

TECHFEST 2020-21

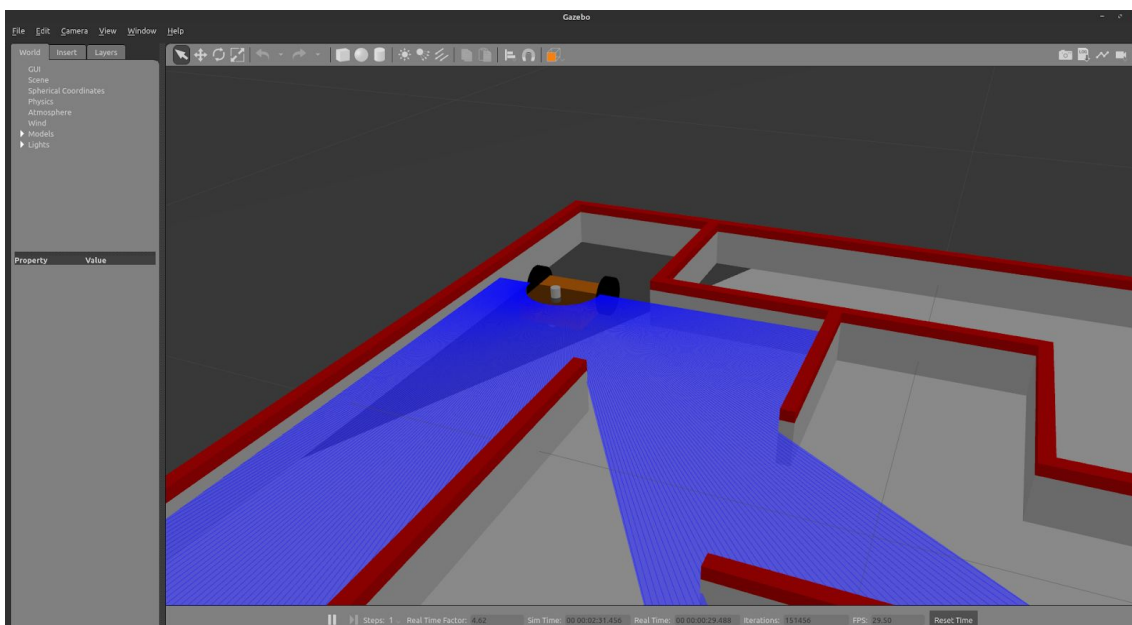
MICROMOUSE CHALLENGE

Objective:

Participants are required to code an autonomous self-contained bot on ROS to be simulated on Gazebo, Micromouse, which can get to the centre of a maze in the shortest possible time. A micromouse essentially comprises of a drive motor or motors to move it; a steering and turning method and sensors to detect the presence or absence of maze walls which has to be specified in the URDF and sensors or control logic to oversee the action of the rest and keep the vehicle 'on track' or to solve the maze.

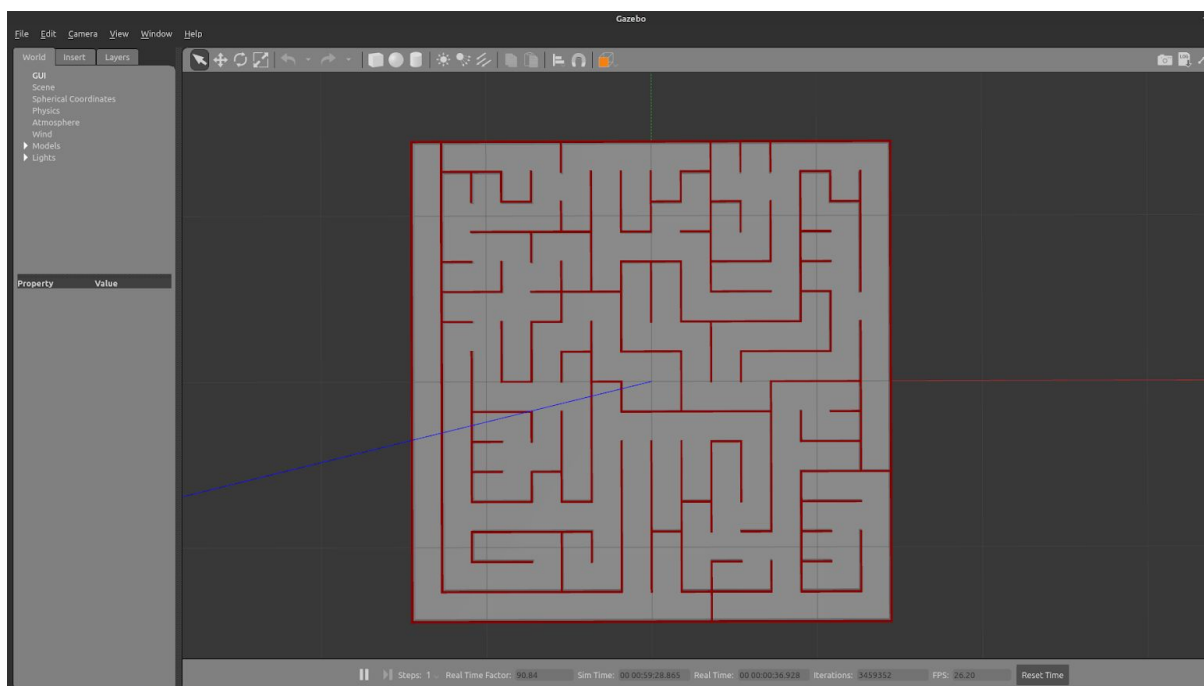
ROS and Gazebo Specifications:

- ROS Melodic and Gazebo 9 will be used in the competition.
- It is recommended to use Ubuntu 18.04 for the competition.
- [Gmaze](#) will be used to generate micromouse maze in Gazebo for the competition. Participants can use Gmaze to generate their own maze to test their code.
- The URDF model of a simple micromouse is provided in **pkg_tf_micromouse** ROS package. Participants can use the same model or modify it according to their need.
- In the **pkg_tf_micromouse** ROS package there is one scripts folder where sample ROS nodes are present. Participants can refer to those scripts to write their own code to solve the maze.
- Refer to the README file for more details.



Maze Specifications:

- For the finals a custom maze for Gazebo will be generated using Gmaze.
- Default dimensions of the maze used in Gmaze will be used in the finals as well.
- The dimension of the maze base in Gazebo will be **2.892m x 2.892m**.
- The maze will be composed of **326 cells** of dimension **0.16m x 0.16m**.
- The walls constituting the maze shall be **0.05m** high and **0.01m** thick. Passageways between the walls shall be **0.16m** wide. The outside wall shall enclose the entire maze. (see figure below)
- The sides of the maze shall be white, and the top of the walls shall be red. The floor of the maze white .
- The start of the maze shall be located at one of the four corners. The starting square shall have walls on three sides. The starting square orientation shall be such that when the open wall is to the 'north', outside maze walls are on the 'west' and 'south'. At the center of the maze shall be a large opening which is composed of 4 unit squares. This central square shall be the destination.
- Small square posts, at the four corners of each unit are called lattice points. The maze shall be constituted such that there is at least one wall touching each lattice point, except for the destination square.



Micromouse Specifications:

- The velocity limit of the micromouse should be **0.4m/s**.
- A micromouse model in Gazebo shall not be larger either in length or in width, than **0.08m**. The height of a micromouse shall not exceed **0.04m**.
- The method of wall sensing is at the discretion of the builder. However, the mouse must not exert a force on any wall
- A micromouse shall not leave anything behind while negotiating the maze.
- A micromouse shall not jump over or climb the walls of the maze.
- Participants need to ensure that the size of micromouse shouldn't hinder/obstruct it's movement in the maze.

Competition Rules:

- Participants have to submit their code to organizers 2 days before the day of the competition. All contesting team code shall be collected before the maze is unveiled.
- After the maze is unveiled, the mouse handler is given 3 minutes, before the start of his/her run, to make any adjustments (if any) to the mouse sensors and calibrate the sensors. However, NO selection of strategies must be made and NO information on the maze configuration should be entered or captured into the memory. Any participant doing so will be disqualified instantaneously.
- Each contesting micromouse is allocated a total of 7 minutes of access to the maze after the 3 minutes sensor adjustment time. The maze-time clock will commence after the expiry of the 3 minutes time limit even if the handler is still making adjustments to the sensors.
- Any time used to adjust a mouse between runs is included in the 7 minutes.
- The time taken to travel from the start square to the destination square is called the "run" time. Travelling from the destination square back to the start square is not considered a run. The total time taken from the first activation (after calibration is done or calibration time is over, whichever is less) of the micromouse until the start of each run is also measured. This is called the "maze" or 'search' time. If the micromouse requires any manual assistance at any time during the contest, it is considered "touched". Scoring is based on these three parameters.
- The micromouse may make up to 7 runs.
- The starting procedure of the mouse should be simple and must not offer a choice of strategies to the handler. For example, a decision to make a fast run to the centre as time runs out must be made by the micromouse itself. The starting procedure should be submitted to the judges when the mouse is registered on the day of the contest.
- Do not make any assumptions about the amount of sunlight, incandescent light, or fluorescent light that may be present in the world configuration.

- The run timer will start when the front edge of the mouse crosses the start line and stops when the front edge of the mouse crosses the finish line. The start line is at the boundary between the starting unit square and the next unit square. The finish line is at the entrance to the destination square.
- Every time the mouse leaves the start square, a new run begins. If the mouse has not entered the destination square, the previous run is aborted. For example, if a mouse re-enters the start square (before entering the destination square) on a run, that run is aborted, and a new run will be deemed begun, with a new time that starts when the starting square is exited.
- The mouse may, after reaching the destination square, continue to navigate the maze, for as long as their total maze time allows.
- If a mouse continues to navigate the maze after reaching the destination square, the time taken will not count toward any run. Of course, the 7-minute timer continues to run. When the mouse next leaves the start square, a new run will start. Thus, for better "Run time", a mouse may make several runs without being touched by the operator. It should make its own way back to the beginning to do so.
- The judges reserve the right to ask the operator for an explanation of the Micromouse. The judges also reserve the right to stop a run, declare disqualification, or give instructions as appropriate (e.g., if the structure of the maze is jeopardized by continuing operation of the mouse).

Note: *The judges have the discretion to request a micromouse to retire early if by its lack of progress it has become boring*

- A contestant should not feed information on the maze to the micromouse. Therefore, changing code or downloading programs is NOT allowed once the maze is revealed. However, contestants are allowed to:
 - o Adjust sensors (gain, position etc.)
 - o Change speed settings
 - o Make repairs
- A contestant should not alter a mouse code in any manner once the final run has started. The judges shall arbitrate.
- The contestants should be prepared with the algorithms and code listings to convince the judges that any alteration they do in the total 3 minutes span does not add topological information about the maze to the mouse.

Judging:

- Winners will be decided on the basis of shortest official time which is calculated as: $\text{Official Time} = \text{Best Run Time} + \text{Touch Penalty} + \text{Search Penalty}$
Search Penalty = 1/30th of the Search Time, in seconds
Touch Penalty = $(N/5) * (\text{Best Run Time})$ Where N = Number of touches prior to the best run.
For example, if a micromouse, after being on the maze for 4 minutes starts a run that takes 20 seconds to reach the destination after being touched twice ; the run will have a Official time of $20 + (2/5) * 20 + 1/30\text{th of } (4 \times 60 \text{ seconds}) = 36 \text{ seconds}$
- If the micromouse does not reach the center of the maze then judges/organisers will make a qualitative assessment of the micromouse's performance, based on distance achieved, 'purposefulness' versus random behaviour and quality of control.

Submission policy:

- While submitting your ROS Application(s) make sure to keep all the ROS Packages that you are going to use in a folder and name the folder **techfest-micromouse**.
- If you are using third party ROS packages make sure to include that in your **techfest-micromouse** folder.
- A single ROS Launch file called **final.launch** should be present in **pkg_tf_micromouse** which should load all the necessary ROS nodes, RViz and Gazebo Simulation to solve the Maze present in **arena.world** which can be found in the **pkg_tf_micromouse** ROS package.
- You can modify the **final.launch** present in the **pkg_tf_micromouse** ROS package as per your need.
- While evaluating your submission we will build your package(s) and launch your **final.launch** file. So, make sure all the necessary nodes are present in your submission and are launched by the launch file.
- Before you submit make sure to screen-record your run on your system. Upload this video on YouTube. While uploading it on YouTube make sure to "Unlist" it.
- Include a **README.md** file in your **techfest-micromouse** folder. This README file should have the link to your YouTube video.
- Once your **techfest-micromouse** folder is ready, zip it and name the zip file as **<your-team-id>-techfest-micromouse-submission.zip** and submit it to the email ID micromouse@techfest.org with the subject Micromouse Challenge: team id (For example - Micromouse Challenge: MM1234)
NOTE: Zip the entire **techfest-micromouse** folder and not its contents.

Timeline:

Last Date of Submission	16 December, 2020
Date of competition	18-20 December, 2020

Team Specifications & Eligibility:

- All students with a valid identity card of their respective educational institutions are eligible to participate in the competition.
- One team can have a maximum of 4 members.
- Students from different institutes can be a part of the same team.

Rules:

- Every team has to register online on the official Techfest website for the competition.
- A Team ID will be allocated to the team on registration which shall be used for future references.
- The code may be checked before the race and will be discarded if an instance of plagiarism is detected.
- Judges decision shall be treated as final and binding on all.
- The organizers reserve the rights to change any or all of the above rules as they deem fit. Change in rules, if any will be notified to the registered participants.

Certificate Policy:

- Certificate of excellence will be awarded to the top 5 teams.
- E-Certificate of participation will be given to all the teams qualified for the finale except the top 3 teams.
- Disqualified teams will not be considered for any certificates.

The Winners will have to mail the following information (immediately after the announcement of results) to shubhamgautam@techfest.org

Subject:

Micromouse Challenge, team id- your position (example: Micromouse Challenge, MM1234 – 1st position)

Body of mail:

1. Account Holder's Name
2. Account Number
3. Bank name and Branch name.
4. IFSC Code