RULE BOOK CHAPTER 1

THE ROBOTIVA HACKATHON 1.0 COMPETITION

INTRO

Robotiva Hackathon is the annual robotics competition organized by Creativa Ismailia Hub, targeting students, hobbyists, and junior professionals. As the inaugural event, Robotiva aims to establish a tradition of yearly hackathons, progressively increasing the complexity of challenges and technical requirements to participate and succeed. Our vision is to bridge the gap between theoretical robotics education and practical application, offering an engaging, competitive, and enriching experience in the serene city of Ismailia.

Creativa Innovation Hubs is a national initiative launched by the Ministry of Communications and Information Technology (MCIT) in Egypt. Implemented through the Technology Innovation and Entrepreneurship Center (TIEC), the initiative aims to support students, entrepreneurs, small and medium-sized enterprises, and startups in becoming key players in driving digital transformation across various industry sectors.

This document serves as a comprehensive guide for enrolling in Robotiva, outlining the requirements and submission procedures. Adherence to the rules and guidelines specified herein is mandatory; non-compliance may result in disqualification or point deductions, at the discretion of the competition management.

Chapter 1 defines the general guidelines, enrollment and eligibility criteria, design limitations, and protocols for submission and communication with the competition organizers.

Chapter 2 will detail the arena designs, competition day guidelines, and specific rules, and will be published prior to the event.

1. ENROLLMENT & GENERAL GUIDELINES

1.1. ELIGIBILITY CRITERIA:

- Participants must be at least 16 years of age.
- Participants could be undergraduate students, recent graduates or STEM/High school students.
- Hobbyist are welcome to participate: graduates or professionals from a non-technical related background.
- Participants must enroll within a team through the Robotiva hackathon enrollment form before the registration deadline in order to qualify for the initial list of competition.
- While the competition is open to all undergraduate students, it is particularly relevant to those studying:

1. Engineering Disciplines: Such as Mechanical, Electrical, Electronics, Mechatronics, and Aerospace Engineering.
2. Computer Science and Information Technology: Including Software Engineering, Artificial Intelligence, and related fields.
3. Robotics and Automation: Specialized programs focusing on robotics, control systems, and automation technologies.
4. Other Related Fields: Physics, Mathematics, Industrial Design, or any discipline where students have acquired relevant skills applicable to robotics.

1. ENROLLMENT & GENERAL GUIDELINES

1.2. TEAM BUILDING & COMPOSITION

- The team must be 3-5 members.
- Each team must have a team leader who will be the main point of contact with the hackathon management.
- While there is no forced structure for your team, we highly recommend that each team member be assigned a clear role with clear responsibilities, ex:

1. Mechanical designer.
2. Software Developer.
3. Hardware Designer.
4. Business Developer.

- Teams are not required to be affiliated with educational institutions, organizations, student activities, or companies.
- Each team must be given a name which complies with ethical and cultural standards.

1. ENROLLMENT & GENERAL GUIDELINES

1.3. CODE OF CONDUCT

The Robotiva Hackathon is committed to fostering an environment of integrity, respect, and professionalism. All participants are expected to adhere to the following standards:

- Act with integrity, honesty, and reliability.
- Behave in a respectful and professional manner with all event participants, attendees, and staff members.
- Refrain from engaging in any form of bullying, harassment, use of profane or insulting language, or any actual or threatened violence.
- Ensure the safety of all participants by following event guidelines and promptly reporting any unsafe behavior to event or local leadership.
- Exhibit Gracious Professionalism® at all times, encouraging high-quality work, valuing others, and respecting individuals and the community.
- Follow all rules as listed in the current game manual(s) and adhere to event-specific guidelines.
- Respect the facility and equipment provided at the event, ensuring proper use and care.
- Operate as student-centered teams, ensuring that students are actively involved in all aspects of their robot's design, build, and programming.

1. ENROLLMENT & GENERAL GUIDELINES

- Avoid any actions that would provide an unfair advantage, such as interference with competition materials or other teams' robots.
- Report any unethical behavior, rule violations, or safety concerns to the hackathon management promptly.

Non-compliance with these standards may result in disciplinary action, including disqualification from the competition. By participating in the Robotiva Hackathon, all team members agree to uphold these principles, contributing to a fair, safe, and respectful environment for all.

1. ENROLLMENT & GENERAL GUIDELINES

1.4. ROBOTIVA SUPPORT

The Robotiva Hackathon management is dedicated to creating an environment that empowers you to excel by providing:

- Access to a team of experienced mentors who will assist you throughout the development and manufacturing of your robots.
- Exclusive discounts at Creativa Hub Ismailia's Fabrication Lab, equipped with state-of-the-art tools such as 3D printers, laser cutters, CNC routers, single and double-layer PCB manufacturing facilities, and electronics workbenches. These resources can be rented hourly or daily to test and refine your robot's electronic and software subsystems.
- Clear communication channels to promptly address any questions or clarify ambiguities regarding the rule book or the competition in general.

2. TECHNICAL CHALLENGES

This edition of the competition comprises three distinct challenges, each designed to test the capabilities of your team and robot. Success in these challenges is essential for maximizing your team's score.

In addition to dynamic events, evaluations will encompass various static-based activities throughout your Robotiva journey—from registration to the final stage.
Detailed information on evaluation criteria and submission guidelines is provided in the relevant section of this rule book.

2. TECHNICAL CHALLENGES

2.1. LINE-FOLLOWING CHALLENGE:

- This challenge requires autonomous operation.
- The course is circular, featuring a combination of straight paths, broad curves, and sharp turns to rigorously test your robot's design and algorithms.
- Teams must position their robot at the starting line and refrain from any form of control or communication during the challenge.
- Each team will participate individually in this challenge.
- Performance is timed; the robot completing the course in the shortest time will receive full points, with other teams' scores proportionally adjusted.
- Comprehensive details, including track layout, dimensions, and surface materials, will be provided in Chapter Two of the rules.

2. TECHNICAL CHALLENGES

2.2. OBSTACLE AVOIDANCE CHALLENGE:

- The robot must navigate the arena automatically without human intervention.
- The arena is square-shaped, containing multiple obstacles of varying dimensions and shapes.
- Teams are to position their robot at the designated start line and must refrain from any form of control or communication with the robot during the challenge.
- Each team will undertake this challenge separately, ensuring an isolated performance assessment.
- The robot is required to continuously navigate the arena, avoiding obstacles for a specified duration.
- Contact or collision with any obstacle will result in a deduction of points; each instance incurs a specific penalty.
- Prolonged inactivity or stoppage of the robot during the challenge will lead to point reductions or potential disqualification from the challenge.
- Robots completing the designated period without collisions or excessive stoppages will receive full points for this challenge.
- Comprehensive details, including arena design, obstacle dimensions, penalty values for collisions, and permissible idle time, will be provided in Chapter Two of the rules.

2. TECHNICAL CHALLENGES

2.3. PICK & PLACE CHALLENGE

- This challenge requires manual control of robots.
- While autonomous completion is permitted, no additional points will be awarded for autonomous operation in this iteration of the competition.
- Teams must designate up to two operators responsible for controlling the robot during this challenge.
- Operators will control the robot from a specified area overlooking the arena.
- Teams are tasked with picking objects from a designated area within the arena and placing them in a specified target area.
- Objects dropped during transit will not be counted; teams must retrieve a new object from the pickup area.
- Multiple teams will participate concurrently in this challenge within the same arena.
- Collisions with other robots will result in point deductions, with the deducted points awarded to the affected team.
- Exploiting collision rules to gain points contravenes the Robotiva Code of Conduct and may lead to disqualification.
- A start signal will commence the challenge, which will run for a specified duration.

2. TECHNICAL CHALLENGES

- Teams earn points based on the number of objects successfully transported from the pickup to the placement area within the designated period.
- Objects will have various shapes corresponding to specific placements in the target area.
- Further details, including arena layout, floor materials, and object shapes and dimensions, will be outlined in Chapter Two of the rules.

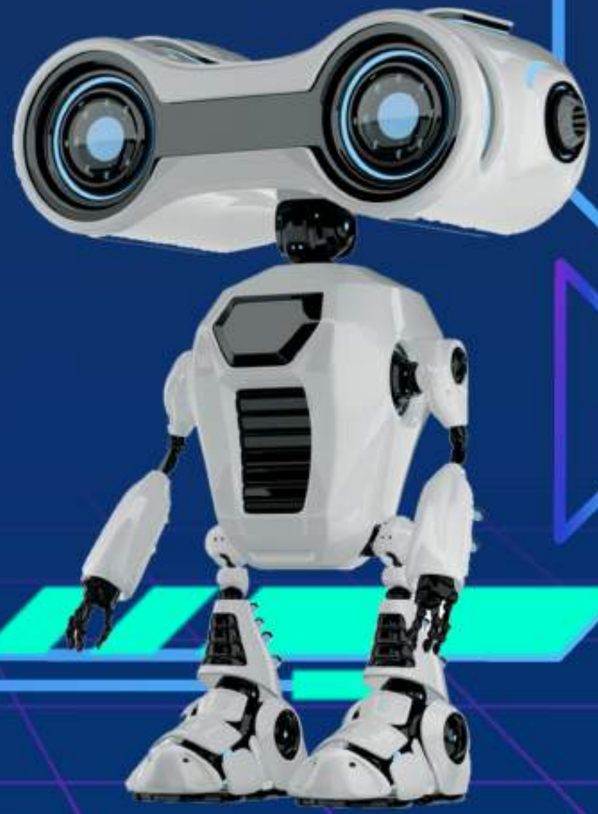
3. SYSTEM DESIGN & LIMITATIONS

This section will outline the robot system requirements and limitations.

3.1. MECHANICAL SYSTEM:

3.1.1. Dimensions:

- The robot length must not exceed 50 cm and that includes the frame and or any accessories, wires, auxiliary parts.
- The robot width must not exceed 30 cm and that includes the frame and or any accessories, wires, auxiliary parts.
- The robot height must not exceed 20 cm excluding the robot arm and gripper(s).
- The robot arm length must not exceed 100 cm including the gripper.
- Wheels' diameter must not exceed 20 cm.
- The robot's weight must not exceed 6.5 Kg.



3. SYSTEM DESIGN & LIMITATIONS

3.1. MECHANICAL SYSTEM:

3.1.2. Frame:

- The robot must have a frame that holds all the components and other subsystems.
- The frame material must support all the loads and operation scenarios of the robot without failures, crack or fractures.
- Using wood as the material of the frame is prohibited.
- Main frame assemble must be less than 4 pieces.
- Frame parts must be assembled together with screws and nuts.
- The usage of glue, zip ties, duct tapes to assemble or connect the main frame parts is prohibited.

3.1.3. Body:

- The robot main frame, wires and internal components must be covered.
- Limitations on the cover material, shape, dimensions are released for simplicity and easiness for this iteration of the competition.
- The body must be fixed during robot operation.
- The body must not be excessively deformable.

3. SYSTEM DESIGN & LIMITATIONS

3.1. MECHANICAL SYSTEM:

3.1.4. Wheels Configuration:

- The robot must have at least 3 contact patches.
- The robot must have at least 2 drive wheels.
- The robot wheels mounting must be done so that there will be a clearance of at least 10 mm from the ground.

3.1.5. Robot Arm & Gripper:

- The robot must be equipped with an arm to qualify for the pick and place challenge.
- The robot arm should have at least 3 degrees of freedom including the gripper degrees of freedom.
- The robot arm must be designed so that it could withstand up to 50 grams objects in its far point of the gripper.
- The material of the robot arm and the gripper must withstand all scenarios of operation without failures, crack or fractures.

3. SYSTEM DESIGN & LIMITATIONS

3.2. ELECTRICAL SYSTEM:

3.2.1. Drivetrain:

- The robot must have at least two drive motors.
- The power of a single motor must not exceed 60 W
- The speed of a single motor must not exceed 800 RPM with gears included.
- Motors must be properly mounted on the robot main frame.
- Using glue, zip ties, duct tapes to mount motors is prohibited.
- Motor selection must be verified with a proper motor sizing calculation and documentation.

3. SYSTEM DESIGN & LIMITATIONS

3.2. ELECTRICAL SYSTEM:

3.2.2. Batteries:

- The robot must be powered with a portable source of power.
- Usage of non-rechargeable batteries is not allowed.
- Powering up your robots from a laptop, tablet or any mobile device is prohibited.
- Batteries capacity must be calculated so that it can cover all three challenges without charging.
- Batteries must have a charging plug, disassembling batteries for charging is not an approved design.
- Once the first challenge starts all teams will be prevented from charging their robots, battery charging during the event may cause disqualification from the competition.
- Charging plugs must be properly fixed and not dangle from the robot while in operation.
- Developing a BMS (Battery management system) is not mandatory but will be rewarded with bonus scores.
- Batteries selection must be verified with a proper battery sizing calculations and documentation.

3. SYSTEM DESIGN & LIMITATIONS

3.2. ELECTRICAL SYSTEM:

3.2.3. Wiring:

- All wires must be labeled using a text-based or color-based approach.
- Breadboards are not allowed for wiring and must therefore not be present in your system beyond prototyping.
- All wires must be properly Isolated and strictly fixed.
- Robots with uninsulated, lossy or messy wiring won't qualify for the dynamic challenges.
- PCBs are not mandatory but highly encouraged.
- Wire sizes, PCB track widths selection must be verified with proper sizing calculations and documentation.

3. SYSTEM DESIGN & LIMITATIONS

3.3. CONTROL SYSTEM:

3.3.1. Controller:

- The robot must have a controller/microcontroller.
- Selection of the robot controller must be verified with proper selection documentation.
- Controller programming after the start of the first challenge is prohibited.
- The controller must be properly mounted to the robot frame.
- A Colling method whether passive or active must be provided to the controller.
- The team is allowed to power up their controller from secondary source, however it must be properly mounted and must be portable and rechargeable.
- Powering up the controller from a laptop, tablet or any mobile device is not allowed.

3. SYSTEM DESIGN & LIMITATIONS

3.3. CONTROL SYSTEM:

3.3.2. Software & Control Algorithms:

- The robot must be capable of performing all the challenges simultaneously without the need to program the controller each time.
- FOTA (Flashing over the air) is prohibited after the first challenge starts.
- The robot control algorithm must include a means to switch operation modes whether using software or hardware.
- The usage of ROS (Robot operating system) is prohibited for this iteration of the competition.
- The robot must have a control dashboard and or a remote.
- Plagiarism while developing your software system must be avoided as it breaches Robotiva code of conduct.

3. SYSTEM DESIGN & LIMITATIONS

3.4. COMMUNICATION SYSTEM:

- The communication between the operator and the robot must be done wirelessly.
- Communication with the robot is only allowed in the manual challenge.
- The only exception for communicating with the robot in autonomous challenges is for data logging or telemetry.
- In case of using Bluetooth as your communication protocol interference with other robots must be avoided.
- Communication module frequency must not exceed 400 Khz.
- Communication module range must not exceed 500 meters.

4. SAFETY

4.1. GENERAL SAFETY GUIDELINES:

- All participants must refrain from dangerous acts that may cause harm to others.
- Safety equipment must be used while manufacturing the robot.
- Always keep distance from manufacturing machinery.
- Always unplug the electrical circuit from power when wiring or debugging.
- Stepping into any of the challenge arenas may cause disqualification of the member and penalty to the team.
- Charging/power plugin during the event day must be coordinated with the facility representatives or competition management.

4. SAFETY

4.2. MECHANICAL SAFETY:

- The robot mechanical design must not have any sharp edges, Sharp edges must be covered with rubbers or a protective material.
- The robot main frame must be tested using stress analysis software to be included in the design document.
- All the mechanical parts must be securely mounted.

4.3. ELECTRICAL SAFETY:

- The robot electrical circuit must be fused.
- The fuse selection must be verified with proper calculations and documentation.
- The robot must be equipped with a power on/off switch that is easily accessible to the team members and the competition management team.
- The battery assembly must be securely sealed and mounted.
- All wires must be insulated.
- Microcontroller placement and mounting must be away from motors and batteries.
- Battery assembly must be properly fixed.
- Batteries must not be overcharged or discharged
- Batteries must not be charged unattended.

5. COST & ENTREPRENEURSHIP

In addition to the technical challenges, the Robotiva Hackathon emphasizes the importance of cost management and entrepreneurial acumen.
Participants are expected to demonstrate not only technical proficiency but also the ability to manage resources effectively and develop sustainable business models.

5. COST & ENTREPRENEURSHIP

5.1. COST MANAGEMENT:

- Teams must adhere to a predefined budget for their projects, promoting efficient resource utilization and cost-effective decision-making.
- Detailed records of all expenditures related to the project must be maintained and submitted for evaluation.
- Participants are encouraged to implement value engineering principles, optimizing functionality while minimizing costs.
- A detailed and well-structured BOM(Bill-of-materials) will be requested from each team.
- Each team must engage in a cost discussion or presentations to evaluate the cost-effectiveness of their robot.
- The score will be given based on the quality of the cost presentation, creative methods to save cost, and the usage of local components.

5. COST & ENTREPRENEURSHIP

5.2. ENTREPRENEURSHIP EVALUATION:

- Teams are required to create a comprehensive business plan outlining the market potential, commercialization strategy, and scalability of their robotic solution.
- Participants will present their business concepts to a panel of judges, simulating real-world investor pitches and demonstrating their entrepreneurial skills.
- An in-depth analysis of the target market, including customer needs, competitive landscape, and potential barriers to entry, should be conducted and included in the business plan.
- Teams should address the sustainability and environmental impact of their solutions, reflecting modern business ethics and responsibility.

6. SUBMISSIONS

All required submissions must be submitted before the declared deadline, failing to do so may cause a deduction of points or disqualification from the competition.

6.1. INITIAL REGISTRATION FORM:

- Each team should fill and submit the initial registration form in order to express their interest for joining the competition.
- At this stage the team should assign a leader to be the point of contact with competition.
- The registration form requires a basic information and contacts with the team and team members.

6.2. Design Report:

Each team should submit a design report to showcase their approach to designing and development of the robot and to qualify for the shortlisted teams.

6. SUBMISSIONS

6.2. DESIGN REPORT:

6.2.1. Mechanical system:

- The DR must include the accurate dimensions of the robot.
- The DR must include the frame parts and assembly.
- The DR must showcase by proof how each rule in the rule book is achieved.
- All the engineering drawings must be clear with dimensions on it.
- The DR must include Isometric views of the robot.
- All photos must be in high quality.
- The motor sizing calculations must be provided.
- Robot Arm calculations and assembly must be included.

6. SUBMISSIONS

6.2. DESIGN REPORT:

6.2.2. Electrical system:

1. Overview of the Electrical System

- **Purpose:** Briefly describe the goals of the electrical system in the robot's operation.
- **Components:** List the main electrical subsystems (e.g., drivetrain, battery, control system, and wiring).

2. Drivetrain Design

Motors:

- Number of motors used.
- Motor specifications (e.g., power rating ≤ 60 W, speed ≤ 800 RPM with gears).
- Verification of motor sizing calculations.
- Mounting details (must avoid glue, zip ties, and duct tape).

Gears: Integration with the drivetrain for speed and torque optimization

6. SUBMISSIONS

3. Power Supply

Battery System:

- Type of battery used (must be rechargeable).
- Capacity calculation to support all three challenges without recharging.
- Mounting and safety features (e.g., charging plug, fixed assembly).

Power Management:

- Description of power distribution and load balancing.
- Optional Battery Management System (BMS) and its functionality if included.

4. Wiring System

Labeling and Organization:

- Method used for wire labeling (text or color-based).
- Layout ensuring insulation and organization.

Prohibited Practices:

- Ensure no breadboards are used in the final design.
- Adherence to safety standards for wire insulation and secure mounting.

6. SUBMISSIONS

Sizing Calculations: Document wire gauge and PCB track width sizing with proper calculations.

5. Control System

Controller:

- Type and specifications of the controller/microcontroller.
- Mounting and cooling method.
- Power supply source for the controller (must be portable and rechargeable).

Control Algorithms: Overview of pre-programmed algorithms and operation modes.

Software Tools: Details of any software or hardware used to switch between modes.

6. Safety Measures

Fusing: Fuse specifications and verification calculations.

Switches: Placement and accessibility of the on/off switch.

Battery Assembly: Secure mounting and protection measures.

6. SUBMISSIONS

7. Compliance with Rules

Rule Validation: Provide evidence (e.g., simulations, tests) demonstrating compliance with Robotiva electrical rules.

Innovations: Any additional features or enhancements implemented for bonus scores.

8. Diagrams and Visuals

Schematics:

- Detailed electrical wiring diagrams.
- Circuit design and PCB layouts (if used).

Photos: High-quality images of the electrical components, labeled and annotated.

Calculations: Include motor, battery, wire, and fuse sizing calculations.

6. SUBMISSIONS

6.3. Cost report :

Executive Summary

Brief overview of your cost management strategy.

Total budget used versus the competition's budget limit.

1. Highlight any innovative cost-saving measures.
2. Bill of Materials (BOM)
3. Create a comprehensive table listing all components and materials used in the robot, including:
4. Item Description: Name and purpose of the component (e.g., "DC Motor for drivetrain").
5. Quantity: Number of each item used.
6. Unit Price: Cost of one unit of the item.
7. Total Price: Quantity × Unit Price.
8. Supplier Name: Where the component was purchased (local or international source).
9. Notes: Additional details, such as discounts or reuse from previous projects.

6. SUBMISSIONS

6.4. Business model

1. Product Overview

- **What is it?** A robot designed for [specific function, e.g., automation or logistics].
- **Why it's unique?** Affordable, efficient, and user-friendly.

---

2. Problem and Solution

- **The Problem:** [Briefly describe the issue, e.g.,]
- **Our Solution**: A robot that automates tasks, improving speed and accuracy.

---

3. Target Market

- **Who will buy it?** Small businesses, industries, or schools needing automation.
- **Market Size:** Growing demand for affordable robotics in Egypt.

---

4. Revenue Model

- **How we earn:**
  - Direct sales.
  - Maintenance and support services.

6. SUBMISSIONS

5. Cost Structure

- **Main Costs:** Materials, assembly, and software development.
- **Cost-saving:** Local sourcing and streamlined design.

---

6. Competitive Edgel

- **Why us?** Cheaper and easier to use than alternatives.

---

7. Growth Potential

- Start with local markets and expand into industries like logistics, education, and manufacturing.

---

8. **Financials**

- **Estimated Price:** [e.g., 20,000 EGP per robot].
- **Profitability:** Break-even after selling [X] units.

7. EVALUATION CRITERIA

The evaluation will be divided into key categories, each emphasizing specific aspects of the robot's performance, design, and presentation.
The scoring will be out of 550 points, distributed as follows:

1. ROBOT PERFORMANCE (300 POINTS)

Line-Following Challenge (100 points):

- Speed and efficiency: Completing the course in the shortest time (90 points).
- Adherence to the line without deviation or stops (10 points).

Obstacle Avoidance Challenge (100 points):

- Successful navigation without collisions (90 points).
- Continuous movement without stoppage or idle time (10 points).

Pick & Place Challenge (100 points):

- Number of objects successfully transported and placed in target areas (80 points).
- Accuracy in object placement and avoidance of collisions (20points).

7. EVALUATION CRITERIA

2. TECHNICAL DESIGN (100 POINTS)

Mechanical System (40 points):

- Adherence to design rules (e.g., dimensions, materials, assembly).
- Robustness and durability of the mechanical structure.
- Innovation in mechanical design.

Electrical System (30 points):

- Compliance with power, motor, and wiring requirements.
- Proper calculations for motor sizing, battery capacity, and fuse selection.
- Overall safety and neatness of the electrical system.

Control System (30 points):

- Effectiveness of the control algorithms in handling challenges.
- Quality of the software design and documentation.
- Functionality and usability of the control dashboard.

7. EVALUATION CRITERIA

3. COST MANAGEMENT AND ENTREPRENEURSHIP (150 POINTS)

Cost Management (50 points):

- Adherence to the budget and efficient resource utilization.
- Completeness and clarity of the Bill of Materials (BOM).
- Innovative cost-saving strategies.

Business model (100 points):

- Feasibility and scalability of the robotic solution.
- Quality of the business plan and presentation.
- Consideration of sustainability and environmental impact.

4. Bonus Points (Up to 30 points)

Development of a Battery Management System (BMS) (20 points).
Integration of advanced features (e.g., innovative algorithms, unique hardware solutions) (10 points).

8. TIMELINE

- **10/1–15/1:** Initial planning and team setup.
- **16/1–30/1:** Design phase with added focus on compliance with rulebook dimensions, weight, and safety.
- **1/2:** initial design report, BMC, cost report.
- **3/2 Filtration short list**
- **3/2–10/2:** Fabrication and assembly.
- **11/2–18/2:** Testing and optimization, with additional focus on implementing bonus features.
- **19/2–20/2:** Finalize reports and submit.
- **21/2–24/2:** Presentation preparation and mock challenges.
- **27/2:** Competition day.

9. ROBOTIVA MANAGEMENT TEAM & COMMUNICATION

Eng. Khaled Eyada
KAAF Managing Director
📞 +20 115 066 6224

Eng. Mohamed Safwat
Operations Manager
📞 +20 128 604 4156

✉️ Email: info@kaaf.site

10. PARTNERS

IEEE Suez Canal University Student Branch is the main partner of the Robotiva Hackathon 1.0 competition

IEEE
Suez Canal University
Student Branch

CREATIVA
مراكز إبداع مصر الرقمية

THANK YOU