UTRA Extended Abstract
RoboCup 2020 Humanoid League (KidSize)

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1 Lessons Learned From Previous Competitions

Our team has participated once in the past at Robocup 2018 Montreal. Given our low budget, we decided to build our robot from the ground up. In the process, we learned how difficult it is to put together such a complex system. We integrated hardware and software components a week before competition which led to a lot of debugging. Therefore being able to integrate early and test often is very crucial. We learned the value of a good simulator for testing our robot. This allows software team to work in parallel as the hardware is being developed. Another major challenge we face as an undergraduate team is teaching the next generation of students to be able to tackle robotics problems. We found in the past that it is hard to teach new members and achieve results for the competition at the same time.

2 New Robot for Robocup 2020

Our second iteration robot, Béz, performed well but has major limitations due to its small size. Our walking speed is low and it is difficult for us kick a ball. We will address these issues in our third iteration of the robot by using stronger motors. Béz costed us a total of $2.8K USD. For a student team with limited funds, this is expensive, since we would like to build four robots in total. Our goal is to keep the cost down to $2K USD for next generation robots.

3 Cheaper Custom Servo

Rather than purchasing more powerful off-the-shelf servos, UTRA plans to re-purpose hobby servos with specs comparable to Dynamixel MX64s while leveraging the work of the Darmstadt Dribblers team as a reference design [2]. We estimate that the cost of these re-purposed motors will be less than one-third of the cost of MX64s, substantially reducing the overall price of the robot. Currently our team plans to build new robot by the end of April using standard Dynamixel motors and swapping select motors with custom servos to test their feasability. The success of this project has yet to be determined.

4 Feedback from Pressure Sensors

Our second goal is to integrate pressure sensors into the feet of the robot and to integrate pressure data into the robot's control systems. We plan to use this data to improve the robot's balance, enabling it to walk more quickly. We are currently testing prototype designs and expect to have the sensors integrated before the competition.

5 Software Improvements

We plan to improve our walking trajectory after integrating various sensors for feedback on the robot. We plan to improve our control development process through a streamlined deployment technique using state of the art Matlab deployment tools and demonstrate the ease of integration. We also plan to use advanced machine learning and AI techniques to improve the stability of the robot's gait as well as cooperative strategy with other robots. Our simulation environment in gazebo includes all major components such that our software can be deployed without any changes in both the robot and the simulation. We have started the process of tuning the simulation parameters to make it correlate better with real-world results.

6 Object Detection Research

Our current research interests lie in computer vision and object detection tasks. We are exploring ways to improve upon current solutions such as [3] by changing neural network architecture or the training methods.

References

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3. Speck, D., Bestmann, M. and Barros, P. *Towards Real-Time Ball Localization using CNN.* RoboCup 2018: Robot World Cup XXII. Springer (2018).