arena depicting disaster situation with exclusive obstacles and difficulties.

Delivering aid, including food, clean water, fuel and medical supplies to places during natural disaster such as Earthquake, becomes a difficult task.

Transporting bulk materials over uneven and rough terrain, in tight spaces, and over long distances is often required to help those in need.

While several frequent tremors were already felt in different regions of Bangladesh, the country is far from being completely safe from massive Earthquake threats.

Keeping these situations in mind and its possible after effects, this year's challenge is to design and develop a scaled-down version of a transporter capable of delivering aid/materials, which will be guided by, at most, one person.

The contestants need to design **two** robots in this competition: an **autonomous line follower** and a **transporter**. Each robot will be assigned to perform separate task in separate arena (line follower arena and Transporter arena).

1. **Autonomous line follower:** A small **autonomous robot** has to follow a line in line follower arena under various conditions (e.g. round corners, sharp corners, crossovers, line obstacles etc.). This line follower robot will be used to unlock different aids/supports to resolve exclusive obstacles (e.g. bridge, road block, short cut etc.) for smooth travel of the **transporter** in transporter arena.
2. **Transporter:** A manually controlled, robot which will be capable of transporting objects of different shapes and sizes to the final unloading zone in the transporter arena.

The manual bot should be wirelessly controlled.

As for example, in line follower arena, the autonomous line follower robot crosses some obstacles by following a line and finishes predefined checkpoints (tasks). The successful completion of those tasks will allow the team to establish a bridge in transporter arena for the manually controlled robot (transporter) to cross a zone filled with water.

Any team failing to perform the tasks to trigger the bridge by the autonomous robot will not be able to perform the other task that will involve the manual robot.

There are 3 stages, each of an increasing level of complexity.

- **Qualifying Stage**
 - **Knock out Stage**
 - **Final Stage**
- Top 10 teams in qualifying stage will be eligible for Knock out stage.*
 - Top 5 teams in Knock out stage will be eligible for Final stage.*
 - Top 3 teams will be selected as Champion, 1st runners up, 2nd runners up.
- The competition is open to all the students of school, college and undergraduate students of all universities.
 - The participant team must register on the website of the competition.

**No. of eligible team in this stage will be decided on the competition day based on the number of participant team.*

Autonomous Robot Specification (Line Follower)

Design Rules: Robot must be a ground wheeled autonomous vehicle.

- **Length:** Maximum length is 30 cm.
- **Width:** Maximum width is 20 cm.
- **Height:** Not to exceed 20 cm.
- **Weight:** 5 kg maximum.
- **Power:** Maximum 24 volts on-board power supply.
Each team has to bring its own power supply for robot. No additional equipment/parts will be supplied in the competition.
- The robot may be:
 - Built from scratch by the participants (recommended).
 - Built from readymade chassis (but no construction set such as LEGO or Meccano or any other Brand is allowed). Teams who use readymade chassis will get 50% of total point.

Manual Robot Specification (Transporter)

Design Rules: The robot must be ground wheeled vehicle, which is manually controlled

- **Length:** Maximum length is 35 cm
- **Width:** Maximum width is 30 cm
- **Weight:** 10kg maximum
- **Power:** Maximum 24V on board power supply.
Each team has to bring its own power supply for robot. No additional equipment/parts will be supplied in the competition.
- The robot may be:
 - Built from scratch by the participants (recommended).
 - Built from readymade chassis (but no construction set such as LEGO or Meccano or any other Brand is allowed). Teams who use readymade chassis will get 50% of total point.
- The robot must be manually and wirelessly controlled by one team member. The team may use any readymade wireless module. Readymade grabbers are not allowed.

Arena Specification for Autonomous Task

- Competition arena will be made of a flat wood platform, with a maximum size approximately 850cm x 300cm.
- The arena consists of a black semi-gloss painted road (track) of 30 cm wide, with a centered white line of 2.5 ± 0.2 cm wide.
- The starting and finishing Zone will be defined separately by 30 cm x 30 cm white colored square area in the arena.
- There will be check marks at different position of the track.
- There will be a Gap on the track for 15 ± 5 cm, and may be placed in a curve or straight portion of the track.
- There will be "T", "Y" and "+" shape intersections.
- The track will have arcs with different curvatures. Minimal curve diameter will be 10 cm.
- Sharp angles may occur, but will not be less than 30° .
- Different obstacles with the discontinuity of the line (maximum dimension of the obstacle is approximately 20 cm x 10 cm x 5 cm; L x W x H) will be placed on the track. The robot has to drive around these obstacles to reach the continuation of the line.
- The number of obstacles will be no more than 4.
- The track will contain shortcuts that might or might not contain obstacles of the above mentioned dimensions.
- Bridge/hill will be placed on the track. The length will be at least 40cm. Height will be at most 15cm above the ground and the inclined angle will be maximum 30° . The black line will be continue on the hill/bridge.
- Position of check points, gaps, obstacles and hill/bridge may be anywhere on the track.
- Lighting levels are unpredictable, so the robot must be able to operate over a wide range of lighting conditions.
- There will be a final checkpoint on crossing which the bridge for the 2nd task will be established automatically.
- Keeping the basic specifications of arena fixed, there will be modifications in arena for 3 stages with increasing difficulties.

Note that the example arena for the Autonomous Task will be published soon.

Arena Specification for Manual Task

- The competition arena for the 2nd task is made out of flat wood platform, with a maximum size of approximately 850cm X 50cm.
- There are two ramps on either side of the arena of angle 30 ± 5 degree.
- The starting and the unloading zones will be marked by 50cm X 50cm mark as "Starting" and "Unloading Zones".
- The arena will be divided in different zones. Each zone has fixed width of 50cm but varied length. Each zone has 1.5 ± 0.2 cm height variation with respect to its adjacent zones.
- The arena will have a zone defined by 60cm X 50cm filled with water, over which a bridge of 35cm wide will be established after the autonomous robot completes its task.
- The arena will have a zone defined by 90cm X 50cm which will consist of small stones and gravels, however the height of this zone will not be uniform. Height will be varied in between 8cm to 10cm. The manual robot needs to cross this zone without the aid of any bridges.
- The manual robot needs to pick up objects of dimension 4cm x 4cm x 4cm, weight 100 ± 50 gm. which might be placed at any position along the track.
- Maximum number of objects may be 4.
- Objects will be placed anywhere in the arena. The manual robot should pick up the objects simultaneously and unload them simultaneously at the unloading zone.
- Object unloaded outside the vicinity of the unloading zone will not be counted.

The following is the **example** track for the manual task. The **checkpoints**, the **loading** and the **unloading** zone will be revealed at the day of the competition.

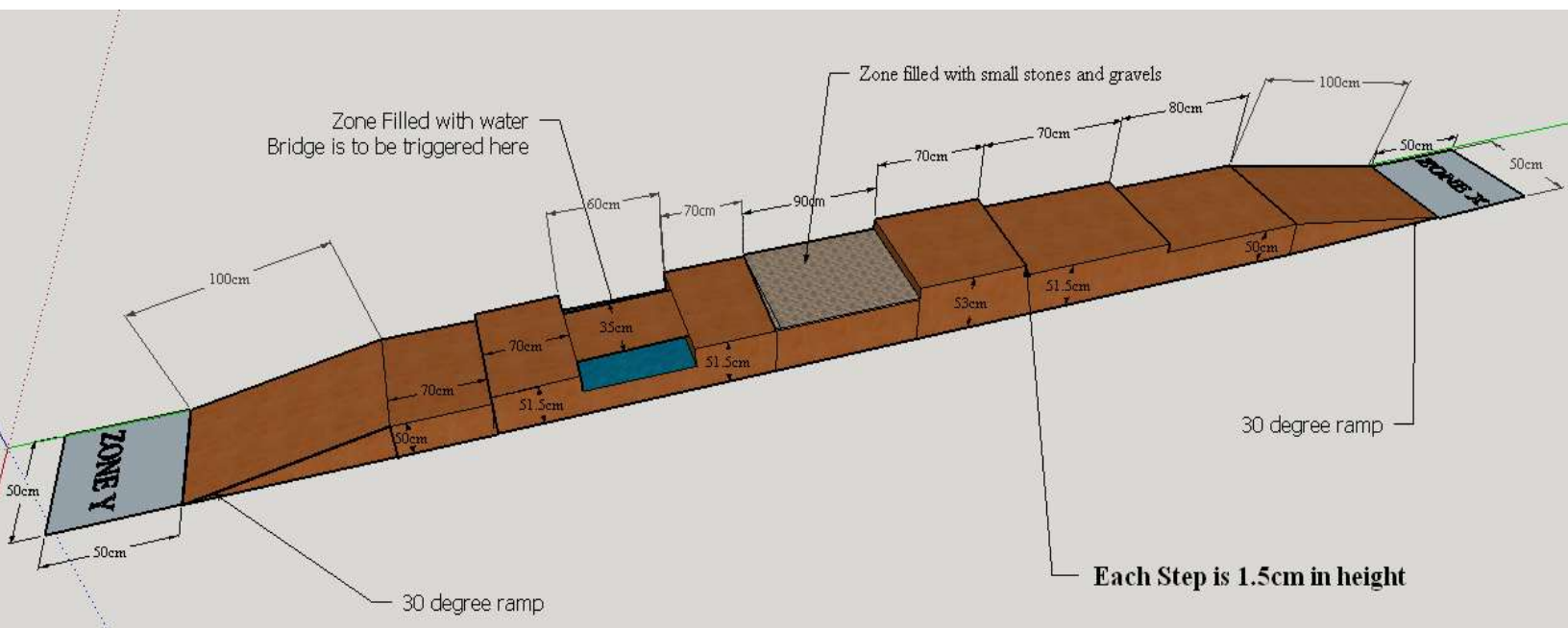


FIG: 3 dimensional view of the track

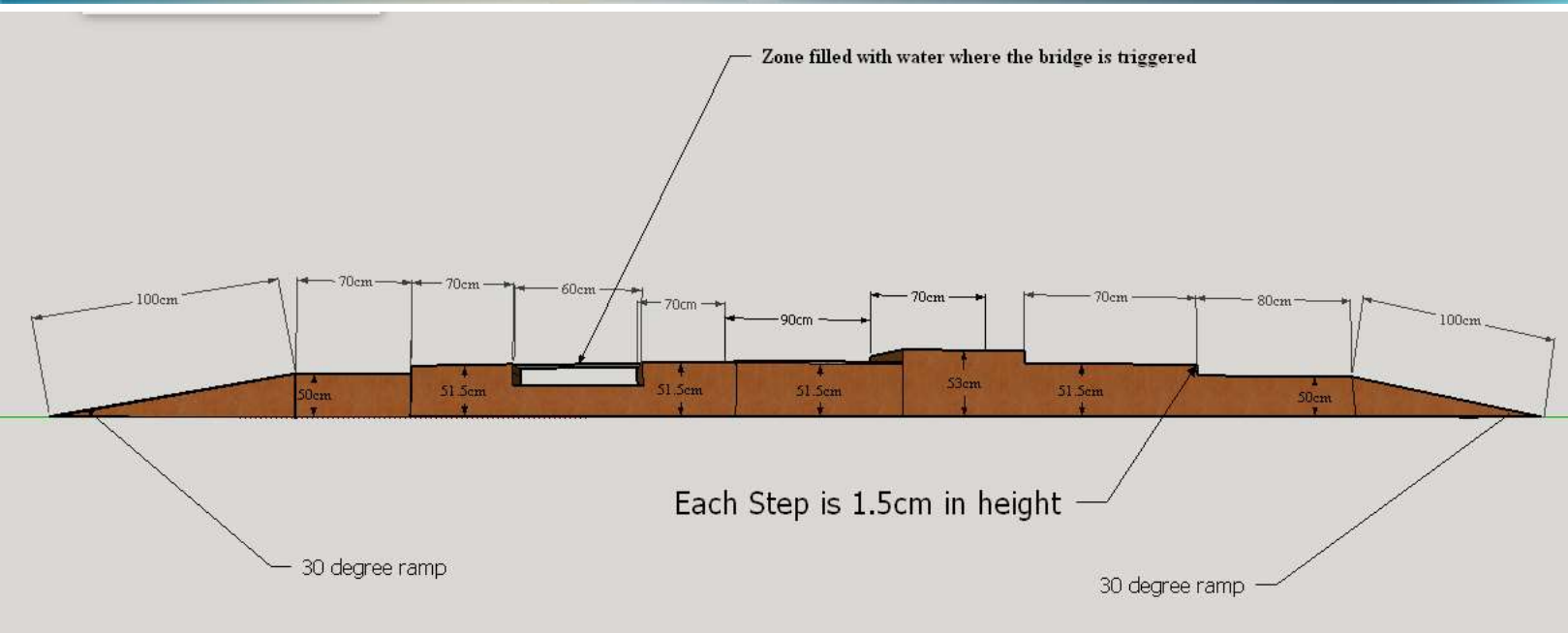


FIG: Side View of the Track

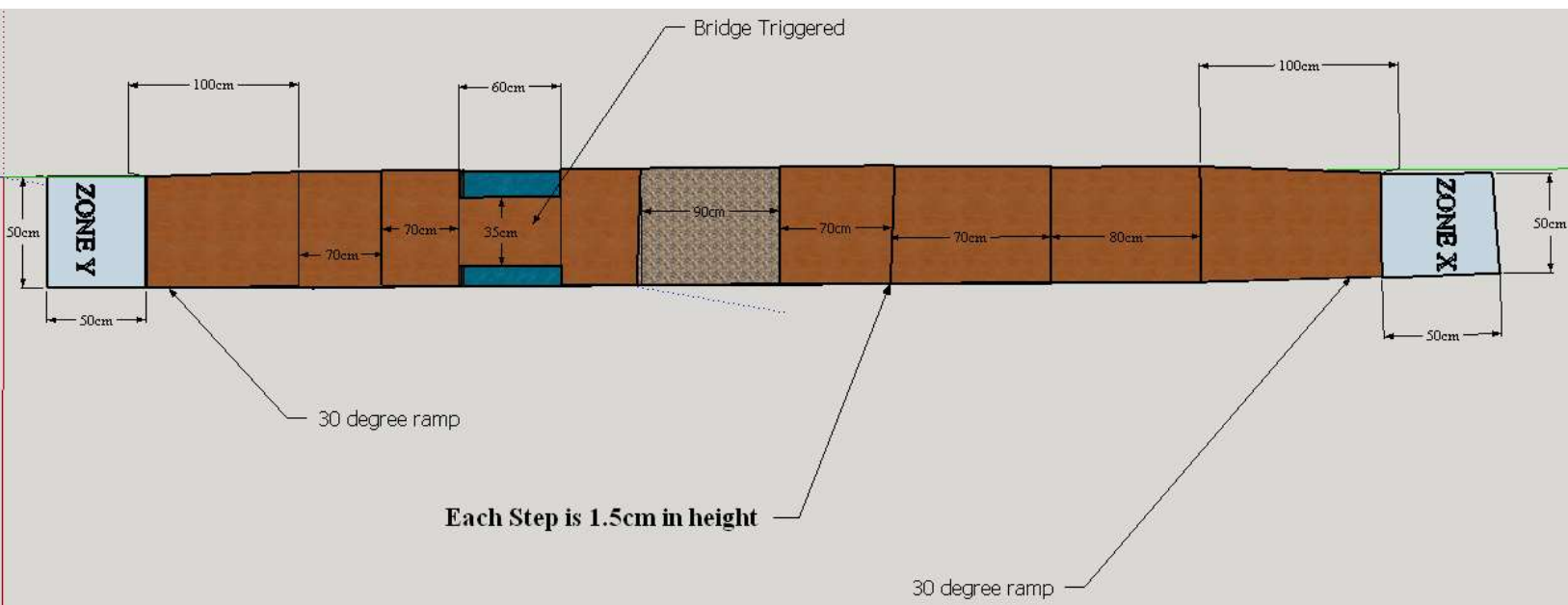


FIG: Top View of the Track

Ratifications of Robots

- Each participating robot has to be submitted to the tests of ratification.
- The tests of ratification consist in verifying that the dimensions of the robot correspond to the technical specifications and the other specifications mentioned in "Robot Specification".
- Any of the robots not satisfying the tests of ratification will be excluded from the competition.
- The ratification will be realized on the day of the competition.
- Team leader should present the robot to the homologation desk.

Competition Rules

- Team must place both robots in their respective position and make ready for run within 3 minutes after calling them to come to the arena. Otherwise team will be disqualified.
- The autonomous robot will be placed at a pre-assigned starting point and may be started by hand when directed by the judge.
- The manual robot will be placed at the pre-assigned starting point and will only be allowed to start once the autonomous robot crosses the final checkpoint.
- The Autonomous Robot must follow a line from the beginning to the end as fast as it can and reach the final checkpoint.
- The manual robot should make a onetime run and proceed to the unloading zone. It picks up each object on the way and unloads them at the unloading zone.
- Time is measured from crossing the start line by the autonomous line follower until the manual transporter robot unloads the last object. A robot is considered to have crossed the line when the forward most part of the robot contacts or crosses over the line.
- Time will be measured by an electronic gate system or by a judge with a stopwatch, based on the availability of equipment. In either case the recorded time will be final.
- The autonomous robot must follow the line fully autonomous without any human intervention.
- No wireless communication or external data feed to the autonomous robot is allowed. This will consider as disqualification from the competition.
- The autonomous robot may use shortcut tactics to complete the course faster by following the line. But the robot must go through every checkpoints including the final checkpoint. Otherwise, the robot will be disqualified. No shortcut tactics for the manual task is available.
- The autonomous robot is placed by at the start and should attend the end point. Any other case, the robot is disqualified.
- For the manual task, the robot should reach the unloading zone. Otherwise the robot will be disqualified.
- The objects must be unloaded in the specific area defined as the unloading zone. Objects unloaded outside the unloading zone will not be considered.

- The start and the unloading zone can be on either side of the arena, and would be revealed on the day of the competition.
- In competition, only 5 attempts or restarts of the autonomous robot are authorized.
- If the autonomous robot loses the line, it must restart from the last checkpoint. In this case, the timer will remain running during restart and a penalty will be pointed.
- In competition, only 3 attempts or restarts of the manual robot are allowed. In this case, the timer will remain running and a penalty will be pointed.
- After crossing the bridge, no restart is allowed for manual robot.
- If any of the robots steps off the arena it will be disqualified.
- The judges can ask for an explanation of any mechanism on the robot and there would be an immediate disqualification of defaulters of any kind.

General Rules

- Each team can have a maximum of 4 participants. Team members may be from same or different institutions. The team members must submit the copy of their institutional ID card attested by the respective departmental Head/Chairman.
- Each team will be recognized by its registered team name and registered team leader.
- The winning team is declared based on point rating and not on its racing time score.
- Judges decision will be final. So no objections shall be declared against the judges' decisions
- 1 team member can be within the arena for restart the robot or getting the robot in line.
- 1 team member can be within the arena for controlling the manual robot
- The team leader can present objections to the Committee, before the match is over, if there is any doubts.
- During the competitions, only the team leader is authorized to present the robot and to contact committee members for any claim or specific need.
- The following comportments could lead a team to be disqualified:
 - Evidence of non-respect to other teams and competitors.
 - Evidence of non-respect to security rules.
 - Evidence of non-respect to competition judges.
- Competition judges are not part of the competition committee; they are assisted by the competition Committee members, but remain completely independent for their decisions.
- A team should agree all the above rules and present a written agreement to the homologation desk.
- The competition Committee reserve the right to change the rules as they deem fit.
- Competition rules may change anytime which will be pre-notified through internet and will applicable to all teams.

Evaluation for the Autonomous Task

Competition Abilities	Points
Run Time = T minute (maximum finishing time is 10 min.)	$+(10-T) \times 100$
Passing each Check point	+300
Arriving to the finishing point	+500
Passing each intersection	+100
Passing each gap	+100
Avoiding each obstacle	+200
Passing Hill/Bridge	+100
Lose the line	-300
Each restart	-200

Evaluation for the Manual Task

Competition Abilities	Points
Run Time = T minute (maximum finishing time is 15 min.)	$+(15-T) \times 100$
Picking up each object	+300
Arriving to the finishing point	+500
Passing each zones	+200
Unloading each object	+300
Each restart	-500

- The winning team will be decided based on a common point system.
- The robot which obtains the maximal point among the participants will be the winner.
- If there is tie among teams, competition committee and judge will take the further decision to break the tie. There may be new test among teams to decide the final winning team.

Flexibility of Rules

- As long as the concept and fundamentals of the rules are observed, these rules shall be flexible enough to encompass the changes in the number of players and of the contents of matches.
- Modifications or abolition of the rules can be made by the competition committee at any time, and the committee has full right to change the rules however contestants would be informed when any rules are updated.

Liability

- Participating teams are always responsible for the safety of their robots and are liable for any accidents caused by their team members or their robots.
- The "ESONANCE" organization and the organizing team members will never be held responsible nor liable for any incidents and / or accidents caused by participating teams or their equipment.