

# RASH TEAM

## ROBOCUP SOCCER LIGHTWEIGHT

FROM NATIONAL CHAMPIONS TO GLOBAL COMPETITORS — UAE'S VISION IN ROBOCUP SOCCER

### ABSTRACT

We are a team of passionate youth representing the UAE in RoboCup Junior Soccer. Over the past two years, we designed, built, and programmed autonomous soccer robots to compete nationally and internationally, including representing the UAE in Sydney and Moscow.

Our robots evolved through multiple prototypes, each improving in accuracy, control, and speed. With a strong focus on AI, real-time sensing, and teamwork, we aim to contribute to the global RoboCup community while developing future-ready skills in robotics and programming.



### TEAM MEMBERS



Mohamed Megahed



Abdullah Almazmi



Omar Alshehhi



Yousef Aldhuhoori

### ACHEIVEMENTS

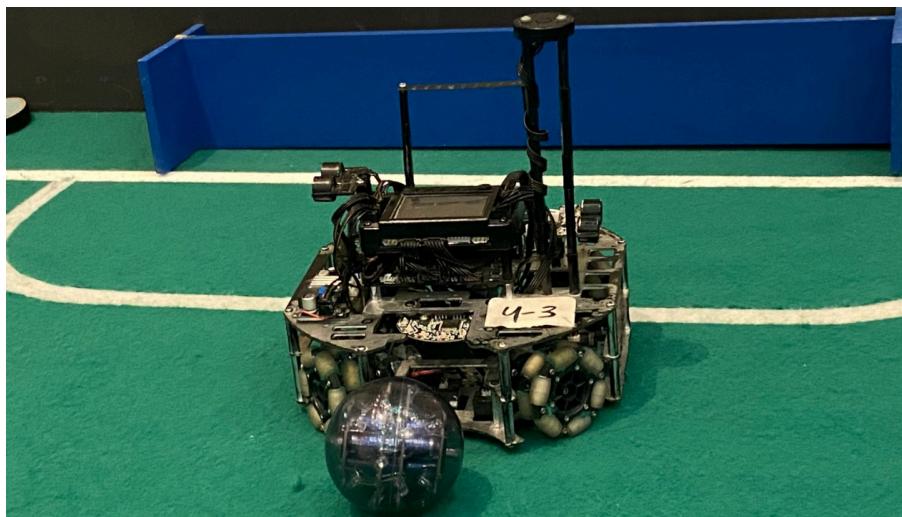
- 🥇 2019: 1st Place – RoboCup UAE
- 🥇 2024 & 2025: 1<sup>st</sup> Place - RoboCup UAE
- 🏅 Represented UAE at RoboCup in Sydney and Moscow

### ROBOT DESIGN: HARDWARE

This year's robot features:

- A compact, modular frame for quick assembly and weight balance
- Custom 3D-printed omni wheels for 360° movement
- High-torque motors for speed and stability
- An advanced kicking mechanism using a solenoid system
- Multi-sensor setup for real-time feedback and decision-making

We improved ball and line detection using optimized camera placement, sensor calibration, and fine-tuned PID control to ensure fast, accurate movement during gameplay.



Component	Function
Joinmax X4 Controller	Central control unit handling inputs, decision-making, and motor outputs.
Compass Module	Maintains orientation and adjusts robot's direction on the field.
Camera Module	Tracks the ball, calculates angle and distance for positioning.
IR Ball Sensor	Detects the RoboCup IR ball based on reflected infrared signals.
Line Sensors	Detect black/white field lines to avoid boundaries and aid in positioning.
Ultrasonic Sensors	Measure distance to objects and boundaries to support navigation.
Zeee 6S Battery	Powers motors and systems with high voltage and capacity.
LM2596 Converter	Steps down voltage to safely power low-voltage components.
3713 Motor Driver	Controls up to 5 motors with precise speed and direction output.

### SOFTWARE & CONTROL

We use the Joinmax X4 as the robot's main controller. It processes sensor data, makes real-time decisions, and sends precise commands to the motors and kicker. It serves as the brain behind all robot functions on the field.

The controller is programmed using RoboExp-X4, a visual development environment that lets us design, simulate, and test robot behaviors efficiently. This helps us quickly adjust and improve performance during development.

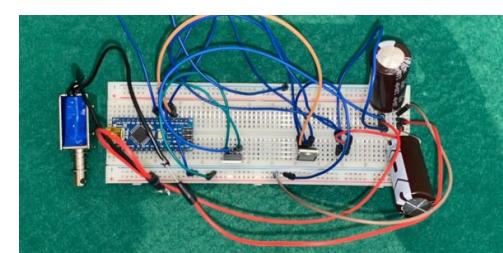
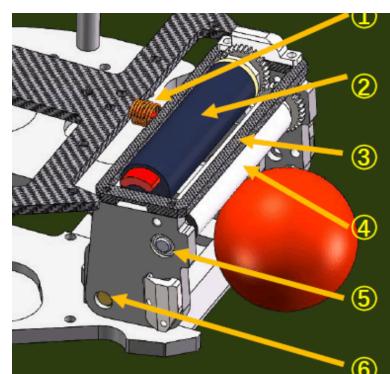
### STRATEGY SUMMARY

Our strategy assigns two fixed roles: one robot acts as the goalkeeper, staying in the penalty area to defend, while the attacker focuses on ball tracking and avoids the goal zone. The goalkeeper is programmed using Arduino with camera, gyroscope, and line sensor inputs. It positions near the goal, searches for the ball, and responds to movement or boundary detection before returning to defend.

### MECHANISMS

#### DRIBBLER SYSTEM

- Positioned at the front of the robot
- Function: Keeps the ball close to the robot to maintain possession during movement
- Uses a rotating roller powered by a motor
- Roller spins in the opposite direction of motion to pull the ball inward
- Maintains stable control while turning, passing, or preparing to shoot
- Improves dribbling, positioning, and shot accuracy



#### KICKER SYSTEM

- Uses a JF-0530B solenoid powered by 36V via an XL6009 step-up converter
- Controlled by:
  - 2 MOSFETs
  - 2 × 4700 µF capacitors (for energy storage and fast discharge)
  - Triggered based on the ball's position detected by the main controller
  - Delivers powerful and quick kicks
  - Enhances passing strength and goal-shooting performance



#### BALL DETECTION

- Sensor: JMP-BE-1732 with infrared eye
- Tracks ball using IR radiation, even in low light
- Single-port detection calculates direction and intensity
- Accurate real-time tracking for better control and movement
- Unaffected by visible light → ensures consistent match performance

