

# ITAndroids Humanoid

## Extended Abstract for RoboCup 2025

Aécio Monteiro, Alan Nascimento, Caio Antonio, Gabriel Padilha, Jansen do Nascimento, Johann Knak, Jone Crispim, Luiz Satoshi, Marcos Maximo, Matheus Defilipo, Narayane Ribeiro, Odair Oliveira, Pedro de Araujo, Ricardo Cardoso, Robson Cardoso, Samuel Afonso, Víctor Nântua and Vítor Betto

Autonomous Computational Systems Lab (LAB-SCA)  
Aeronautics Institute of Technology (ITA)  
São José dos Campos, São Paulo, Brazil  
{aeciomonteiro81,gabrielpadilhalf,jansensilva49,johannfknak,jrudsonc,luiz.satoshi.yo,narayane.rm,araujopedro2000,ricardo.cardoso.filho3,robsonleonarth,samuel.afonsodesouza,vhlink2004,vitorbetto}@gmail.com  
{alan\_stille-10,caioviniciussa,matdefilipo}@hotmail.com  
{mmaximo,odair}@ita.br  
<http://www.itandroids.com.br>

**Abstract.** ITAndroids is a robotics competition group associated with the Autonomous Computational Systems Lab (LAB-SCA) at Aeronautics Institute of Technology (ITA). ITAndroids is a reference team in Latin America, having won more than 80 awards in robotics competitions in the last 13 years. In 2017, the team developed the Chape humanoid robot and built four units to participate in RoboCup Humanoid KidSize for the first time. Since then, the team has been evolving the robot's hardware and software while participating in many competitions, especially RoboCup and the Latin American Robotics Competition (LARC). The team also designed the Chape G2 robot, the second generation of Chape, which is currently under construction and testing. This work describes our recent development efforts for RoboCup 2025.

### 1 Lessons learned in previous RoboCup competitions

1. Annotating images during competition can significantly improve the robot's computer vision performance.
2. Some changes in active vision, such as requiring looking at the ball while kicking and prioritizing scanning the field in a higher neck tilt angle, are necessary to improve the ball's and the robot's localization.

### 2 Major problems that the team is trying to solve for the upcoming competition

1. Vision: the robot commonly misidentifies white objects, such as the NAO's feet and white sneakers, as the ball. In addition, YOLOv8 is being executed

on the CPU with a high computational cost, increasing latency, which leads to problems described in [2]. Moreover, the localization inaccuracy is exacerbated by the camera distortion and the angular offsets of the robot's joints.

2. Behavior: the current goalkeeper behavior does not rely on the robot's localization data, which restricts its decision-making capabilities.

### 3 Plans for the major changes that the teams anticipate to have implemented by the RoboCup 2025 competition

1. Vision: The team expects to (i) retrain YOLO to recognize the adversary and teammate robots and to avoid false positives in ball recognition; (ii) improve the efficiency of YOLO in the Intel hardware; (iii) apply the camera distortion removal using the intrinsic calibration and (iv) correct the angular and translation offsets of the camera by integrating the transformations calibration described in [1].
2. Perception: development of a more accurate calibration of the inertial measurement unit.
3. Localization: design and implementation of tools for calibration and debugging.
4. Behavior: develop a goalkeeper behavior that uses the localization data.
5. New robot: construction and testing of the Chape G2 robot.

### 4 The implementation status of the changes planned by the time of applying

1. Vision: image annotation and YOLO optimization are in progress. The intrinsic calibration is under testing, and transformations calibration is being integrated into the code.
2. Perception changes, tools related to localization, and goalkeeper behavior: in planning.
3. New robot: the mechanical part is already advanced, while the electronic part is still in the schematics design phase.

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### References

1. Francisco Bruno D., Marcos R. O. A. Máximo, and Others. Calibration of Inverse Perspective Mapping for Humanoid Robot. In *Robot World Cup Initiative (RoboCup)*, 2023.
2. Narayane Medeiros, Marcos R. O. A. Máximo, and Others. ITAndroids Humanoid Team Description Paper for RoboCup 2024. 2024.