

ITAndroids Humanoid

Extended Abstract for RoboCup 2020

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Abstract. ITAndroids is a robotics competition group associated to the Autonomous Computational Systems Lab (LAB-SCA) at Aeronautics Institute of Technology (ITA). ITAndroids is a reference team in Latin America, having won 42 trophies in robotics competitions in the last 8 years. In 2016, the group acquired a Robotis OP2 robot and material to build four more robots. In 2017, the team built four Chape robots and participated in RoboCup Humanoid KidSize for the first time. Since 2018 the team has been qualified for the quarterfinals. This work describes our recent development efforts for RoboCup 2020.

1 Lessons learned in RoboCup 2019

We highlight some lessons learned in the previous RoboCup competition:

1. We were using a wood structure to place Aruco codes in order to calibrate the transforms of our robot. This structure proved very hard to transport and assemble with precision during the competition.
2. We have discovered that a 4S 1,300 mAh LiPo battery is not enough to endure a half game. In previous competitions, our robots were not robust enough (in regards to hardware or software) to keep working for the majority of the half without any failure, so our batteries were never depleted.
3. Despite we have many tools for calibration (servo, color table, IMU, camera parameters, etc.) and debugging, they are not user friendly, so calibration is taking too much time from the team during the competitions. Moreover, most teams have a tool for monitoring the robots during matches, but we lack such tool.

4. Changing uniform color of our robots was taking too much time. We have learned from other teams about very simple ideas that make this much easier, such as using velcro tape.
5. Our getting up motions were not robust. We learned from other teams that having longer arms, a round hand, and applying low friction materials on the hand's surface helps.
6. Our new leg design which avoid metal bending was extensively tested during RoboCup. The robots which used this design required less servo calibration and presented better walking performance.

2 Solutions being implemented

We highlight some solutions already implemented or being implemented in our robot team:

1. We learned from other teams, such as MRL [1], that using a Aruco code carpet was a much better solution in this regard. We have implemented this solution succesfully, but we still need more testing and fine tuning.
2. We are now using 1,500 and 1,800 mAh batteries. They proved large enough in Latin American Robotics Competition (LARC) 2019.
3. We are currently improving our software tools. Moreover, we now have a monitoring tool for matches, but it still needs improvements and bug fixing.
4. We implemented the idea of using velcro tape for LARC 2019 to allow fast change of uniforms.
5. The new hand design made the getting up motions much more robust.
6. Legs of 3 robots have been changed to the new design and we expect the last one to also have new legs by RoboCup 2020. Our new generation of robots were designed using the same design principles for its legs. For more information, please refer to [3].
7. We have implemented a new kick motion based on splines which is stronger than the previous one.
8. We are working on implementing MPC-based walkings [2].
9. We are designing a new generation of robots, which will have 65 cm of height (our current robots have 53 cm), stronger servos (XM-540), and a faster main computer (Intel NUC i7). The mechanical CAD is finished and manufacturing is starting. Our PCB is manufactured and we starting testing.

References

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