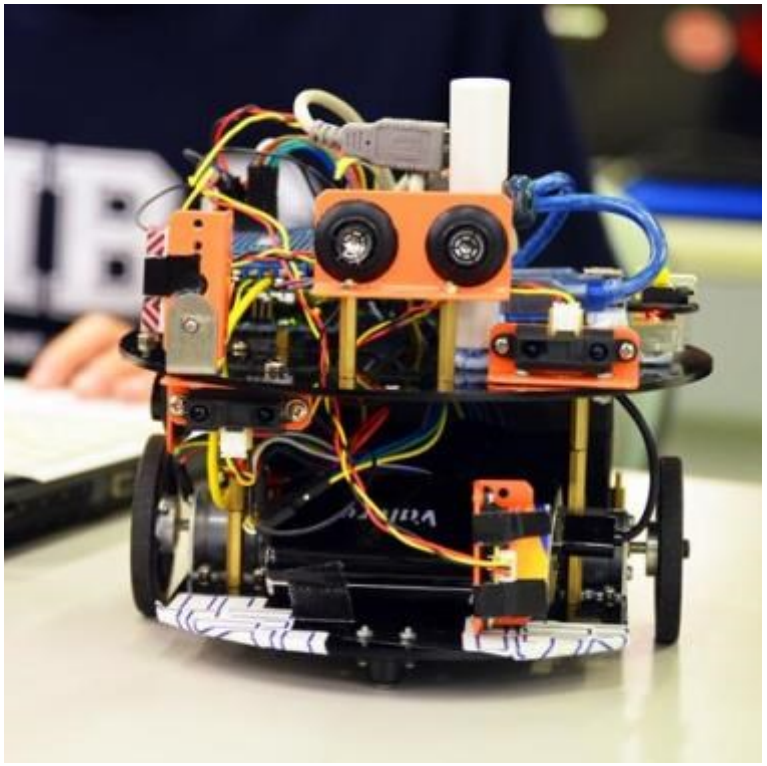
MDP Challenge

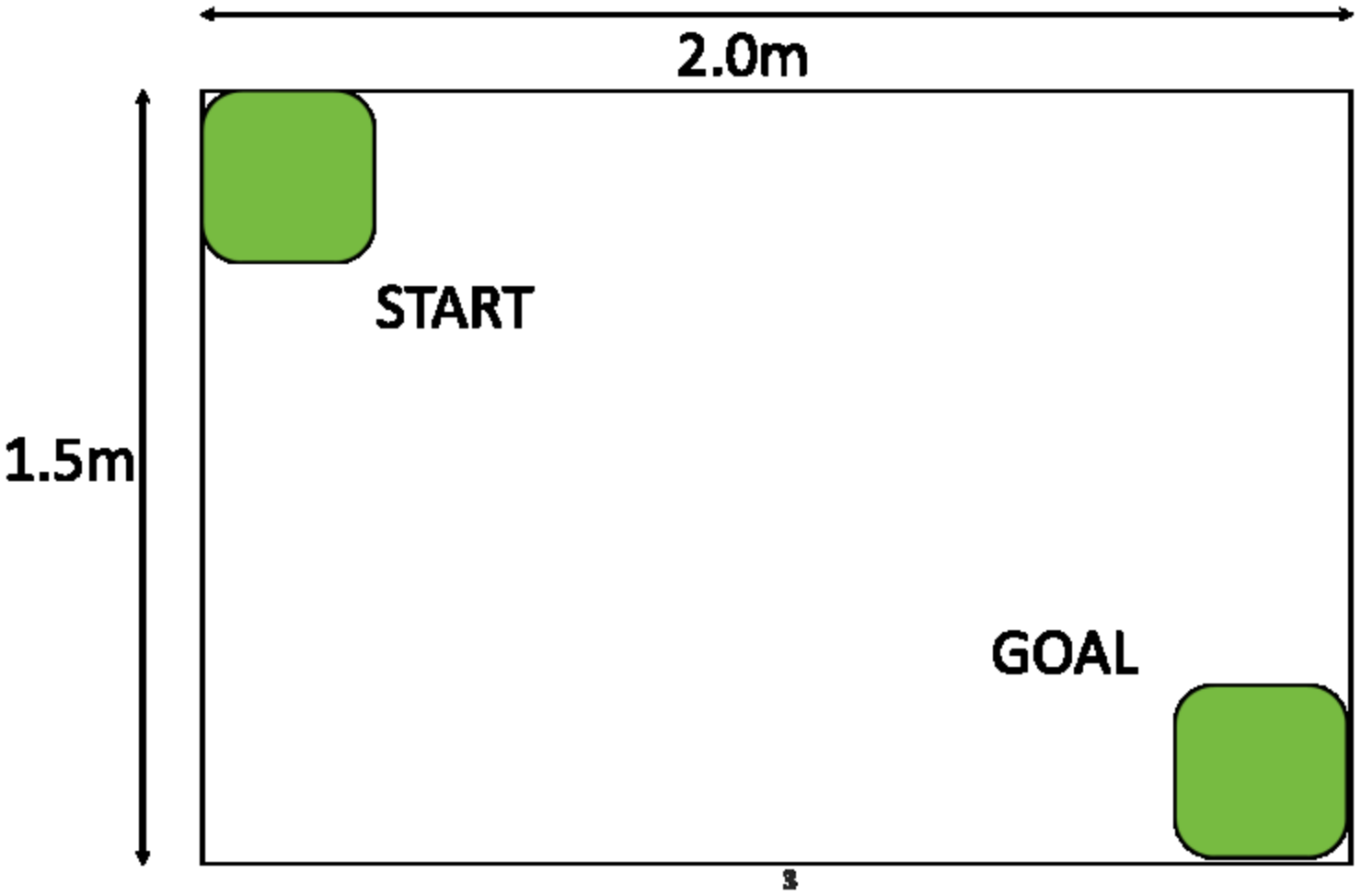
Ravi Suppiah



Arena Layout

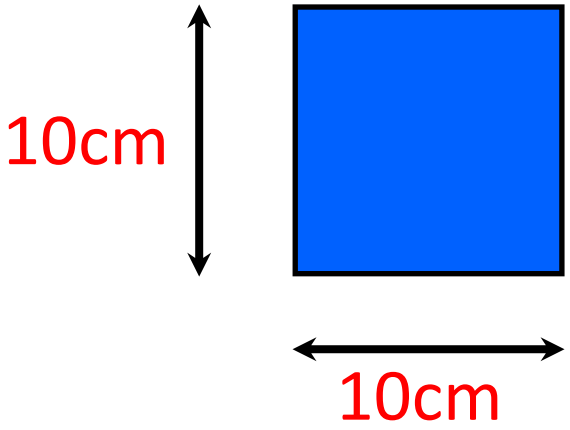
- Challenge arena is 2.0m long x 1.5m wide
- Arena is completely surrounded by a 15cm high boundary wall
- Arena floor covered in high-grip black paint with yellow dots painted on a 10cm grid
- START and GOAL zones are 30cm x 30cm

Arena Layout



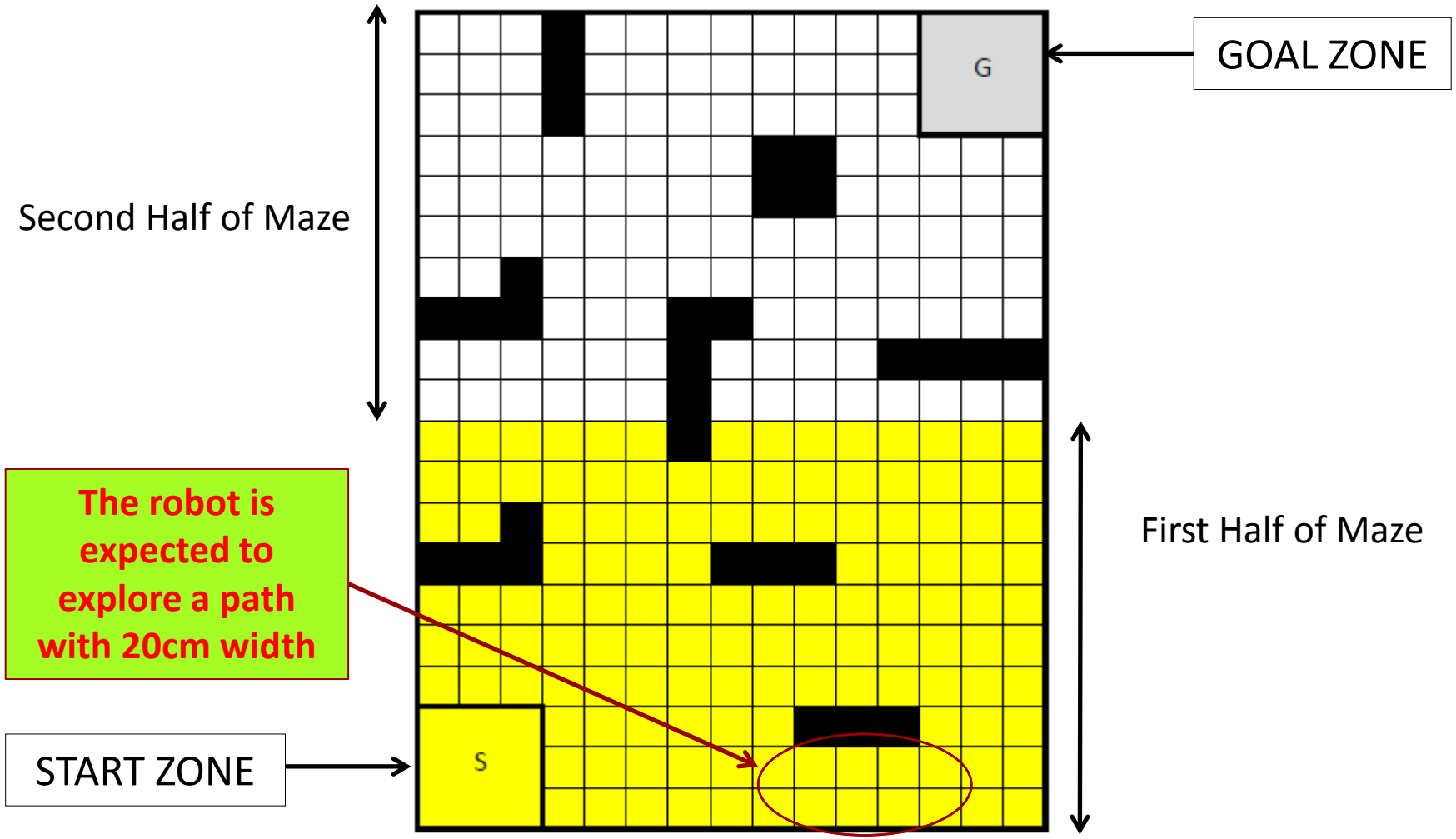
Arena Obstacles

- Obstacles are 15cm high
- Hollow acrylic blocks
- Matte black surface



- Obstacle sections are composed of blocks with ~10x10cm footprint
- 5 different obstacle layout maps, one each week from Weeks 8-12

Sample arena layout



Challenge Tasks

1. Start Phase
   - Robot placed anywhere within **YELLOW** Zone (first half of maze) with **ANY** orientation.
   - Update Start coordinates through Android Tablet
   - Press <**EXPLORE**> button in Android App.
2. Exploration Phase
   - Robot to explore Arena
   - Robot **MUST** enter **GOAL** Zone and explore back to **START** Zone within the Exploration Time Limit
3. Fastest Path Run Phase
   - Press <**RUN**> button in Android App.
   - Robot to move from START to GOAL in shortest possible time.
4. Run Complete
   - Robot **STOPS** within the GOAL zone.

Competition Timeline

- Each week:
  - By 9:00am: Teams attempting a run must submit names to supervisor
  - By 9:05am: Teams attempting a run must place robot in quarantine area
  - 9:10am: Supervisors configure arena
  - 9:15am: Competition starts
  - By 10:25am: All runs complete

Quarantine Procedure

- All teams attempting a run must place their robots + all mobile computing devices in the quarantine area before the arena is configured
- Once a team is activated, they have 2 minutes to retrieve their robot + tablet + laptop from the quarantine area and make final preparations.
- After the 2 min preparation period, the teams have a total of
  - 6 minutes to attempt/complete the exploration &
  - 2 minutes to attempt/complete the fastest-run.
  - Any attempted exploration/run that exceeds the limit is **Invalid**
- All computing devices used must be in plain sight of the judges at all times during the run

Timing Breakdown

- The Timing Starts the moment the team is asked to retrieve their equipment from the Quarantine area.
- What must happen within the first 2mins?
  - This is the time for your team to set-up all your equipment and ensure that your robot is ready for the challenge.
- What must happen during the 6mins Exploration Phase?
  - This is the time for you to explore the maze to gather as much information as possible.
  - The information that you gather during this phase will help you get onto LeaderBoard A and it will also help you in your Fastest-Run.
- What must happen during the 2mins Fastest-Run Phase?
  - This is the time for you to ensure that the robot makes the fastest run from “Start” to “Goal”.
  - The timing from this phase will affect your position in LeaderBoard B.

Time Scoring

- T_E = Time to explore (exploration phase)
  - Clock starts when [**EXPLORE**] button is pressed on tablet
  - Clock stops when robot finally enters [**START**] zone
- T_R = Time to complete fastest path run
  - Clock starts when [**RUN**] button pressed on tablet
  - Clock stops when robot enters [**GOAL**] zone
- For each (distinct contact with wall/obstacle) $T_{Penalty}$ += 0:10
- Continuous contact with a Wall/Obstacle > 5s, $T_{Penalty}$ += 0:10
  - $T_F = T_R + T_{Penalty}$

LeaderBoards

- **LeaderBoard A: Exploration**
  - Map generated during exploration will be scored for accuracy (based on map descriptor output, see map descriptor format)
    - +1 pt for correctly identified obstacle
    - -10 pt for incorrectly identified obstacle
    - 0 pt for open spaces
    - -2pt for unexplored spaces
  - **Ranked by map accuracy points, Tie-break done using Exploration Time**
- **LeaderBoard B: Fastest run**
  - Ranked by T_F
  - Tie-breakers: $T_{Penalty}$, T_R

Further Notes

- The **Exploration Timing** will only be considered if all the following conditions are met:
  - Robot begins in the YELLOW Zone.
  - Only after signal is given, robot moves to explore
  - Robot enters GOAL zone and returns to START zone and stops.
  - **The Exploration timing does not exceed 6mins**
- The **Fastest Run Timing** will only be considered if all the following conditions are met:
  - Only after signal is given, the robot moves from START to GOAL
  - Arena boundary walls are not dislodged
  - Robot does not leave the arena at any time
  - **The Fastest Run timing does not exceed 2mins**
- A run may be successful even if obstacles are touched/moved

FAQ

- When is my robot deemed to have reached the GOAL / START?
  - Once the midpoint of the robot is INSIDE the GOAL/START zone.
- During the Exploration Phase, my Robot did not enter the GOAL zone. Can I still do the Fastest Run?
  - Yes, as long as the robot managed to come back to the START zone and stop. However, the Exploration Phase result will not qualify for LeaderBoard A.
- During the Exploration Phase, my Robot entered the GOAL zone but did not come to the START zone. Can I still do the Fastest Run?
  - No. If the robot did not come back to the START zone at the end of the Exploration Phase, then you CANNOT proceed with the Fastest Run.
- During the Exploration Phase, my Robot hit some obstacles. How will the penalty be computed?
  - Each Penalty Hit will add 10s to the Fastest Run timing.

FAQ

- During the Exploration Phase, my Robot first entered START zone and then proceeded to the GOAL zone and then came back to START zone. Do we still qualify for LeaderBoard A?
  - Yes, as long as the robot entered the GOAL zone during the exploration phase and came back to the START zone and stopped, then you qualify for LeaderBoard A.
- What happens if my Robot does not return back to the START zone by the end of the 6mins Exploration phase?
  - If the robot is not able to return to the START zone by the end of the Exploration phase, it CANNOT proceed for the Fastest-Run phase.
- During the Exploration Phase, my Robot hit some obstacles. How will the penalty be computed?
  - Each Penalty Hit will add 10s to the Fastest Run timing.

FAQ

- What is meant by each distinct contact with Wall / Obstacle?
  - It refers to any NEW move that is made while still having contact with an obstacle/wall.
  - E.g. A robot touches an obstacle and stops. -> 10s Penalty
    The robot continues to turn left/right while maintaining contact with the obstacle.
    -> 10s Penalty for EACH turn.
  - E.g. Robot touches the side wall -> 10s Penalty
    The robot continues to move from grid-to-grid while maintaining contact with the wall.
    -> 10s Penalty for EACH move.
- What if my team cant complete the preparation within 2mins?
  - You will start to make use of the Exploration Time buffer.
  - For example if you complete the preparation within 3mins, then you have a total of 5mins left to complete your exploration.
- Can my Robot Bull-Doze through all the obstacles and reach the GOAL?
  - Bull-Dozing is strictly NOT allowed.

THANK YOU!

- For any other doubts and queries, please consult your Lab Supervisors or the Coordinators.
- Please refer to the updated Rules & FAQ document in NTULearn.