Xelerator

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Open Source Software

https://github.com/423Tech/Xel-RCJ2025Open.git

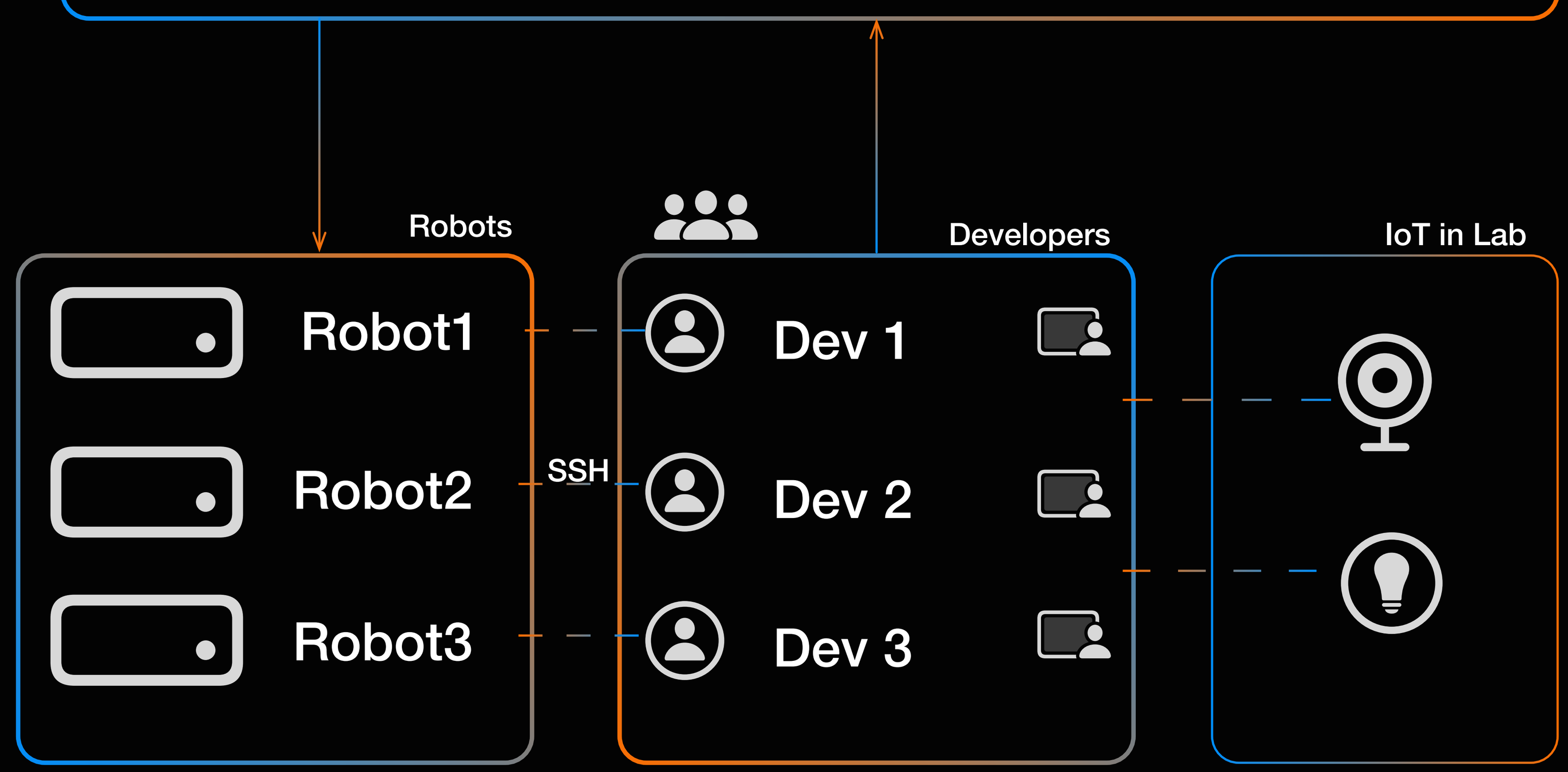
Abstract

We are xelerator, a young and dynamic team from Shanghai with an unwavering passion for innovation and excellence. In just three months, we have boldly redefined our technology stack, completely revamped our workflows, and propelled ourselves to a new level of performance — culminating in our long-awaited return to the global stage after a decade.
As we stand once again on the global stage, we carry with us the spirit of continuous self-innovation and the determination to inspire others through our work. This is not just a milestone — it is the beginning of an even more ambitious chapter for xelerator.

Develop Pipelines

This year, we developed a method by which the robot can connect to the Internet and download code. In this way, we can significantly improve our working efficiency. With the help of GitHub, all the programmers (three people) in our team can debug the code simultaneously, and decrease the time on merging the codes or finding different versions of the code. What's more, this method also allows us to try 're-mote working', we put a camera on the top of the court and a remote-controlled light. After that, we can stay at home to program our robot.

https://github.com/423Tech/Xel-RCJ2025Open.git



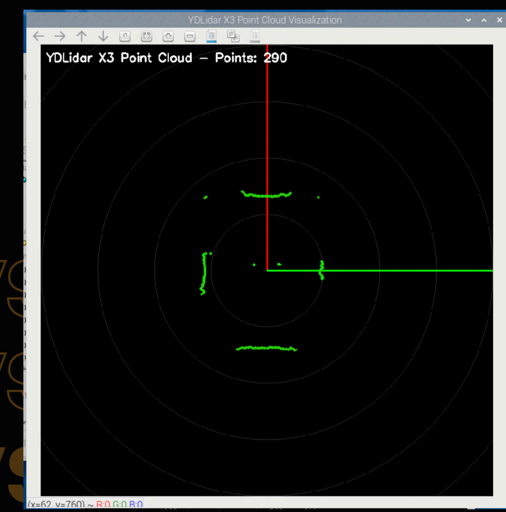
Overview

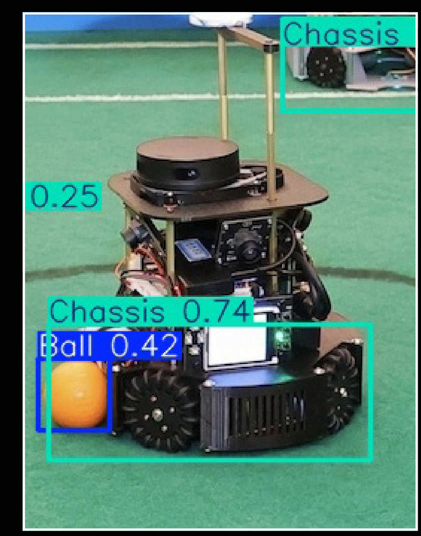
1 S1M1 Lidar $34	2 Hailo8 26T Hat $85	3 Raspberry Pi 5 $74
4 STM32F103 PCB $30	5 CHR-GM25-KB370 $4.5	6 Self-made Poly Wheel $0.5
7 Electromagnet $1	8 DC-DC 12V-48V $2	9 Relay $1
10 Self-made Dribble $4	11 USB Camera $13	

Vision & Positioning

1 Self Positioning System

This year, we developed a method by which the robot is able to obtain its absolute coordinates on the field. First, the robot uses its top-mounted LiDAR to scan in all directions and generate a point cloud of distance measurements. Next, it fits lines to every pair of points in the point cloud. Finally, it selects valid lines by comparing their orientation theta to the robot's yaw, and then chooses the farthest one as the reference for its absolute distance to the wall.

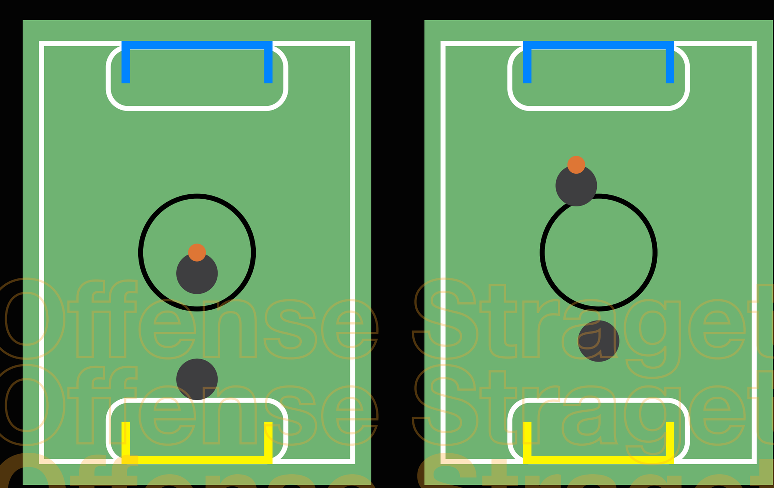




2 Robot Detection

To defend against the hide-ball shooting strategy, we deveoped two methods to locate the opponent's robots.
The first method is based on color binarization. First, the program uses the Self-Positioning System to segment the field area in the vision. Then, it applies a binary filter to remove the green color. The remaining regions in the frame are assumed to be the opponent's robots and can be easily located.
The second method is based on machine learning algorithms.This time, we chose the YOLO model. We trained it with thousands of samples of balls and over 40 types of robots. Using this method, the robot is able to achieve the goal more robustly and reliably.

Stragety



1 Offense Stragety

In opponent territory, the NormalShoot module engages: `LockBallSlip()` dynamically adjusts motor power through wheel differentials, maintaining optimal ball distance. Critical shooting range detection (Y=5-10cm) activates automatic goal calibration - calculating positional deltas to rotate toward shooting vectors. The architecture employs three core algorithms: enemy coordinate mapping for evasion, trigonometric goal alignment, and adaptive power control. Continuous sensor monitoring ensures operational integrity during execution.

2 Defense Stragety

The system incorporates layered safeguards: ball loss detection ([1024,1024] coordinates) triggers positional reset; opponent tracking fuses multiple sensor inputs; adaptive curvature adjustment recalculates defense arcs based on real-time positional relationships. This integrated approach combines sector-based response protocols, mathematical tracking models, and synchronized team positioning for comprehensive coverage.