Researchers develop a new humanoid platform for robotics research

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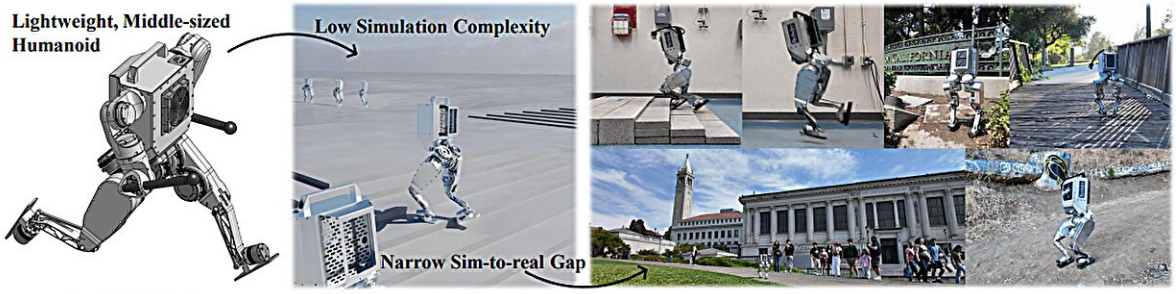

(a) CAD Design (b) Training in Isaac Lab (c) Sim2real Deployments

Design, training, and sim-to-real deployment of our custom-built humanoid with a learning-based controller. Credit: *arXiv* (2024). DOI: 10.48550/arxiv.2407.21781

Advancements in the field of robotics are fueled by research, which in turn heavily relies on effective platforms to test algorithms for robot control and navigation. While numerous robotics platforms have been developed over the past decades, most of them have shortcomings that limit their use in research settings.

Researchers at the University of California (UC) Berkeley recently developed Berkeley Humanoid, a new robotic platform that could be used to train and test algorithms for the control of humanoid robots. This new humanoid robot, introduced in a paper posted to the preprint server *arXiv*, addresses and overcomes some of the limitations of previously

introduced robotics research platforms.

"Having conducted several experiments with commercially available robots, we have become aware of some of their weaknesses," Qiayuan Liao, co-author of the paper, told Tech Xplore. "For instance, some robot hardware is very expensive, while other hardware is not designed especially for learning-based control or for research, which often means that it is 'fragile,' easy to break, and hard to maintain and repair."

The key objective of the recent work by Liao and his colleagues was to develop more cost-effective and scalable platforms for robotics research. These platforms should be low-cost, easy for researchers to fabricate and experiment with, robust against failures, easy to carry, requiring little maintenance and should be manageable by a single operator.

"The platform we developed, the Berkeley Humanoid robot, has high performance, transparent low-level actuators and transmission, higher reliability, and is inexpensive," Liao explained. We achieve this by designing and building everything from scratch, including both its mechanical and electrical components."

Berkeley Humanoid is a compact, low-cost and lightweight robot that could be easily deployed in robotics laboratories. Its customized mechanical components include a gearbox and actuators, as well as its various limbs and body parts. Its electrical components, on the other hand, are a motor driver and an inertial measurement unit (IMU) module.

The researchers tested their robotic platform in a series of tests and demonstrated that it could effectively tackle various locomotion tasks, even when controlled by a basic learning-based policy. With this simple policy, the robot was capable of walking on different terrains, single and double leg hopping and walking over long distances on both urban and

unpaved terrains.

"We have introduced a new high-performance, reliable, low-cost, humanoid research platform, and demonstrated amazing locomotion tasks with a simple learning-based policy," Liao said. "The Berkeley Humanoid is designed specifically for academic research instead of direct deployment to industry. We want to accelerate algorithm development and experimental validation."

Initial tests highlighted the significant promise of Berkeley Humanoid, showing that it can support dynamic walking with various locomotion styles while also retaining its stability on different types of terrain. The platform could soon be used both at Berkeley and at other robotics research labs to train and test new algorithms for robot control and navigation.

"We now hope to add arms to our robot to make the robot perform manipulation-related research," Liao added. "As part of our next studies, we also hope to add perception capabilities using the camera to enable even better performance."

More information: Qiayuan Liao et al, Berkeley Humanoid: A Research Platform for Learning-based Control, *arXiv* (2024). DOI: 10.48550/arxiv.2407.21781