2024

ROBOTICS COMPETITION

GUIDE BOOK

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1. Introduction

Transforming Ideas into Reality

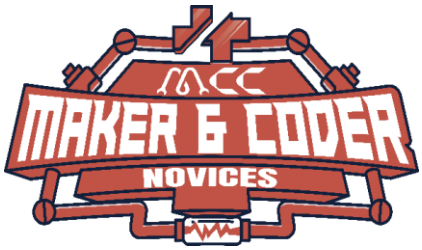
Maker and Coder Championship is an engaging innovation competition presented by Maker and Coder, designed to inspire students in the fields of robotics, coding, IoT, and AI. At its core, the challenge revolves around hardware construction and programming, aiming to create a dynamic environment that guides students through every stage of project development while igniting a passion for transforming ideas into reality.

Aligning with Sustainable Development Goals

The competition reflects the ethos of SDG 4 (Quality Education) and SDG 9 (Industry, Innovation, and Infrastructure) by providing an inclusive platform for education and innovation. It aims to develop critical thinking skills and creativity among students, fostering holistic development beyond technological proficiency. By emphasizing teamwork and collaborative learning, the Maker and Coder Challenge supports SDG 17 (Partnerships for the Goals), promoting global cooperation and knowledge sharing.

Mastering Robotics, AI, and IoT

This unique challenge serves as a platform for students to not only showcase their technical expertise but also to cultivate essential life skills such as problem-solving, communication, and collaboration. By participating in the Maker and Coder Challenge, students engage in hands-on learning experiences that prepare them for the workforce of industry 4.0, and future challenges and opportunities in the rapidly evolving field of robotics, Ai, and IoT.



2. Competition Overview

2.1 Participation Criteria

Students are to participate in teams with a mentor. The categories and age groups for participation are as follows:

Maker and Coder Novices

- **Age Group:** 8-13 years
- **Team Composition:** 2-4 members

Maker and Coder Pioneers

- **Age Group 1:** 13-18 years
- **Age Group 2:** 18-24 years
- **Team Composition:** 2-4 members

Maker and Coder Innovators

Maker and Coder Innovators is divided into three categories based on age groups and complexity levels:

- **MC Young Innovators**
  - **Age Group:** 6-13 years
  - **Team Composition:** 2-6 members
- **MC Junior Innovators**
  - **Age Group:** 13-18 years
  - **Team Composition:** 2-6 members
- **MC Senior Innovators**
  - **Age Group:** 18-24 years
  - **Team Composition:** 2-6 members

Note: **Every team should have 1 mentor aged above 18**

2.2 Registration & Preparation

Participating in the competition involves several steps, from initial registration to preparing for the event and acquiring necessary equipment. This section provides a detailed guide to help teams navigate the registration process, prepare adequately, and purchase required kits.

Registration

1. **Visit the Registration Website:**
   - Go to the official competition website: mcc.me
   - Navigate to the 'Registration' section.
2. **Create an Account:**
   - Click on 'Sign Up' to create a new account.
   - Verify your email address to activate your account.
3. **Complete the Registration Form:**
   - Log in to your account and access the registration form.
   - Fill in the required details such as team name, team members' names, contact information, and school or organization affiliation.
   - Provide detailed information about your team, including the age category (Novices, Pioneers, Innovators).
   - Fill in any other details that are required in the form.
4. **Submit Registration Fee:**
   - Pay the registration fee through the secure payment gateway provided on the website.
   - Upon successful payment, you will receive a confirmation email with your registration details and further instructions.

Preparations

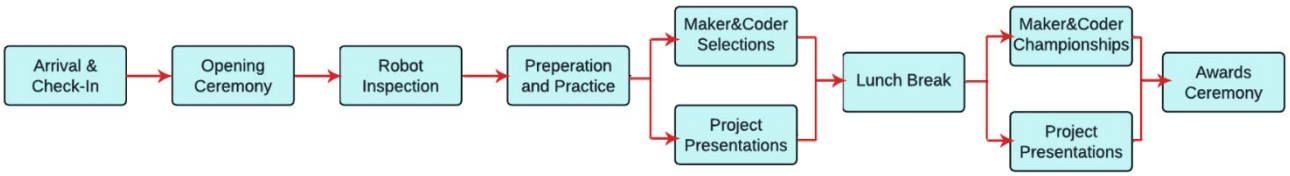
1. **Visit Maker & Coder Website**
   - Go to the official Maker & Coder Website makerandcoder.com
   - Browse the available kits and accessories required for the competition.
2. **Select and Purchase Kits:**
   - Choose the appropriate kit for your age category and competition category.
   - Complete the purchase through the provided online store.
   - Contact Maker & Coder directly for any assistance.
3. **Kit Assembly and Testing:**
   - Assemble the kits as per the instructions provided.

- Test all components to ensure they are functioning correctly before the competition day.

4. **Access Preparation Resources:**
    - Visit learningportal.makerandcoder.com to find a comprehensive course designed to help teams prepare for the competition. The course includes tutorials on robot building, programming, and understanding competition rules.
5. **Practice and Training:**
    - Engage in regular team meetings and practice sessions to build and program your robot.
    - Simulate matches to improve performance and strategy.
6. **Filling Team Details Form (For Maker & Coder Novices and Pioneers)**
    - Fill out the Team Details Form, which includes information about the team operator, co-operator, and other team specifics. (refer to MCC Novices & Pioneers Section for more details)
    - Bring this form with you on the competition day for verification.

2.3 Competition Procedure

The competition procedure section outlines the steps and activities that will occur on the day of the competition. This section provides a detailed schedule to help teams understand the flow of events and ensure they are prepared for each phase of the competition day.



Arrival & Check-In

- Participants arrive at the competition venue.
- Teams check in at the registration desk.
- Teams receive their badges, schedules, and any necessary materials.
- Each team submits their Engineering Notebook.

Opening Ceremony

- Welcome speech by the event organizers.

- Introduction of judges and volunteers.
- Overview of the day's schedule and important announcements.

Robot Inspection

- Robots must pass inspection to compete.
- If a robot fails, it must be adjusted and re-inspected.

Teams Preparation

- Teams set up their workstations in the designated areas.
- Last-minute preparations and testing of robots.
- Teams ensure their equipment and software are functioning properly.

Project Demonstrations

- Teams present their projects to the judges in the designated areas.
- Each team has 10-15 minutes for their presentation, including Q&A.
- Judges evaluate projects based on creativity, technical skill, and presentation.

Maker & Coder Selections

- Each team competes in a single round consisting of two matches.
- Scores from two matches are recorded and averaged for ranking.

Lunch Break

- Teams take a break while scores from the Robot Game Start Round are collected.

Maker & Coder Championships

- The top 4 teams based on average scores from the Maker & Coder Selections are announced and are given time to modify and improve their robots.
- Teams play one round of two matches each to determine the final two teams.
- The final two teams compete in a round of two matches to determine the champion.

Awards Ceremony

- Announcement of winners in various categories.
- Presentation of awards and certificates.
- Closing remarks by organizers and sponsors.
- Group photo session.

3. MCC Novices & Pioneers

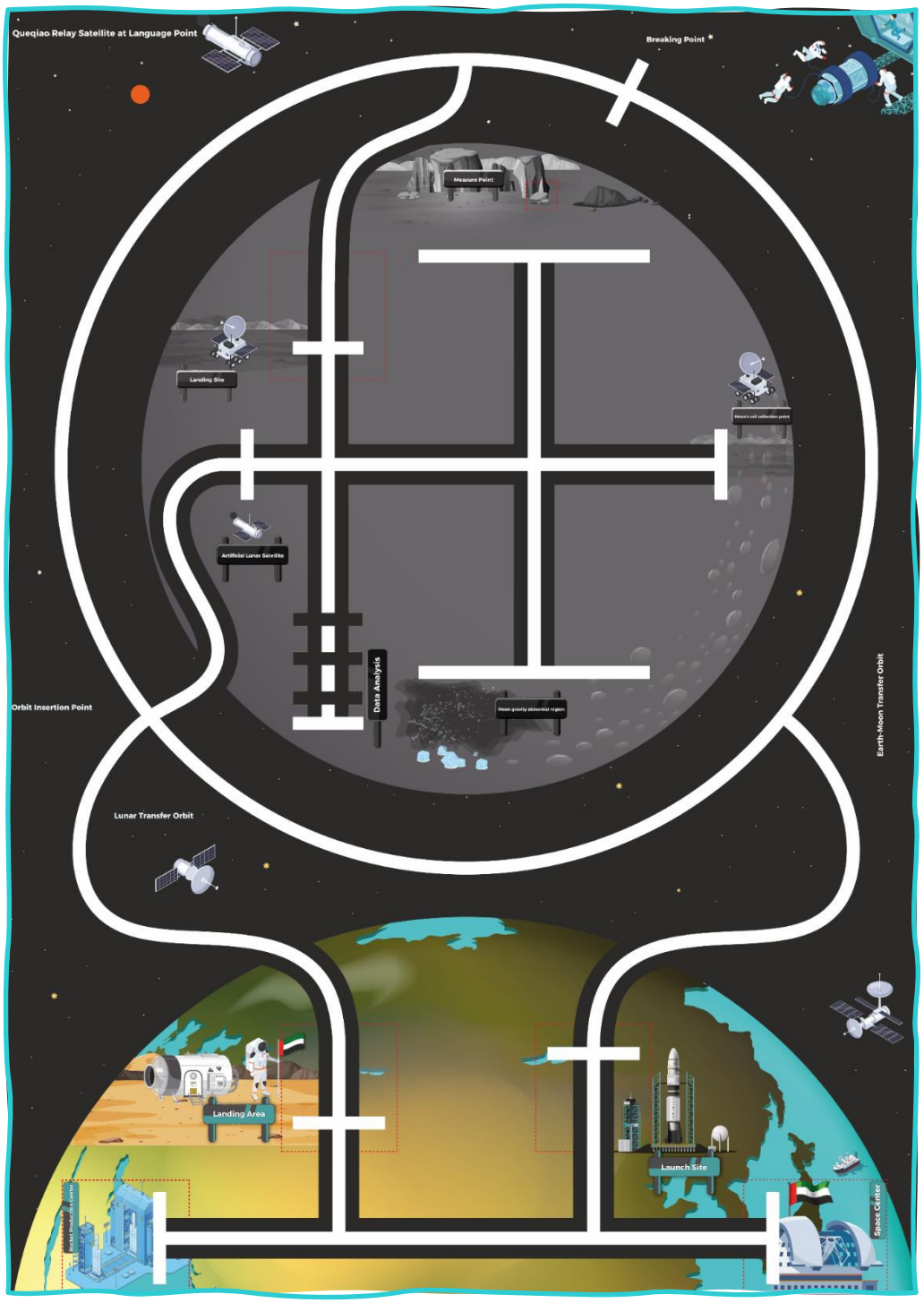
3.1 Equipment Specifications

The equipment specification section details the necessary tools, software, and hardware required for participating in the competition. This includes the technical requirements for the robots, the software applications used for programming and control. By adhering to these specifications, teams can ensure their projects are compatible with competition standards in order to perform during the event.

Category	Specification
Controller	Must use MC 4.0
Motors & Actuators	Maximum of 4 DC motors with a rated voltage of 6-12V Servos with a torque of up to 10 kg-cm Stepper motors with a resolution of at least 1.8° per step
Sensors	Any sensor is allowed but up to 5
Construction Materials	Plastic, aluminum, or composite materials 3D-printed components Laser-cut parts from wood, acrylic, or similar materials Fasteners such as screws, nuts, and bolts
Programming languages	Support for both block-based and script-based programming (Python preferred for advanced tasks) UIflow Python Matlab Arduino IDE ROS

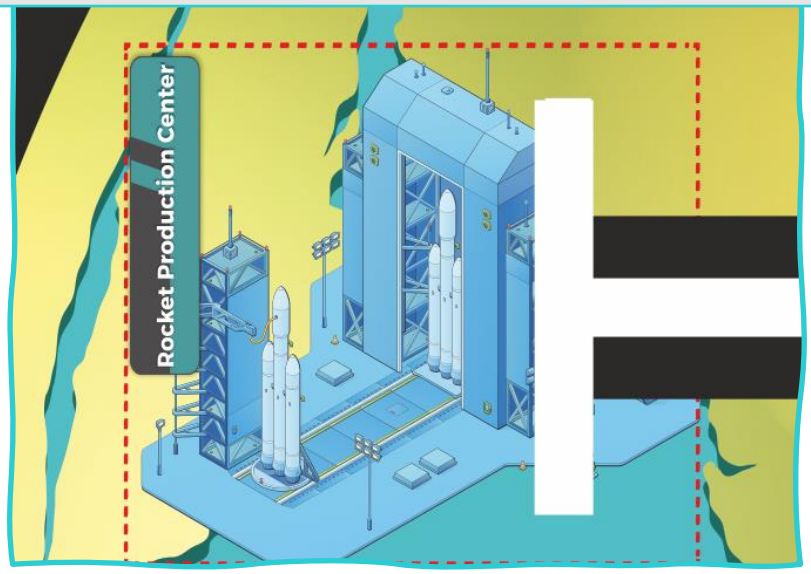
3.2 Arena

Full Arena

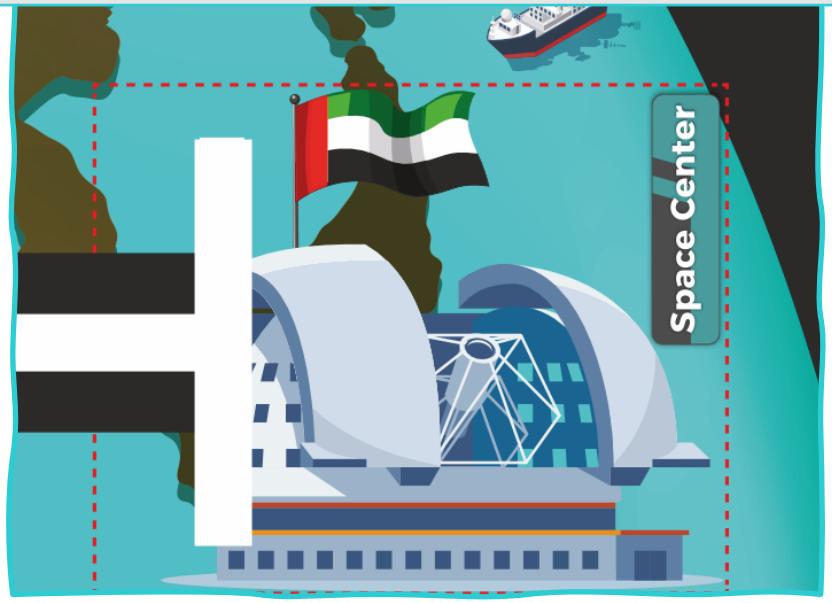


Arena Areas

1 **Rocket Production Center:** The birthplace of all lunar rockets, where engineers work tirelessly to



2 **Space Center:** The central hub for all lunar operations, coordinating missions and managing



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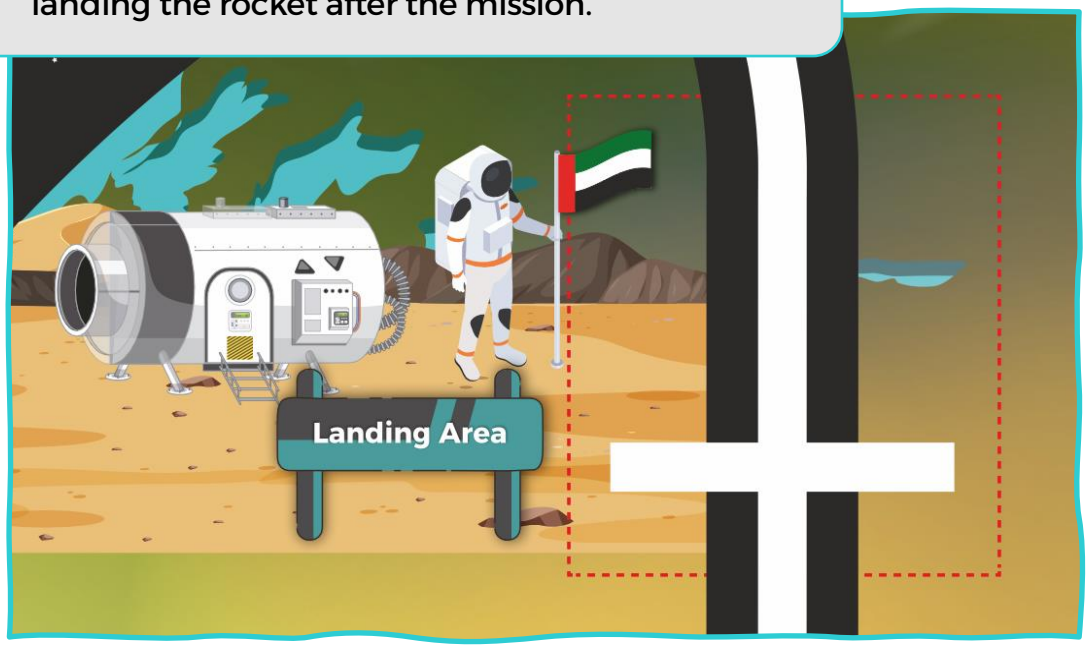
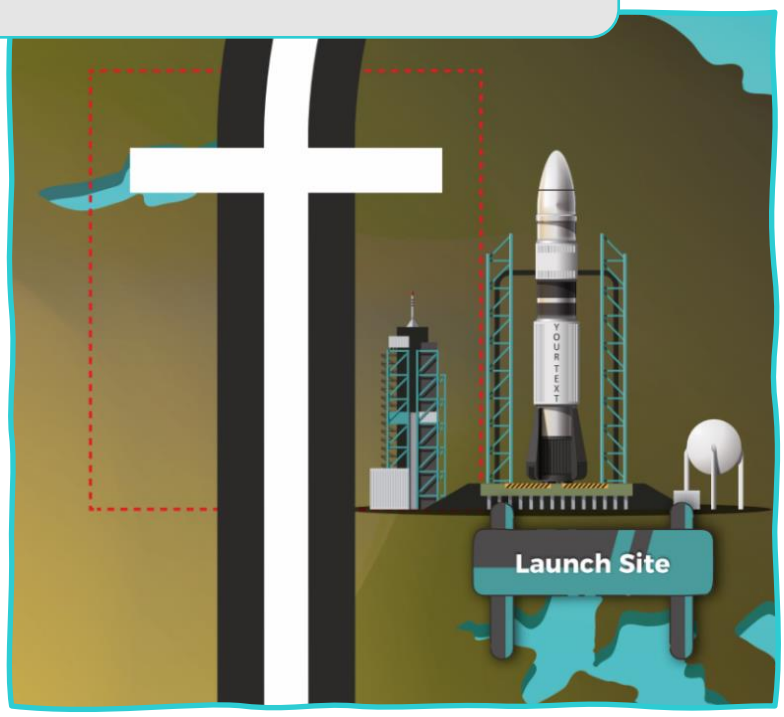
Landing Area: The return point on Earth for safely landing the rocket after the mission.



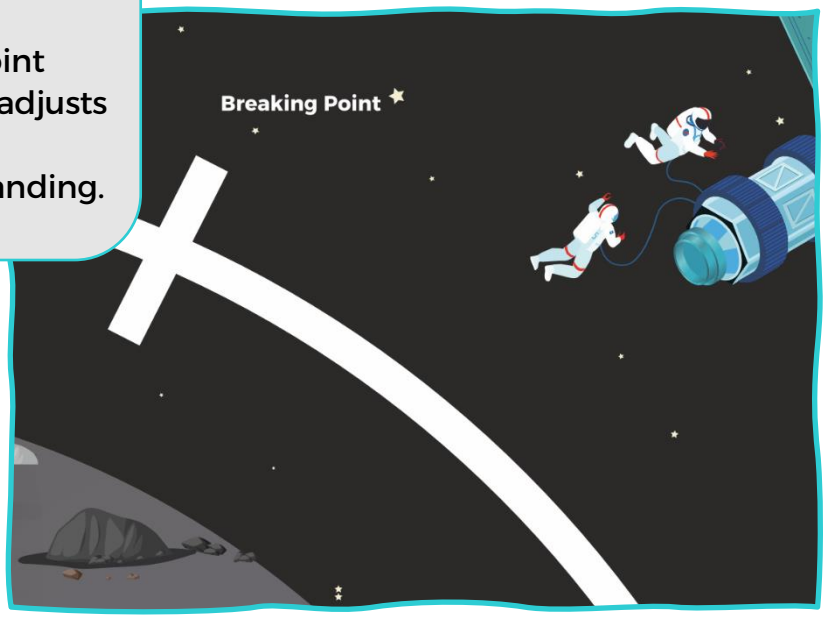
4

Launch Site: The gateway to space where rockets are fuelled and launched towards the Moon.



5

Breaking Point:
A crucial checkpoint where the rocket adjusts its trajectory for a successful lunar landing.



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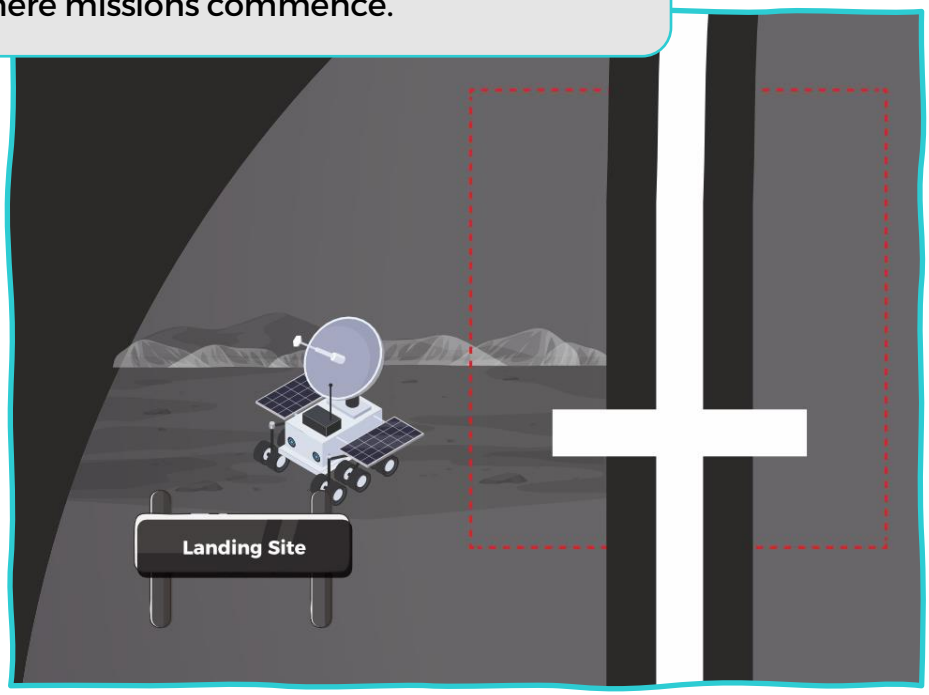
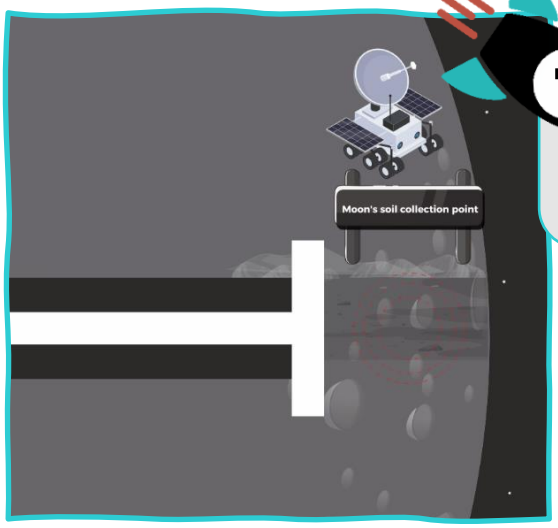
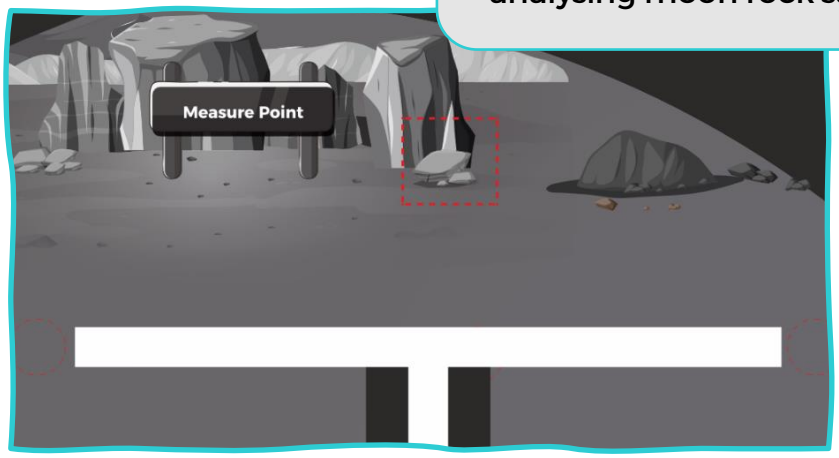
Landing Site: The designated landing area on the Moon where missions commence.



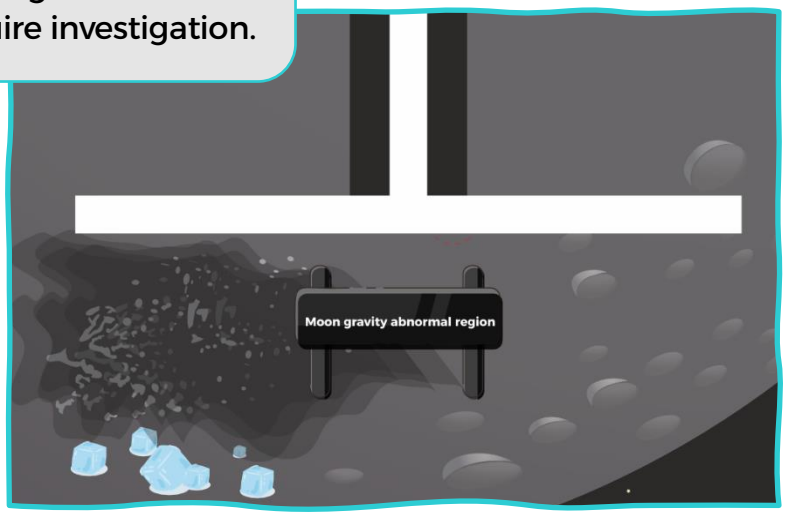


7 **Moon's Soil Collection Point:** A research area where moon soil samples are collected for analysis.

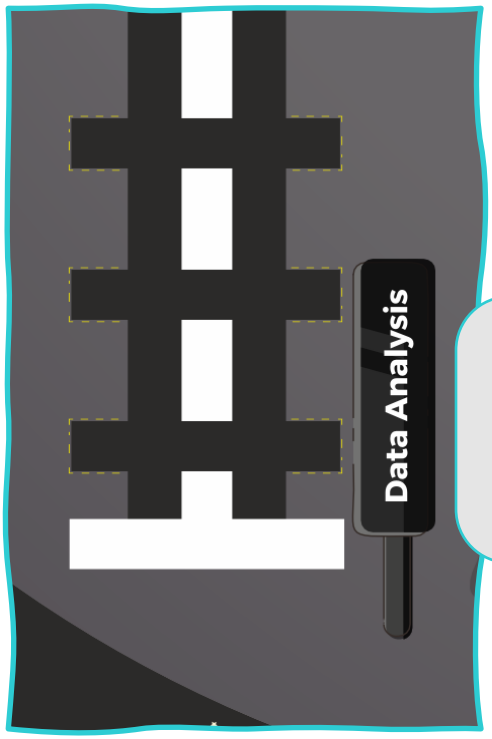
8 **Measure Point:**
A scientific station for analysing moon rock samples.



9 **Moon Gravity Abnormal Region:**
An area with unusual gravitational properties that require investigation.



10 **Artificial Lunar Satellite:**
A satellite orbiting the Moon, used for communication with Earth.

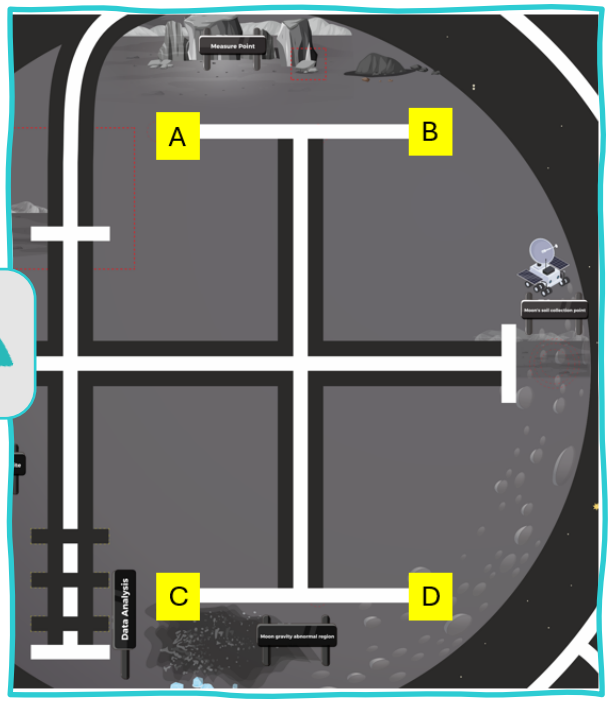


11

Data Analysis: The lunar research facility where scientists and engineers scrutinize the samples and information gathered during the mission.

12

Location Names of Moon Samples



3.3 Engineering Notebook Structure

Participants in the Maker & Coder Novices and Pioneers categories are required to submit an engineering notebook. This notebook should document the entire process of creating their robot, including both hardware and software development. The notebook helps teams organize their work, reflect on their design and programming decisions, and provide judges with a detailed account of their project development.

Cover Page

- **Team Name:**
- **Team Number:**
- **School/Organization:**
- **Team Members:**
- **Date:**

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- Engineering Notebook Table of Contents

Section 1: Introduction

- **Team Introduction:** Briefly introduce your team members, their roles, and your team's journey.
- **Project Overview:** Provide a summary of your project, including the main objectives and goals.

Section 2: Planning & Strategy

- **Brainstorming Ideas:** Document your initial brainstorming sessions and ideas.
- **Research:** Summarize the research conducted related to your project. Include references.
- **Planning:** Outline your project plan, including timelines, milestones, and task assignments.

Section 3: Design & Development

- **Design Process:** Describe the process of designing your robot, including sketches, diagrams, and CAD models.
- **Hardware Development:** Detail the development of the robot hardware, including materials used and construction methods.
- **Software Development:** Explain the software development process, including coding languages, tools, and algorithms used.
- **Testing:** Document the testing phase, including test cases, results, and any modifications made based on testing.

Section 4: Challenges & Solutions

- **Challenges Faced:** Describe any challenges or obstacles encountered during the project.
- **Solutions Implemented:** Explain how your team addressed and overcame these challenges.

Section 5: Final Implementation

- **Final Robot Design:** Provide detailed information about the final design of your robot.
- **Program Code:** Include the final code used for the robot, with explanations for each part of the code.
- **Performance Summary:** Summarize the performance of your robot in different tasks and missions.

Section 6: Reflection & Lessons Learned

- **Team Reflections:** Reflect on the overall experience, including what worked well and what could be improved.
- **Lessons Learned:** Document the key lessons learned by the team throughout the project.

Section 7: Appendices

- **Diagrams & Charts:** Include any additional diagrams, charts, or visual aids.
- **References:** List all references and resources used in your project.
- **Acknowledgments:** Acknowledge any assistance or support received during the project.

3.4 Team Details Form

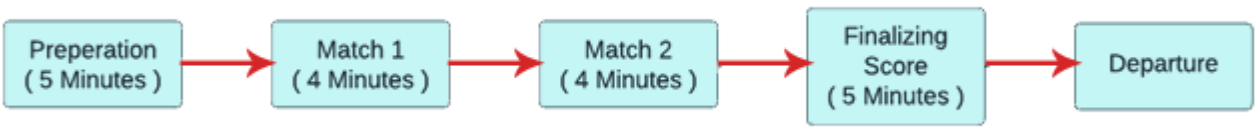
The Team Details Form is an essential document that details important information about each participating team and their robots. This form ensures that all necessary details regarding team members, their roles, the robot's technical specifications, and the use of any devices or networks.

Each team is required to fill out this form prior to the competition day and keep it with them before each round.

Field	Description
Team Name	The official name of the team participating in the competition.
Team Number	A unique identifier assigned to each team upon registration.
MCC Category	Specify whether the team is in the Novices, Pioneers, or Innovators category.
School/Organization	The name of the school or organization the team represents.
Team Operator Name	The name of the primary operator responsible for the robot during the competition.
Team Observer Name	The name of the primary observer responsible for showcasing Remote+ / AWS / Azure.
Remote+ QR Code	QR Code of the Remote+ if applicable.
AWS/Azure Details	QR Code of the place of sharing the details in AWS/Azure.
Robot Name	The official name of the robot being used in the competition.
Robot Weight	The weight of the robot in grams.

3.5 Robot Game Procedure

This section outlines the detailed procedure for the robot game segment of the competition. It provides a step-by-step guide for teams to follow, ensuring a smooth and organized flow of events. Referees will make specific calls before and after each match to guide the participants through the process. Teams must be prepared and comply with the instructions to maintain the competition's integrity and fairness.



Preparation (5 Minutes)

- Teams arrive at the competition area and set up their robots on the starting area.
- Teams place their devices showing Remote+ or AWS in the designated area as indicated by the referee.
- Referee checks that all equipment is correctly placed and functioning.

Match 1 (4 Minutes)

- Referee announces, "Match 1 will start in 3, 2, 1, go!" and starts the timer.
- Teams execute their pre-programmed tasks and missions within the given time.
- Referee keeps track of the time and announces a 1-minute warning before the end of the match.
- At the end of the 4 minutes, the referee announces, "Match 1 is over. Stop your robots."

Match 2 (4 Minutes)

- Referee announces, "Match 2 will start in 3, 2, 1, go!" and starts the timer.
- Teams execute their pre-programmed tasks and missions within the given time.
- Referee keeps track of the time and announces a 1-minute warning before the end of the match.
- At the end of the 4 minutes, the referee announces, "Match 2 is over. Stop your robots."

Finalizing Score (5 Minutes)

- Referee and scoring officials review the performance and record the points for each team.
- Referee announces, "We are now finalizing the scores."
- Teams may be asked to verify certain actions or results from their matches.
- The final scores for both matches are confirmed and teams will be asked to sign the paper.

Departure

- Referee announces, "Please gather your equipment and leave the competition area."
- Teams collect their robots and devices, ensuring they leave nothing behind.
- Teams exit the competition area, making way for the next group to begin their preparation.

4. MCC Novices Details

4.1 Introduction

About Maker & Coder Novices

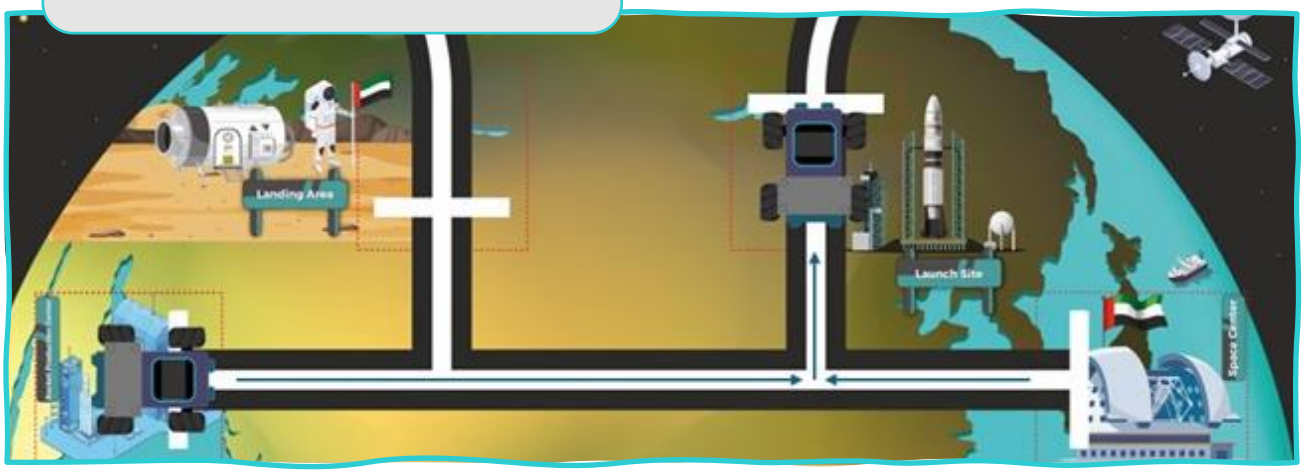
The Maker & Coder Novices category is designed for young participants aged 8-13, providing them with an exciting opportunity to explore robotics, programming, and IoT in a fun, hands-on environment. The aim is to introduce these budding innovators to the basics of robotics, programming, and teamwork through engaging challenges.

Background Story

The year is 2040, and humanity has established a lunar base as a stepping stone for deeper space exploration. The mission of the Maker & Coder Novices is to assist in critical operations on the Moon. These operations include transporting rockets, fuelling them, launching missions, collecting and analysing moon soil samples, and communicating with Earth. Each task is crucial for the success of the lunar base and future missions to Mars and beyond.

4.2 Missions

Mission No.1:
Transport to Launch Site



Background Story:

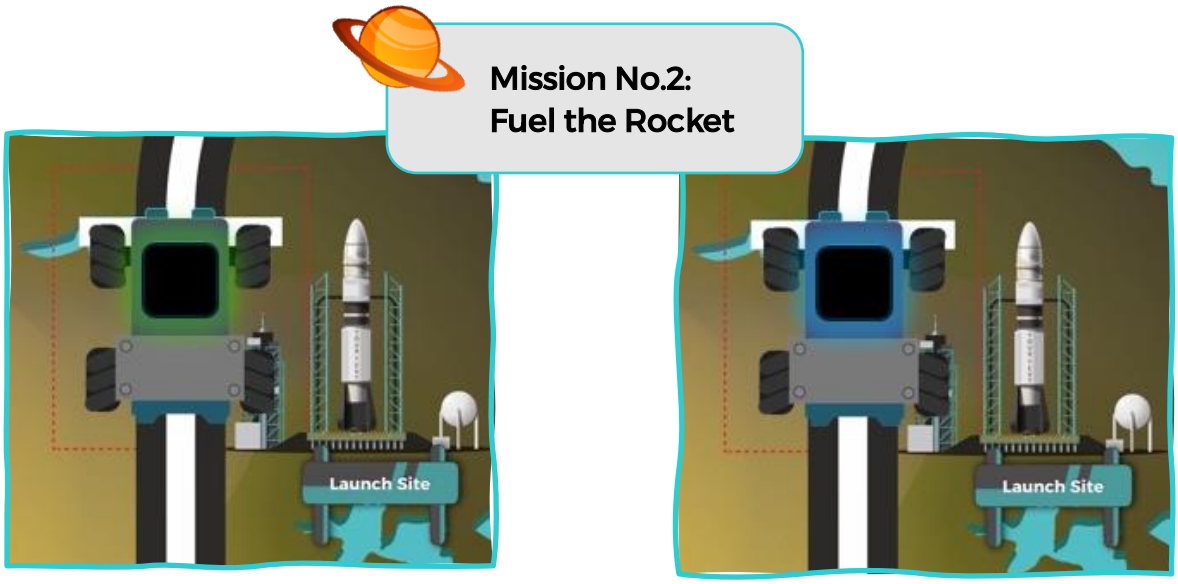
The rocket, built at the Rocket Production Center, needs to be transported to the Launch Site for its mission to the Moon. This transportation phase is crucial as it marks the beginning of the mission and ensures that the rocket is positioned correctly for launch.

Task:

The robot must transport the rocket from either the Rocket Production Center or Space Center to the Launch Site. Extra points are awarded if starting from the Rocket Production Center.

Scoring Criteria:

- Successfully stop within the red area (10 points)
- Start from Rocket Production Center (BONUS 10 points)
- Screen shows successful rocket transport (extra 5 points)
- Remote+ shares launch status (extra 5 points)



Storyline:

Before the rocket can launch, it needs to be fully fueled. This process involves ensuring that the rocket has enough fuel to reach its destination and carry out its mission objectives. The robot plays a vital role in indicating the fuel status and ensuring that the rocket is ready for launch.

Task:

The robot must change the color on the controller from red to green to indicate the fuel status.

Scoring Criteria:

- Successful color change of RGB (10 points)
- Screen shows fuel status change (extra 5 points)
- Remote+ shows fuel level(extra 5 points)

Mission No.3: Moon Launch

Storyline:

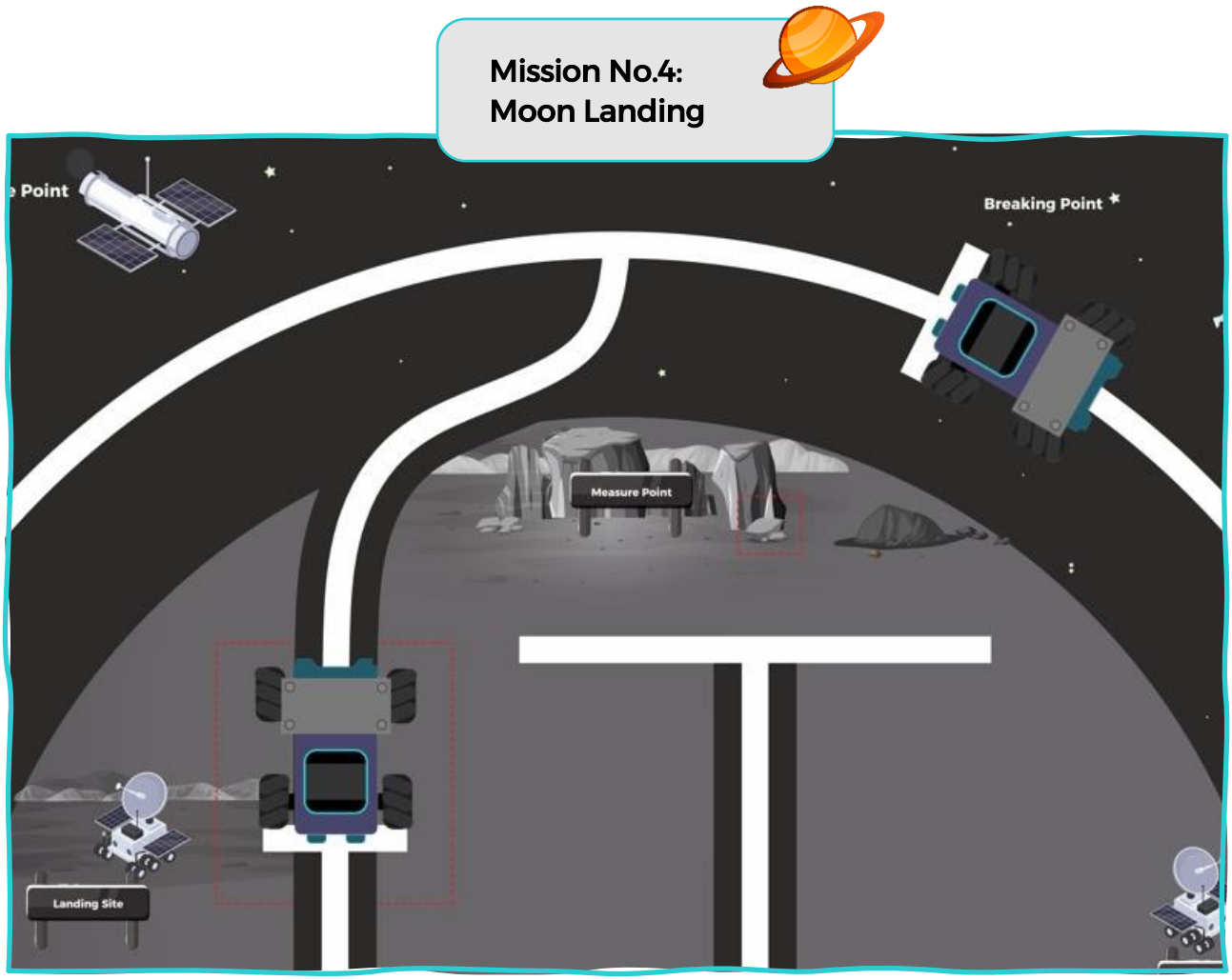
The rocket must follow the launch sequence and reach the Breaking Point to adjust its trajectory towards the Moon. This phase is critical for ensuring that the rocket is on the correct path for a successful lunar landing and mission execution.

Task:

The robot follows the line from the Launch Site to the Breaking Point.

Scoring Criteria:

- Stop at Breaking Point (10 points)
- Screen shows status (extra 5 points)
- Remote+ shares status (extra 5 points)



Storyline:

The rocket lands on the Moon, marking the beginning of its lunar mission. A successful landing is crucial for the continuation of the mission, allowing the robot to carry out various tasks on the lunar surface.

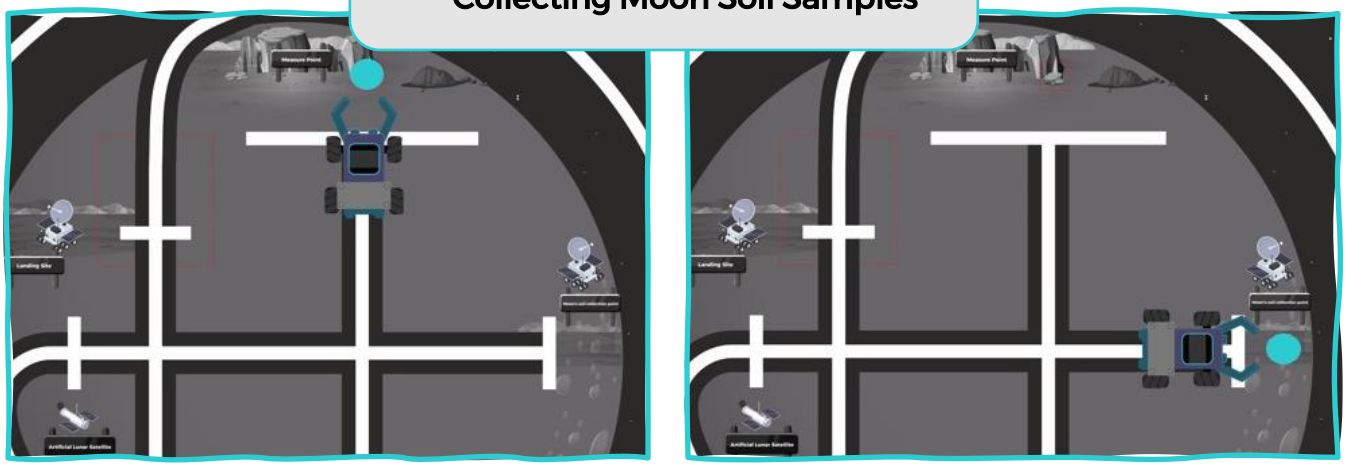
Task:

The robot moves from the Breaking Point to the Moon Landing Site at a reduced speed that what it was moving in before.

Scoring Criteria:

- Move at a reduced speed and stop within the landing site (10 points)
- Screen shows moon landing (extra 5 points)
- Remote+ shares status (extra 5 points)

Mission No.5:
Collecting Moon Soil Samples



Storyline:

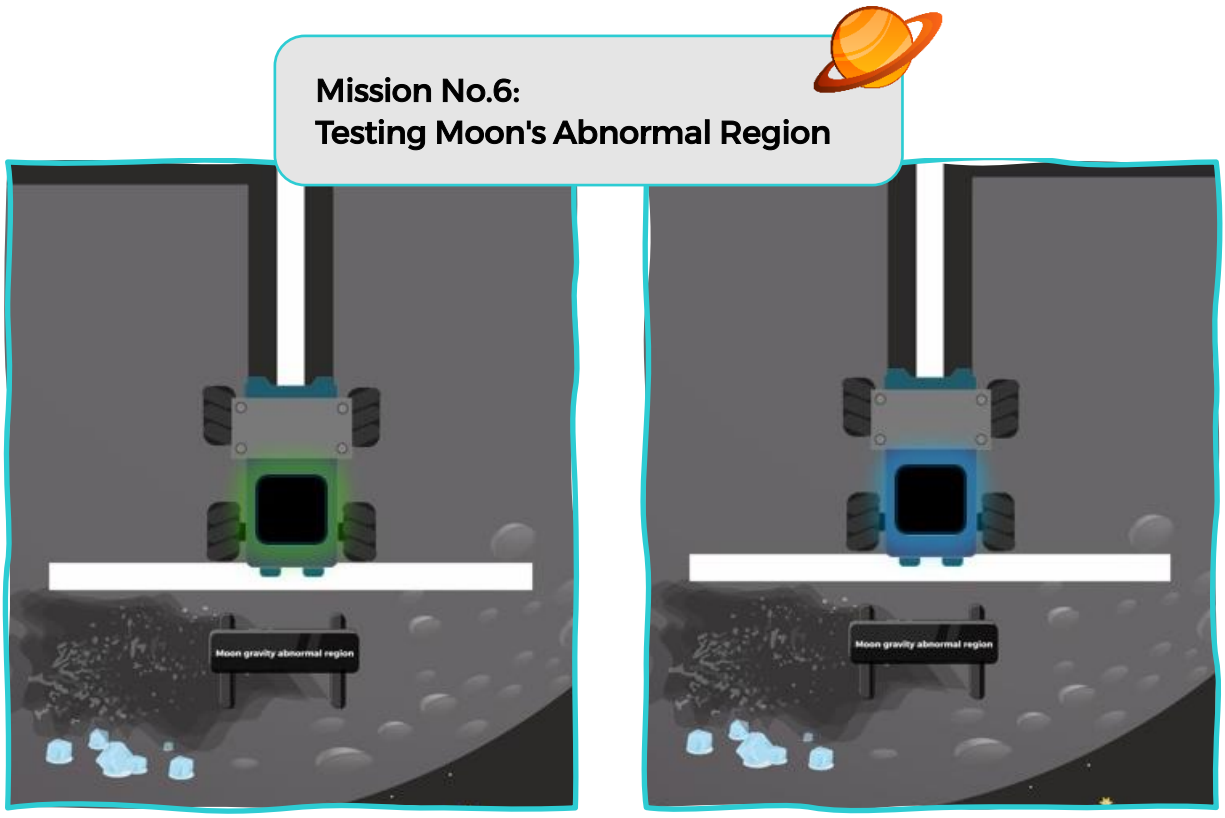
The lunar mission involves collecting valuable soil samples from the Moon's surface. These samples are essential for scientific research, helping scientists understand the Moon's composition and history. The robot must carefully collect and transport these samples, simulating the meticulous work done by lunar rovers and astronauts.

Task:

The robot goes to the measure point, picks up a rock sample, and places it in the moon soil collection point. The sample needs to be dropped within the circular area to get points, with more points awarded for higher accuracy.

Scoring Criteria:

- Drop within the largest circle (10 points)
- Drop within the middle circle (15 points)
- Drop within the smallest circle (20 points)
- Screen shows status (extra 5 points)
- Remote+ shares status (extra 5 points)



Storyline:

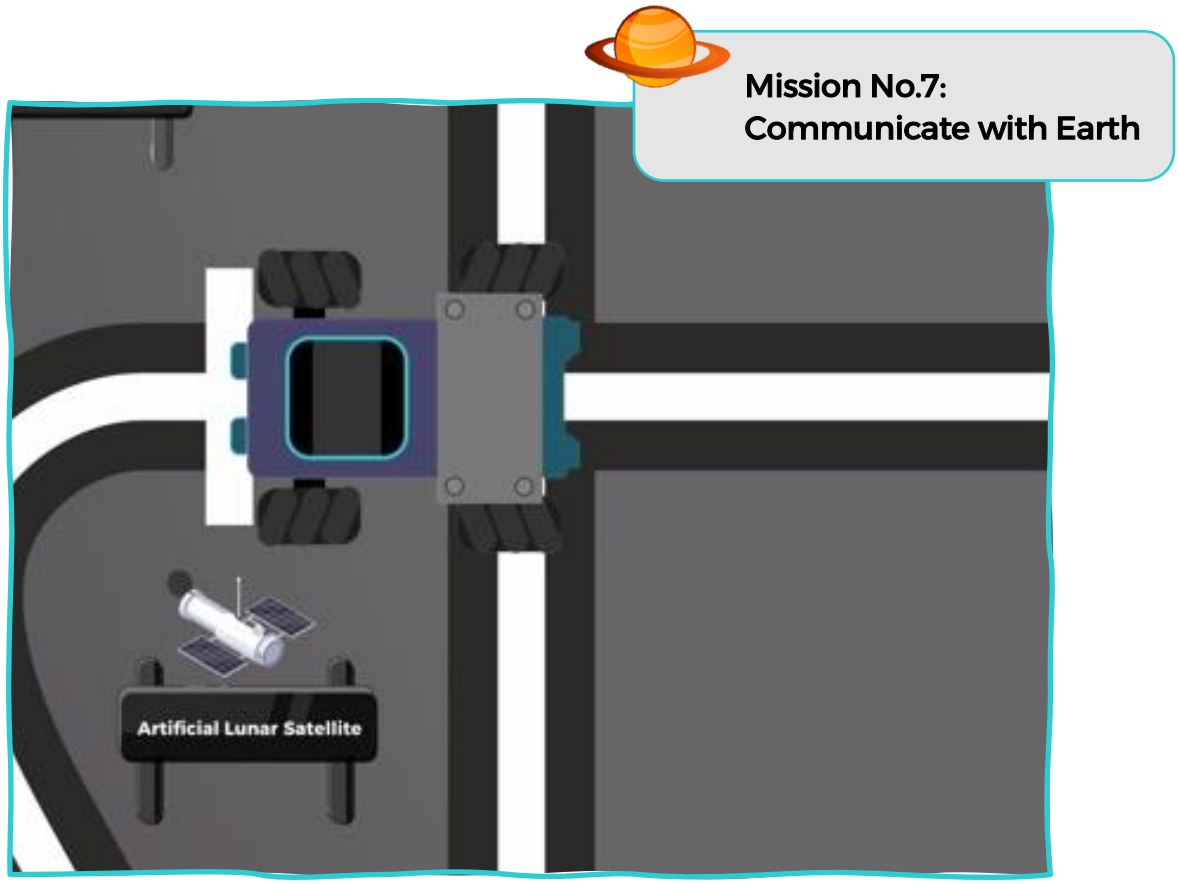
The robot investigates an area with unusual gravitational properties. This mission highlights the exploration and discovery aspects of lunar missions. By testing the Moon's abnormal regions, scientists hope to uncover new insights about the lunar environment. The robot must navigate and conduct experiments in these areas, reflecting the innovative spirit of space exploration.

Task:

The robot goes to the moon gravity abnormal region and changes the LED color and shows the value of the reading on the screen.

Scoring Criteria:

- Successful LED change and reading on the screen (15 points)
- Remote+ shares status (extra 5 points)



Storyline:

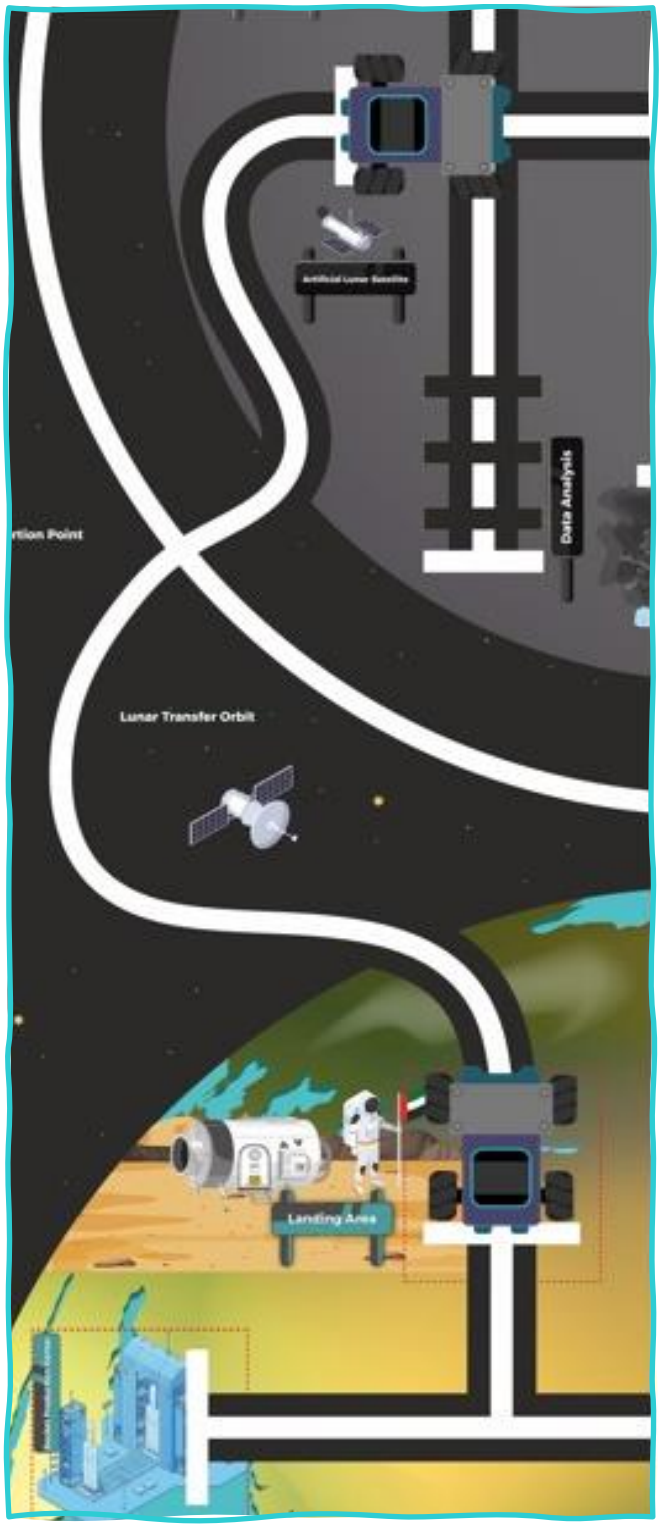
The robot communicates the mission's progress back to Earth using the artificial lunar satellite. Effective communication is crucial for the success of space missions. This task simulates the real-time updates sent by astronauts and rovers to mission control on Earth, ensuring that all mission details are accurately relayed for analysis and decision-making.

Task:

The robot stops at the artificial lunar satellite to communicate with Earth.

Scoring Criteria:

- Successful stop (10 points)
- Screen shows communication (extra 5 points)
- Remote+ shares status (extra 5 points)
- Publish on remote+ the time it took to fly from the launch area to the moon landing site. (BONUS 20 points)



Mission No.8: Returning to Earth

Storyline:

After completing all lunar operations, the robot must ensure a safe return to Earth. This final mission symbolizes the successful completion of the lunar expedition, bringing back valuable data and samples for further study. The robot's journey back represents the culmination of all efforts, ensuring that the mission's findings are safely delivered.

Task:

The robot must go and stop at the landing area.

Scoring Criteria:

- Successful stop within the red area (10 points)
- Screen shows status (extra 5 points)
- Remote+ shares status (extra 5 points)

4.3 Scoring Cards

MCC Novices Scoring Card

MCC Novices Scoring							
Mission	**Base Points**	**Extra Points (Screen UI)**	**Extra Points (Remote+)**	**Bonus Points**	**Max Points**	**Match 1**	**Match 2**
Transport to Launch Site	10	5	5	10	30		
Fuel the Rocket	10	5	5		20		
Moon Launch	10	5	5		20		
Moon Landing	10	5	5		20		
Collecting Moon Soil Samples	10/15/20	5	5		30		
Testing Moon's Abnormal Region	15	5			20		
Communicate with Earth	10	5	5	20	40		
Returning to Earth	10	5	5		20		
All Points	**95**	**40**	**35**	**25**	**200**		
Total Time							
Final Points (Added Points from Match 1 and Match 2)							

Team Captain Signature: _____

Referee Signature: _____

Date: _____

Engineering Notebook Scoring Card

Engineering Notebook Scoring Card		
Section	**Criteria**	**Score (0-5)**
Cover Page	Details are written and design is thoughtful	
Team Introduction	Clear and comprehensive introduction	
Project Overview	Detailed and concise project summary	
Brainstorming Ideas	Documented and diverse ideas	
Research	Thorough research with references	

Planning	Well-structured plan with timelines	
Design Process	Clear design process with visuals	
Hardware Development	Detailed and well-executed hardware development	
Software Development	Comprehensive software development	
Testing	Documented testing with results	
Challenges Faced	Clear description of challenges	
Solutions Implemented	Effective solutions documented	
Final Robot Design	Detailed final design	
Program Code	Well-documented and explained code	
Performance Summary	Clear summary of robot performance	
Team Reflections	Insightful reflections	
Lessons Learned	Valuable lessons documented	
Total Score		

Team Captain Signature: _____

Referee Signature: _____

Date: _____

4.4 Awards

Awards Table for Maker & Coder Novices Category		
Award Category	**Award Name**	**Criteria**
Based on Points	**Champion Award**	Highest score based on missions. Time used as tie-breaker.
	1st Runner-Up	Second highest score based on missions. Time used as tie-breaker.
	2nd Runner-Up	Third highest score based on missions. Time used as tie-breaker.
Based on Engineering Notebook	**Excellence in Engineering Award**	Demonstrates exceptional engineering skills in both hardware and software.
	Creative Problem-Solving Award	Shows outstanding creativity in overcoming challenges.
	Outstanding Documentation Award	Most detailed and well-organized engineering notebook.

5. MCC Pioneers Details

5.1 Introduction

About Maker & Coder Pioneers:

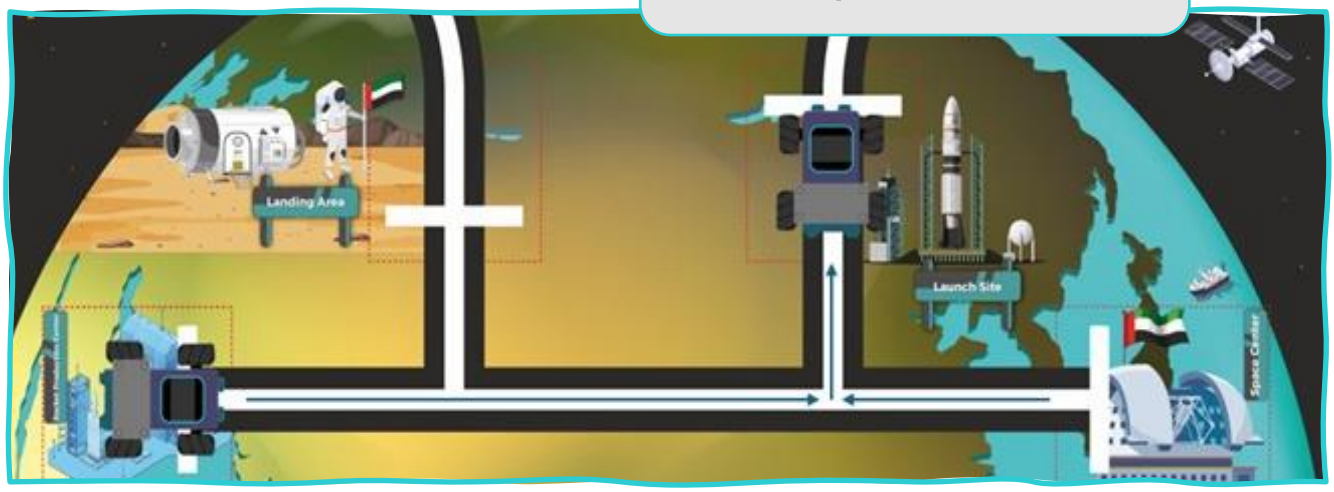
The Maker & Coder Pioneers category is designed for participants aged 13-24, divided into two age groups (13-18 and 18-24). This category offers more advanced challenges in robotics and coding, emphasizing problem-solving, innovation, and the integration of advanced technologies such as AI, IoT, and machine learning.

Background Story:

The year is 2040, and humanity has established a lunar base as a stepping stone for deeper space exploration. The mission of the Maker & Coder Pioneers is to assist in critical operations on the Moon. These operations include transporting rockets, fueling them, launching missions, collecting and analyzing moon soil samples, and communicating with Earth. Each task is crucial for the success of the lunar base and future missions to Mars and beyon.

5.2 Missions

Mission No.1:
Transport to Launch Site



Background Story:

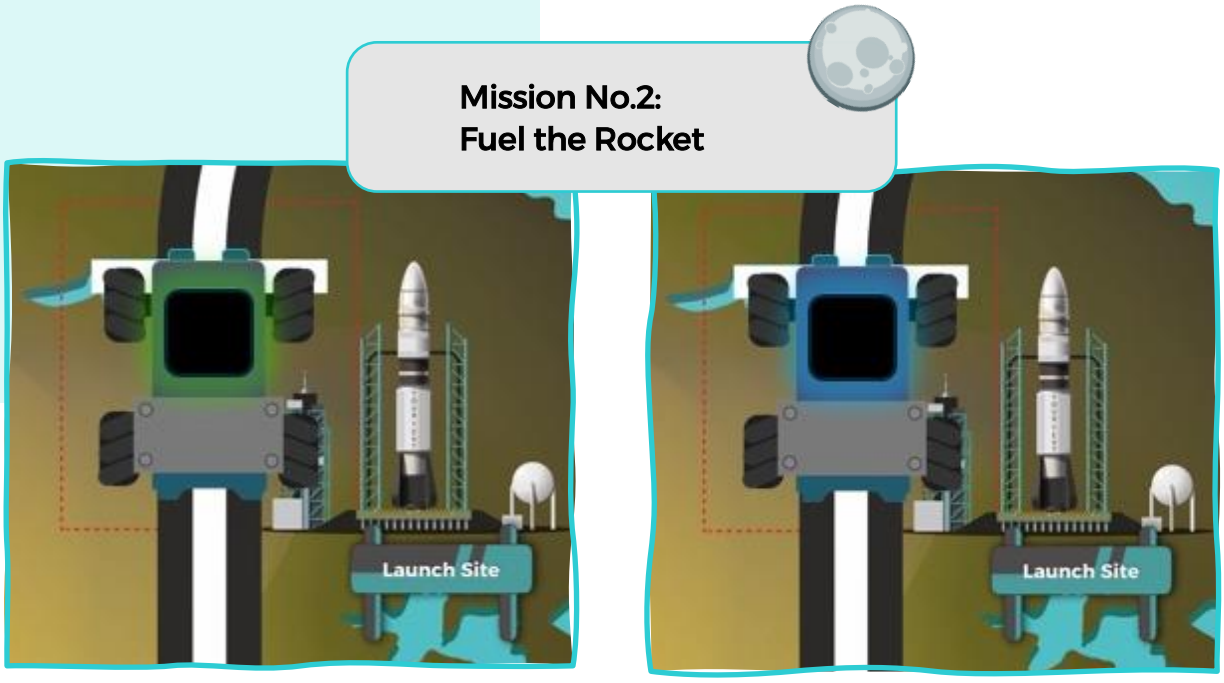
The rocket, built at the Rocket Production Center, needs to be transported to the Launch Site for its mission to the Moon. This transportation phase is crucial as it marks the beginning of the mission and ensures that the rocket is positioned correctly for launch.

Task:

The robot must transport the rocket from either the Rocket Production Center or Space Center to the Launch Site. Extra points are awarded if starting from the Rocket Production Center.

- Successfully stop within the red area (10 points)
- Start from Rocket Production Center (BONUS 5 points)
- Screen shows successful rocket transport (extra 5 points)
- Remote+ shares launch status (extra 5 points)
- MQTT shares launch status on APP (extra 10 points)

Scoring Criteria:



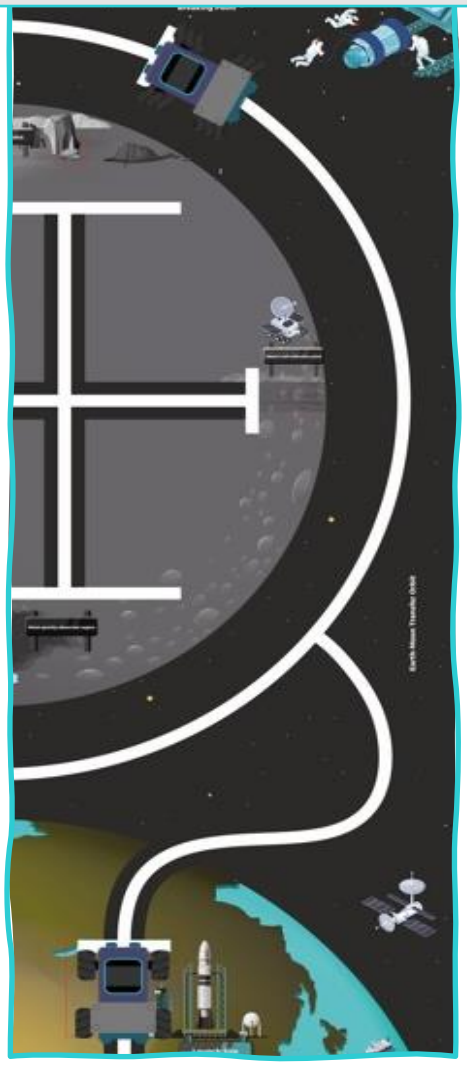
Storyline:

Before the rocket can launch, it needs to be fully fueled. This process involves ensuring that the rocket has enough fuel to reach its destination and carry out its mission objectives. The robot plays a vital role in indicating the fuel status and ensuring that the rocket is ready for launch.

Task:

The robot must change the color on the controller from red to green to indicate the fuel status.

Mission No.3: Moon Launch



Scoring Criteria:

- Successful color change of RGB (10 points)
- Screen shows fuel status change (extra 5 points)
- Remote+ shows fuel level (extra 5 points)
- MQTT shares fuel status on APP (extra 10 points)

Storyline:

The rocket must follow the launch sequence and reach the Breaking Point to adjust its trajectory towards the Moon. This phase is critical for ensuring that the rocket is on the correct path for a successful lunar landing and mission execution.

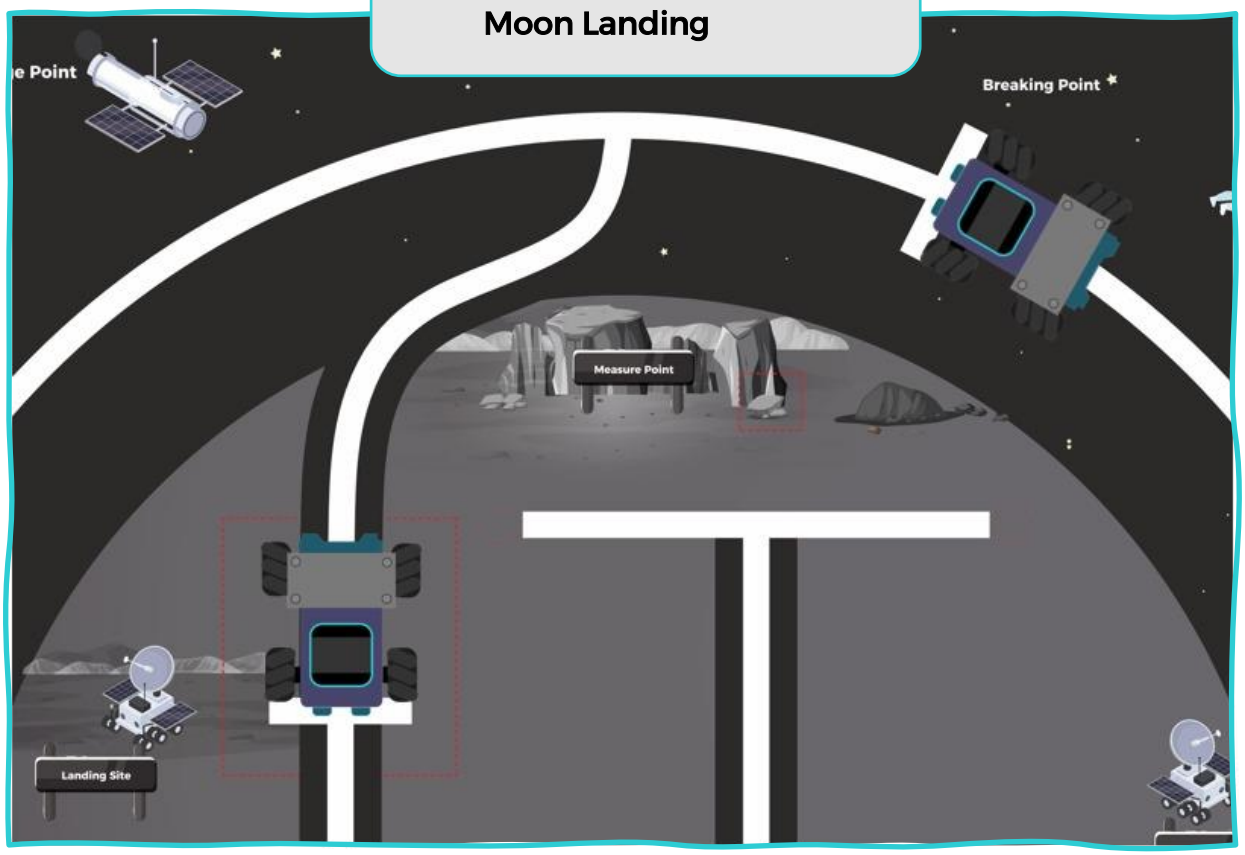
Task:

The robot follows the line from the Launch Site to the Breaking Point after 2 Revolutions around the moon.

Scoring Criteria:

- Stop at Breaking Point after 2 revolutions around the moon (20 points)
- Screen shows status (extra 5 points)
- Remote+ shares status (extra 5 points)
- MQTT shares status on APP (extra 10 points)

Mission No.4:
Moon Landing



Storyline:

The rocket lands on the Moon, marking the beginning of its lunar mission. A successful landing is crucial for the continuation of the mission, allowing the robot to carry out various tasks on the lunar surface.

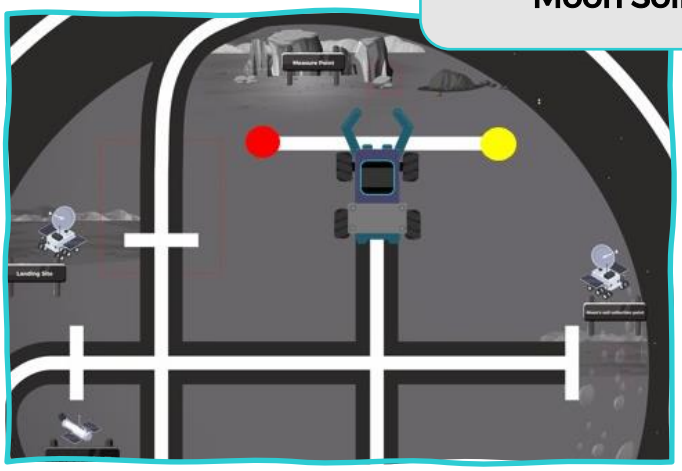
Task:

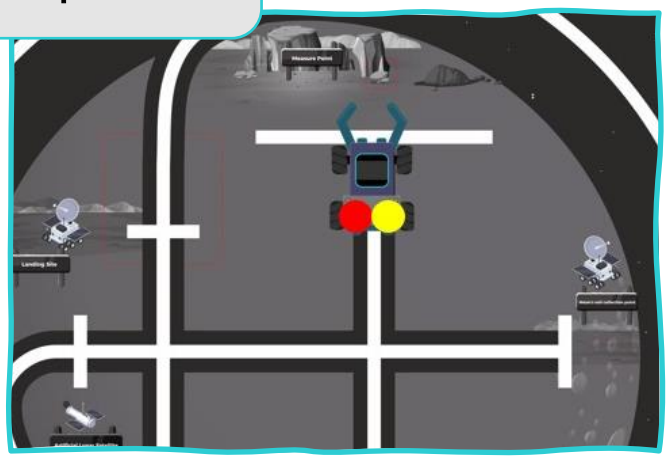
The robot moves from the Breaking Point to the Moon Landing Site.

Scoring Criteria:

- Stop within the landing site (10 points)
- Screen shows moon landing (extra 5 points)
- Remote+ shares status (extra 5 points)
- MQTT shares status on APP (extra 10 points)

Mission No.5: Collecting Moon Soil Samples





Storyline:

The lunar mission involves collecting valuable soil samples from the Moon's surface. These samples are essential for scientific research, helping scientists understand the Moon's composition and history. The robot must carefully collect and transport these samples, simulating the meticulous work done by lunar rovers and astronauts.

Task:

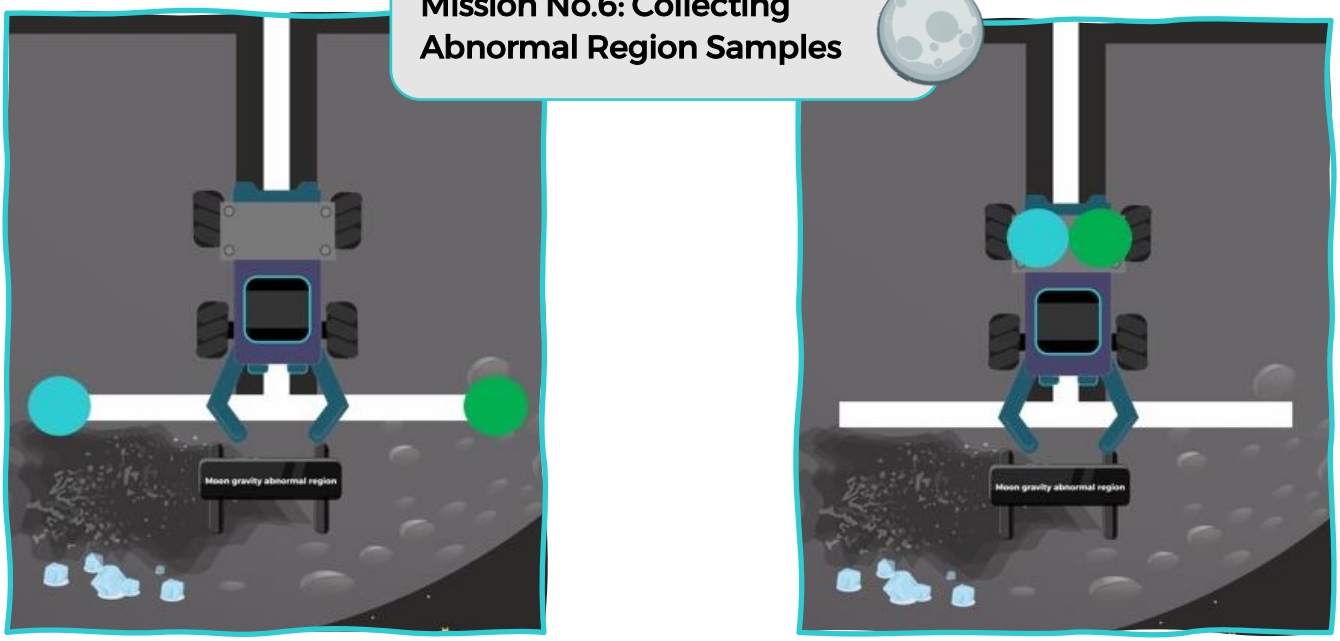
The robot goes to the measure point and pick-up two-coloured samples.

Note: The coloured samples (blue/red/yellow/green) position will be random.

Scoring Criteria:

- Pick up each sample (10 points each)
- Screen shows status of what samples have been collected (extra 5 points)
- Remote+ shares status about samples that have been collected (extra 5 points)
- MQTT shares detailed status of what coloured samples have been collected (extra 10 points)
- If blue is positioned there it is recognized to be picked to the moon soil collection point (using RGB sensor Bonus 10 points) (using AI camera Bonus 15 points)

Mission No.6: Collecting Abnormal Region Samples



Storyline:

The robot investigates an area with unusual gravitational properties. This mission highlights the exploration and discovery aspects of lunar missions. By testing the Moon's abnormal regions, scientists hope to uncover new insights about the lunar environment. The robot must navigate and collect additional samples in these areas.

Task:

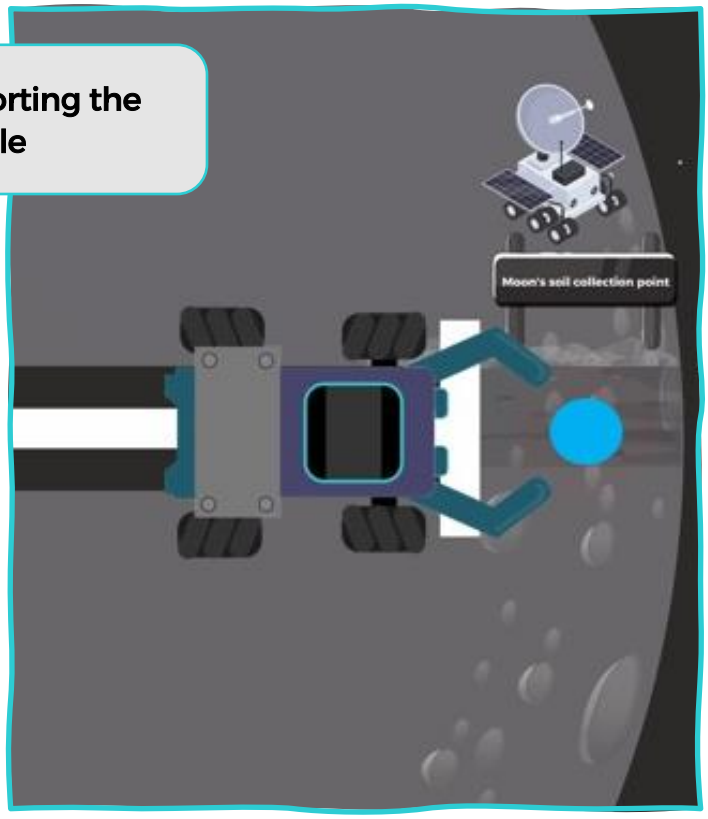
The robot goes to the moon gravity abnormal region and pick-up two-coloured samples.

Note: The coloured samples (blue/red/yellow/green) position will be random.

Scoring Criteria:

- Pick up each sample (10 points each)
- Screen shows status of what samples have been collected (extra 5 points)
- Remote+ shares status about samples that have been collected (extra 5 points)
- MQTT shares detailed status of what coloured samples have been collected (extra 10 points)
- If blue is positioned there it is recognized to be picked to the moon soil collection point (using RGB sensor Bonus 10 points) (using AI camera Bonus 15 point)

Mission No.7: Transporting the Abnormal Soil Sample



Storyline:

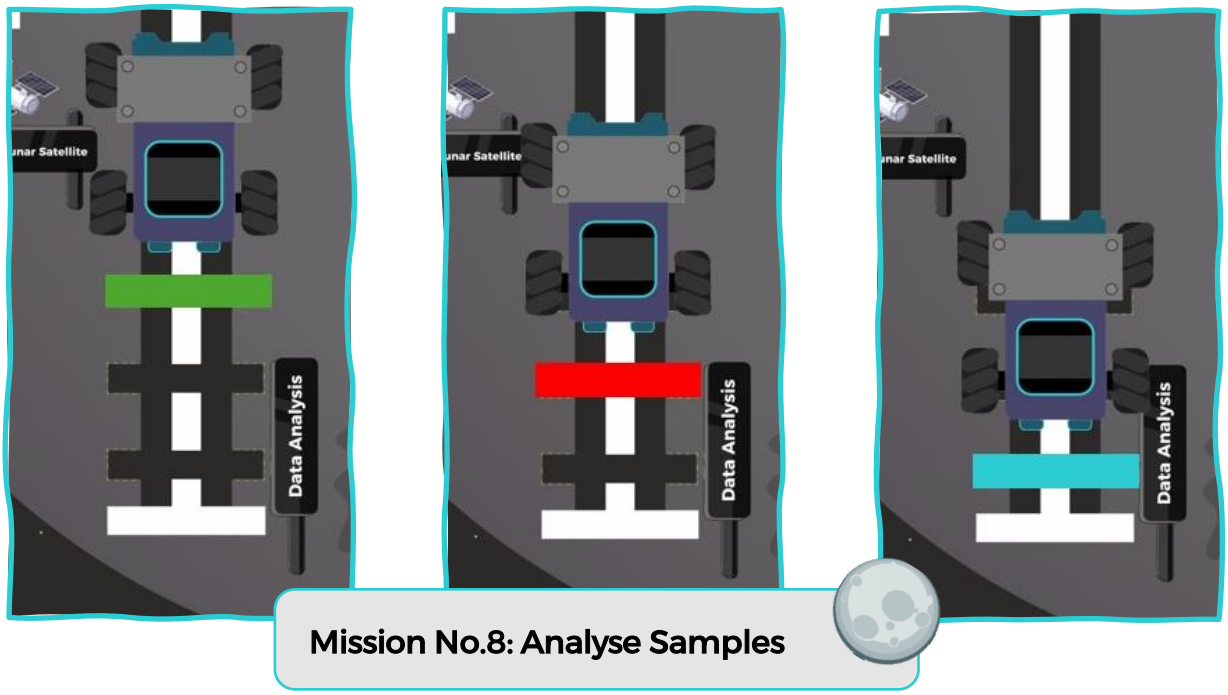
The collected samples need to be placed precisely to ensure accurate analysis. This task emphasizes the importance of precision in scientific research.

Task:

The robot must place the blue sample in the circular area at the moon soil collection point. The more accurate the placement, the more points awarded.

Scoring Criteria:

- Place within the largest circle (10 points)
- Place within the middle circle (15 points)
- Place within the smallest circle (20 points)
- Screen shows status (extra 5 points)
- Remote+ shares status (extra 5 points)
- MQTT shares status (extra 10 points)



Mission No.8: Analyse Samples

Storyline:

The mission's final phase involves analysing the collected data to extract valuable insights. This data analysis is critical for planning future missions and enhancing our understanding of the Moon.

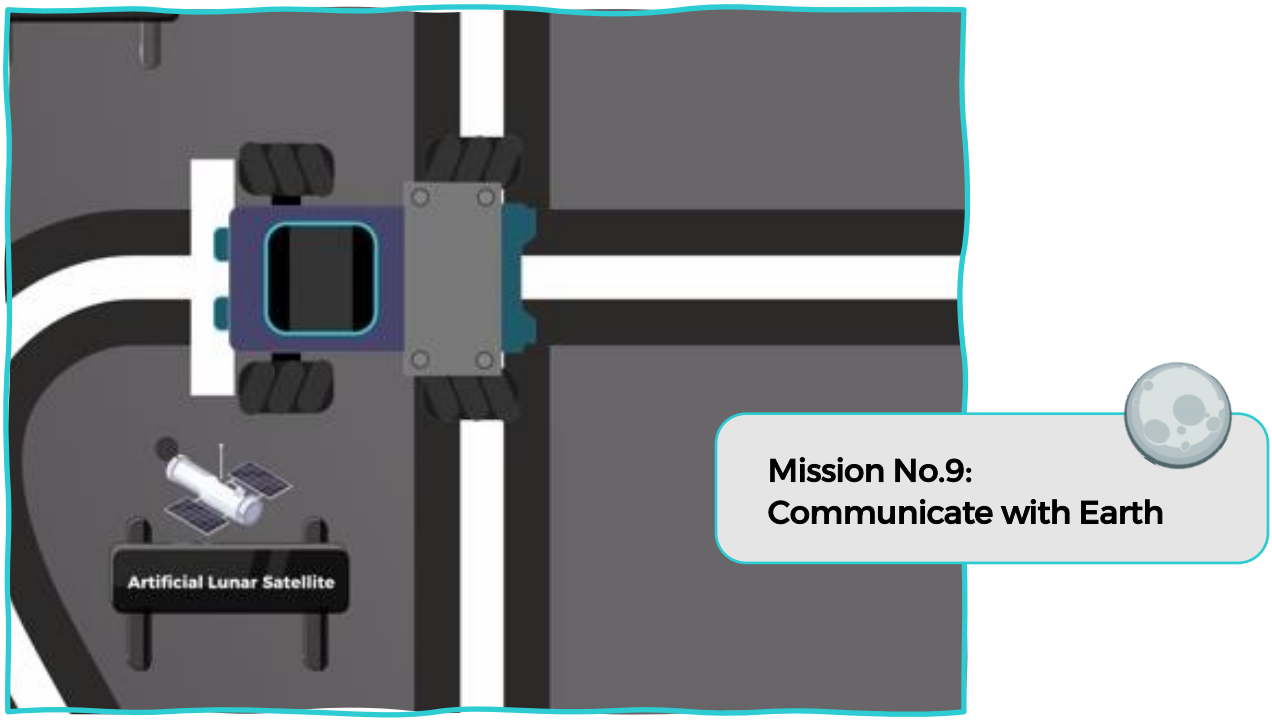
Task:

The robot must analyse the data by identifying the position of a board placed over one of three black areas and display the result (10, 20, or 30) on the controller screen.

Note: The board (red/blue/green) colour will be random.

Scoring Criteria:

- Correctly identify and display data analysis result 10, 20, or 30 points based on board position on the screen (20 points)
- Remote+ shares analysis result (extra 5 points)
- MQTT shares detailed analysis (extra 5 points)
- Showcase the type of data of which colour the board is (using RGB sensor Bonus 10 points) (using AI camera Bonus 20 point)



Storyline:

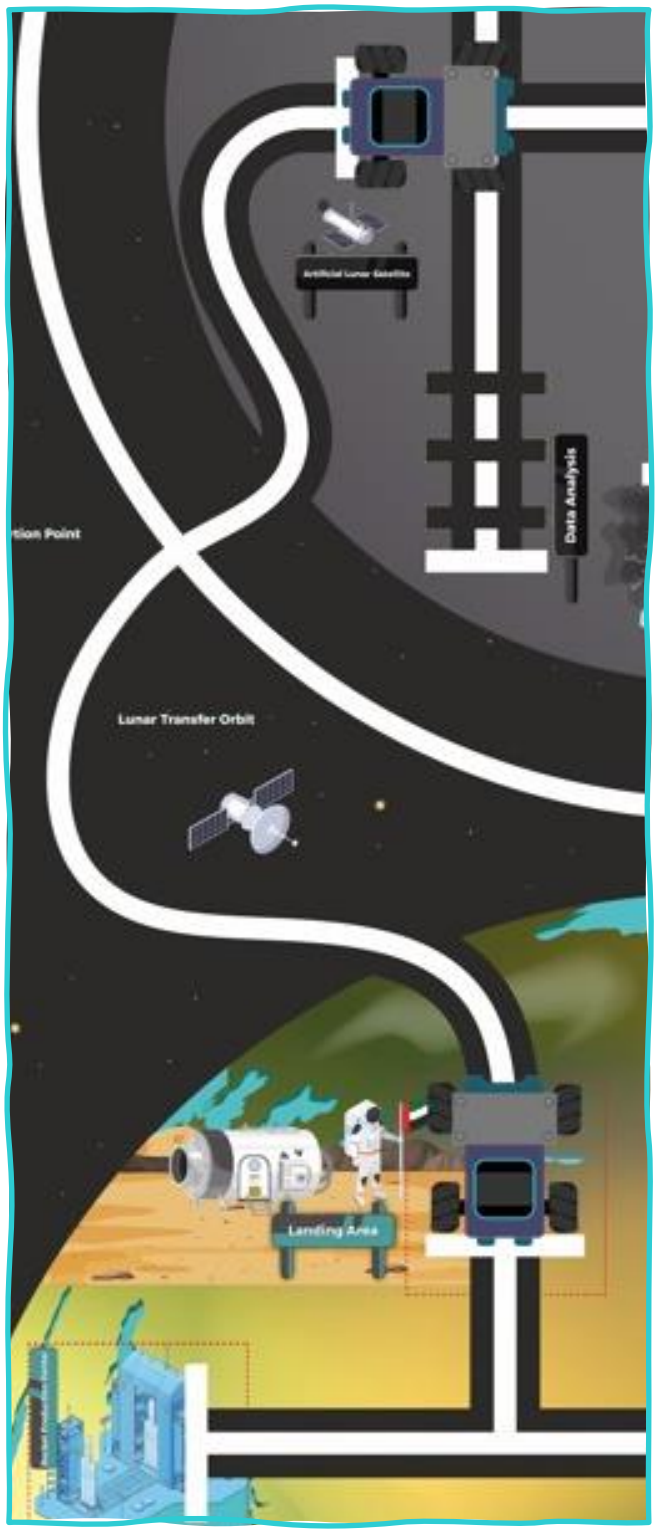
Effective communication is crucial for the success of space missions. The robot must confirm mission status and request permission to return to Earth.

Task:

The robot stops at the artificial lunar satellite to communicate with Earth. Points are awarded only if Remote+ confirms the communication, and the operator must accept the request to proceed.

Scoring Criteria:

- Successful communication confirmed by Remote+ (20 points)
- Share information through Remote + or MQTT about the following details (Bonus 20 points):
    - Time it took the rocket to fly from the launch site to the moon landing area
    - Time it took to finish the moon missions



Mission No.10: Running to Earth

Storyline:

After completing all lunar operations, the robot must ensure a safe return to Earth. This final mission symbolizes the successful completion of the lunar expedition, bringing back valuable data and samples for further study. The robot's journey back represents the culmination of all efforts, ensuring that the mission's findings are safely delivered.

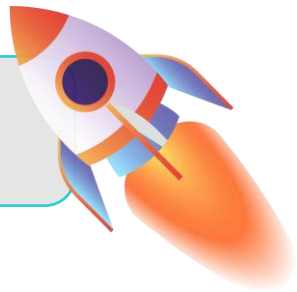
Task:

The robot must go and stop at the landing area.

Scoring Criteria:

- Successful stop within the red area (10 points)
- Screen shows status (extra 5 points)
- Remote+ shares status (extra 5 points)
- MQTT shares status (extra 10 points)

BONUS MISSION:
Data Integration with AWS/Azure



Storyline:

In this advanced stage of the mission, the robot must utilize cloud computing services to store and analyze data collected during the lunar expedition. This step is crucial for leveraging the power of advanced data analytics and ensuring that the data is securely stored and accessible for future missions. By integrating with AWS or Azure, teams can simulate real-world applications of cloud technology in space exploration, showcasing their ability to handle complex data operations.

Task:

At the end of the mission, the robot must use AWS or Azure to transmit the collected data. This includes:

- Status updates of all previous missions.
- Analysis results from the Data Analysis mission.
- Confirmation of communication with Earth and return status.

Scoring Criteria:

- 20 points: Connect to AWS/Azure
  - A Created AWS/Azure Account
  - A Successful Connection from MC 4.0 to AWS/Azure
- 30 points: Data transmission
  - Connect to a database of your choice.
  - Share data of the timeline of the missions done on the moon.
  - Share the data of the result of the data analysis.
- 50 points: AIoT Integration
  - Share data of the position of each coloured block.

5.3 Scoring Cards

MCC Pioneers Scoring Card

MCC Pioneers Scoring								
Mission	**Base Points**	**Extra Points (Screen UI)**	**Extra Points (Remote+)**	**Extra Points (MQTT)**	**Bonus Points**	**Total Points**	**Match 1**	**Match 2**
Transport to Launch Site	10	5	5	10	5	35		
Fuel the Rocket	10	5	5	10		30		
Moon Launch	20	5	5	10		40		
Moon Landing	10	5	5	10		30		
Collecting Moon Soil Samples	20	5	5	10		40		
Collecting Abnormal Region Samples	20	5	5	10		40		
Recognizing the Abnormal Soil Sample	10 or 15					15		
Transporting the Abnormal Soil Sample	10/15/20	5	5	10		40		
Analyse Samples	20		10	10	10 or 20	60		
Communicate with Earth	20				20	40		
Returning to Earth	10	5	5	10		30		
Bonus Mission	50				50	100		
Total Points	**95**	**40**	**50**	**90**	**75**	**500**		
Total Time								
Final Points (Added Points from Match 1 and Match 2)								

Team Captain Signature: _____

Referee Signature: _____

Date: _____

Engineering Notebook Scoring Card

Engineering Notebook Scoring Card		
Section	**Criteria**	**Score (0-5)**
Cover Page	Details are written and design is thoughtful	
Team Introduction	Clear and comprehensive introduction	
Project Overview	Detailed and concise project summary	
Brainstorming Ideas	Documented and diverse ideas	
Research	Thorough research with references	
Planning	Well-structured plan with timelines	
Design Process	Clear design process with visuals	
Hardware Development	Detailed and well-executed hardware development	
Software Development	Comprehensive software development	
Testing	Documented testing with results	
Challenges Faced	Clear description of challenges	
Solutions Implemented	Effective solutions documented	
Final Robot Design	Detailed final design	
Program Code	Well-documented and explained code	
Performance Summary	Clear summary of robot performance	
Team Reflections	Insightful reflections	
Lessons Learned	Valuable lessons documented	
Total Score		

Team Captain Signature: _____

Referee Signature: _____

Date: _____

5.4 Awards

Awards Table for Maker & Coder Pioneers Category		
Award Category	**Award Name**	**Criteria**
Based on Points	**Champion Award**	Highest score based on missions. Time used as tiebreaker.
	1st Runner-Up	Second highest score based on missions. Time used as tiebreaker.
	2nd Runner-Up	Third highest score based on missions. Time used as tiebreaker.
Based on AioT Integration	**AioT Connectivity Award**	Successful Connection to AWS/Azure
	AioT Excellence Award	Full points on the bonus mission
Based on Engineering Notebook	**Excellence in Engineering Award**	Demonstrates exceptional engineering skills in both hardware and software.
	Creative Problem-Solving Award	Shows outstanding creativity in overcoming challenges.
	Outstanding Documentation Award	Most detailed and well-organized engineering notebook.

6. MCC Novices & Pioneers Guidelines

Disciplinary Actions

To ensure a fair and safe competition, disciplinary actions will be enforced when rules are violated. There are four levels of disciplinary actions:

1. **Warning**
    - **Description:** A verbal or written notice indicating a minor rule violation.
    - **Impact:** No points are deducted, but the team is made aware of the violation and is expected to correct the behavior.
2. **Violation**
    - **Description:** Issued for repeated violations or a single more serious violation.
    - **Impact:** A 10-point deduction from the team's score.
3. **Suspension of Robot for Current Match**
    - **Description:** Issued for severe violations or repeated violations after a warning and a violation have been given.
    - **Impact:** The team's robot is suspended for the current match, resulting in zero points for that match. Team can still join for the next matches.
4. **Disqualification**
    - **Description:** Issued for cheating, unsportsmanlike conduct, safety violations, or continuous non-compliance with the rules.
    - **Impact:** The team is disqualified from the entire competition, and all scores are nullified.

Safety Rules

1. **SR1: General Safety**
    - Participants must follow all safety instructions provided by the competition organizers.
2. **SR2: Electrical Safety**
    - Robots must be powered off during adjustments and inspections.
    - Use only approved batteries and power sources.
    - Any exposed wiring must be properly insulated to prevent short circuits and electrical hazards.
3. **SR3: Handling and Movement**

- Robots must be handled with care to avoid damage.
- Only designated team members are allowed to move the robot in and out of the competition area.

4. **SR4: Emergency Procedures**
   - In case of any emergency, follow the instructions of the event staff.
   - Familiarize yourself with the location of emergency exits and first aid kits.

Robot Operation Rules

1. **RR1: Specifications**
   - Robots must not exceed the following size and weight limits:

Specification	Limit
Max Dimensions	320mm x 320mm x 450mm
Max Weight	6 kg
Max Wheel Diameter	70mm
Max Motor Count	4
Max Servo Count	4

   - Only components from the approved list are allowed in the robot construction.
   - The robot must use the MC 4.0 as the controller.
2. **RR2: Restarting the Robot**
   - A robot may be restarted only with the permission of the referee.
   - The team must request a restart by saying "Request Reboot."
   - Unauthorized restarts will result in a violation then suspension.
3. **RR3: Wi-Fi Connection**
   - Teams are responsible for providing their own Wi-Fi connection for Remote+ and AWS/Azure integration.
   - Interference with other teams' Wi-Fi signals is prohibited and will result in complete disqualification from the current and future competitions.
4. **RR4: Use of Phones**
   - Phones are allowed only for the purpose of displaying Remote+ or AWS/Azure data.

- Only one approved phone is to be used during the completion.
- The operator is the only one allowed to use the approved phone.
- Phones must be placed in a visible location and should not be used for communication during the match.

5. **RR5: Controller Specifications**
   - The controller must be programmed using one of the following **software**:

UIFlow	MATLAB	ROS
Python	Arduino IDE	

6. **RR6: Team Details Form**
   - Teams must complete a Team Details Form before starting the matches.
   - The form must be carried and presented at the start of each match. Otherwise they will not be allowed to start the match and they will be marked absent until the next match.

Participants Operation Rules

1. **PR1: Conduct and Behaviour**
   - Participants must always conduct themselves with professionalism and respect.
   - Any form of cheating or unsportsmanlike behaviour will not be tolerated and team will be disqualified from the competition.
2. **PR2: Competition Area**
   - Only team members and authorized personnel are allowed in the competition area.
   - Teams must adhere to the schedule and be present at their designated times.
3. **PR2: Arena Area**
   - Only the Operator and the Observer is allowed around the arena area during the match.
   - Any other person entering the arena without permission will be issued a warning and then result in being asked outside of the coemption area.
4. **PR3: Communication**
   - Verbal communication between team members is allowed, but no external assistance is permitted.

- Teams must notify the referee if they need to leave the competition area for any reason.

5. **PR4: Handling Equipment**
    - Teams must handle all equipment carefully and return it in good condition.
    - Any damage to competition equipment must be reported immediately.

Award Rules

1. **AR1: Award Eligibility**
    - A team can only win one major award (e.g., Champion, 1st Runner-Up).
    - Teams that win a major award are not eligible for other awards.
2. **AR2: Award Prioritization**
    - If a team qualifies for multiple awards, the higher priority award will be given.
    - Priority order: Champion > 1st Runner-Up > 2nd Runner-Up > Other Awards.
3. **AR3: Distribution of Awards**
    - Awards will be distributed based on the final scores and performance criteria.
    - Ties will be broken based on the time taken to complete missions.
    - Awards based on points can only be given to 1 team each. Other Awards can be given to up to 2 teams each If there are ties.

Appeal Rules

1. **AP1: Scoring Disputes**
    - Teams may appeal scoring decisions within 30 minutes of the score being posted.
    - Appeals must be submitted in writing to the head referee.
    - If there is no dispute at the match and team captain signed the scoring sheet, an appeal will not be accepted.
2. **AP2: Appeal Process**
    - The appeal will be reviewed by a panel of three judges.
    - The decision of the appeal panel is final.
3. **AP3: Grounds for Appeal**
    - Appeals can be made on grounds of scoring errors, rule violations, or procedural errors.

7. MCC Innovators

7.1 Introduction

About Maker & Coder Innovators:

The Maker & Coder Innovators competition is designed to challenge participants to apply their skills in robotics, AI, IoT, and STEAM to solve real-world problems creatively and effectively. This category is divided into three age groups:

- Young Innovators: Ages 7-12
- Junior Innovators: Ages 13-18
- Senior Innovators: Ages 18-24

Participants will demonstrate their projects, which should align with the annual theme and subthemes, showcasing their innovation and technical skills. The competition emphasizes the integration of AI and IoT technologies and encourages participants to think critically about sustainable development and technological advancement.

Annual Theme: Smart World

The 2024 theme for the Maker & Coder Innovators competition is "Smart World," focusing on creating innovative solutions to improve our living environment through AI, IoT, and sustainable practices. This theme is divided into three subthemes:

Sub-Themes:

Smart Sustainable Cities Participants are tasked with developing projects that address urban challenges such as traffic congestion, pollution, and resource management. Utilizing AI and IoT, these projects should aim to make cities more efficient, sustainable, and livable, aligning with SDG Goal 11 (Sustainable Cities and Communities).

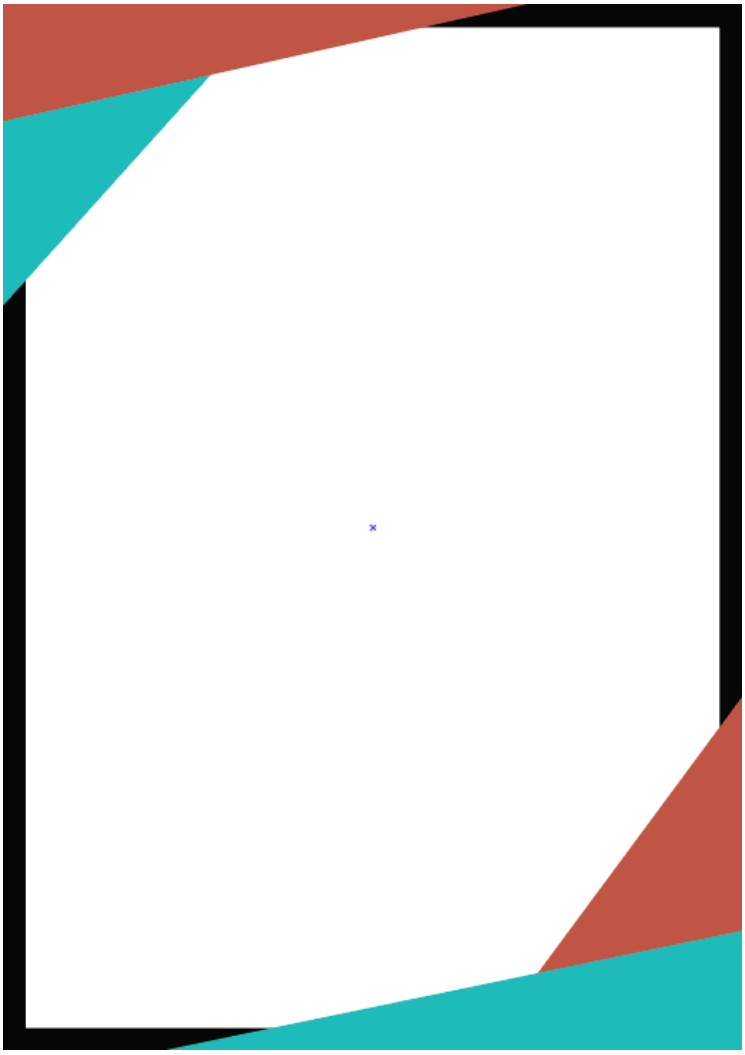
Climate Resilience and Renewable Energy This subtheme focuses on creating solutions to mitigate and adapt to climate change impacts. Projects may include AI-driven climate monitoring systems, IoT-based renewable energy management, and innovative approaches to reducing carbon footprints, aligning with SDG Goals 7 (Affordable and Clean Energy) and 13 (Climate Action).

Smart Schools Projects under this subtheme should aim to enhance the educational experience through technology. This includes creating smart classrooms, IoT-based school management systems, and AI-driven personalized learning tools. The goal is to promote inclusive and equitable quality education, aligning with SDG Goal 4 (Quality Education).

7.2 Equipment Specification

Category	Specification
Controller	MC 4.0
Motors & Actuators	Maximum of 4 DC motors with a rated voltage of 6-12V Servos with a torque of up to 10 kg-cm Stepper motors with a resolution of at least 1.8° per step
Sensors	Any sensors up to 5
Construction Materials	Plastic, aluminum, or composite materials 3D-printed components Laser-cut parts from wood, acrylic, or similar materials Fasteners such as screws, nuts, and bolts
Programming languages	Support for both block-based and script-based programming (Python preferred for advanced tasks) UIflow Python Matlab Arduino IDE ROS
Poster Dimensions	100 x 100 CM Must use Maker & Coder Innovators Template

Maker & Coder Innovators Poster Template

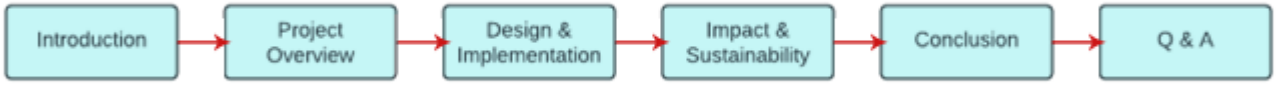


7.3 Project Presentation

This section outlines the process for the project presentation phase of the Maker & Coder Innovators competition. It details the steps teams should follow to ensure a clear, engaging, and informative presentation of their projects.

The project presentation is the most important aspect of the Maker & Coder Innovators competition. It provides teams with the opportunity to showcase their innovative projects, explain their design and implementation processes, and demonstrate the impact of their solutions. Each team will have 10-15 minutes for their presentation, followed by a Q&A session with the judges.

Presentation Structure



Introduction (2 Minutes)

- Briefly introduce the team members and the project.
- Provide an overview of the project's objective, inspiration, and relevance to the competition's annual theme and subthemes: Sustainable Cities, Climate Resilience and Renewable Energy, and Smart School.

Project Overview (3 Minutes)

- Describe the project in detail, including the problem it addresses and the solution proposed.
- Explain how the project aligns with the Sustainable Development Goals (SDGs).

Design and Implementation (5 Minutes)

- Discuss the design process, including brainstorming, planning, and development stages.
- Highlight the technologies used, particularly AI and IoT integrations.
- Demonstrate the functionality of the project, showcasing key features and components.

Impact and Sustainability (5 Minutes)

- Explain the potential impact of the project on the target community or environment.
- Discuss the project's sustainability and scalability.

Conclusion (2 Minutes)

- Summarize the key points of the presentation.
- Reiterate the significance of the project and its contribution to the theme.

Q&A Session (3 Minutes)

- Judges will ask questions to gain a deeper understanding of the project.
- Teams should be prepared to answer questions related to their design choices, technical challenges, and project impact.

7.4 Assessment Criteria

Innovation & Design Dimension

Sub-dimension	Rating 0	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5
Originality	No originality, entirely copied	Minimal originality, slight modifications	Some originality, basic modifications	Good originality, significant modifications	High originality, innovative approach	Exceptional originality, groundbreaking innovation
Creativity	No creativity, very mundane	Minimal creativity, basic ideas	Some creativity, moderate ideas	Good creativity, innovative ideas	High creativity, unique and engaging ideas	Exceptional creativity, exceptionally engaging and unique ideas
Practicality	Not practical, cannot be implemented	Very limited practicality, major issues	Somewhat practical, several issues	Good practicality, minor issues	High practicality, easily implementable	Exceptional practicality, highly feasible and impactful

Hardware & Software Technology Dimension

Sub-dimension	Rating 0	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5
Structural Stability	No stability, falls apart	Very poor stability, major issues	Some stability, several issues	Good stability, minor issues	High stability, very stable	Exceptional stability, extremely robust
Component Use	No appropriate use of components	Very poor use of components, inappropriate	Somewhat appropriate use of components	Good use of components, mostly appropriate	High use of components, very appropriate	Exceptional use of components, perfectly appropriate
Programming Complexity	No complexity, very basic	Very minimal complexity, basic logic	Some complexity, moderate logic	Good complexity, well-structured logic	High complexity, advanced logic	Exceptional complexity, highly advanced and optimized logic

AI & IoT Integration Dimension

Sub-dimension	Rating 0	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5
Effective Use of AI	No AI used	Basic AI usage, very limited	Some AI usage, partially effective	Good AI usage, mostly effective	High AI usage, very effective	Exceptional AI usage, highly effective and innovative
Effective Use of IoT	No IoT used	Basic IoT usage, very limited	Some IoT usage, partially effective	Good IoT usage, mostly effective	High IoT usage, very effective	Exceptional IoT usage, highly effective and innovative
Integration of AI & IoT	No integration of AI and IoT	Minimal integration, barely functional	Some integration, partially functional	Good integration, mostly functional	High integration, very functional	Exceptional integration, perfectly functional and highly innovative

Communication & Presentation Dimension

Sub-dimension	Rating 0	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5
Communication Skills	Very poor communication, not understandable	Poor communication, barely understandable	Some communication issues, partially understandable	Good communication, mostly clear	High communication, very clear and engaging	Exceptional communication, extremely clear, engaging, and professional
Poster Creativity	No creativity, very basic	Minimal creativity, basic design	Some creativity, moderate design	Good creativity, well-designed	High creativity, very well-designed and engaging	Exceptional creativity, highly engaging, and beautifully designed
Team Contribution	No team contribution, one person dominated	Minimal team contribution, mostly one person	Some team contribution, uneven roles	Good team contribution, mostly even roles	High team contribution, very even roles	Exceptional team contribution, perfectly balanced and collaborative

Scoring Sheet

Dimension	Sub-Dimension	Score (0-5)
Innovation & Design	Originality	
	Creativity	
	Practicality	
Hardware & Software Technology	Structural Stability	
	Component Use	
	Programming Complexity	
Ai & IoT Integration	Effective use of AI	
	Effective use of IoT	
	Effective use of AioT	
Commuincation & Presentation	System Architecture	
	User Interface Design	
	Hardware Design	
Judge's Expertise Rating		
Total Score		
Judge's Comments:		

Judge's Name: _____

Judge's Signature: _____

Date: _____

7.5 Awards

Award Name	Criteria
Maker & Coder Champion Award	Highest total score across all dimensions.
Innovation Award	Highest score in the Innovation & Design dimension.
Technical Excellence Award	Highest score in the Hardware & Software Technology dimension.
Best Presentation Award	Highest score in the Communication & Presentation dimension.
Sustainability Award	Best integration of sustainable practices in the project that align with SDGs
Cloud Integration Award	Highest total score across Ai & IoT Integration dimension.

7.6 Guidelines

This section outlines the guidelines for the MCC Innovators category, ensuring fair play, safety, and clarity throughout the competition. Each guideline is categorized to cover different aspects of the competition.

Presentation Setup and Conduct

- **PRS-001**: Teams must stand by their project display 10 minutes before the scheduled presentation time.
- **PRS-002**: Each team will have 10-15 minutes for their presentation, followed by a Q&A session with the judges.
- **PRS-003**: Participants should use professional language during their presentation.
- **PRS-004**: Posters and visual aids must be clear, creative, and directly related to the project.
- **PRS-005**: Teams are responsible for bringing any necessary equipment for their presentation.

Poster and Visual Aids

- **PST-001**: Posters should be no larger than (120 x 120 cm).
- **PST-002**: All posters must be securely mounted on provided display boards.
- **PST-003**: Posters should include the project title, team name, team members, and a summary of the project.
- **PST-004**: Posters must be used on the Maker & Coder Innovators Template

- **PST-005**: Ensure all visual aids are appropriate for all audiences and do not contain any offensive material.

Project Content and Requirements

- **PJT-001**: The project must align with one of the subthemes: Sustainable Cities, Climate Resilience and Renewable Energy, or Smart Schools.
- **PJT-002**: Projects should demonstrate the integration of AI and IoT technologies.
- **PJT-003**: The project must have a practical application and show potential for real-world impact.
- **PJT-004**: Teams must submit an engineering notebook documenting their design process, challenges faced, and how they were overcome.

Equipment and Setup

- **EQT-001**: Teams must bring their own laptops, presentation clickers, and other necessary equipment.
- **EQT-002**: Any IoT devices used in the project must comply with safety standards and not pose any hazards.
- **EQT-003**: Teams must ensure all equipment is set up and tested before the presentation begins.
- **EQT-004**: Power strips and extension cords will be provided; teams should ensure all devices can be connected within the provided power limits.

Judging Criteria

- **JD-001**: Presentations will be judged based on the following dimensions: AI & IoT Integration, Communication Skills, Poster Creativity, Team Contribution, and Project Impact.
- **JD-002**: Each dimension has specific sub-dimensions that will be scored on a scale from 0 to 5.

Awards

- **AWD-001**: Awards will be given for the top three projects, with additional awards for Best Communication, Best Poster, and Best Team Collaboration.
- **AWD-002**: Awards cannot be shared between teams; each team is eligible for only one award.
- **AWD-003**: In case of a tie, the judges will review the tied projects and decide based on overall presentation and impact.