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Short Communication

Humanoid Robots that can be Used in the Real World

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Multiple humanoid robots have been constructed in different parts of the world since the 1996 introduction of Honda's P2, and much R&D has been done on many foundational technologies such bipedal walking. Humanoids have been created and put to use in a broad variety of industries, including but not limited to those of plant maintenance, tele-medicine, car operation, home-security, construction, aircraft manufacture, emergency management, and entertainment, amongst others.

Humanoids have biomorphic bodies, the primary benefit of which is that they are able to navigate in environments constructed for human beings and use equipment and automobiles created for human beings. Another advantage of humanoid robots is that they are able to interact with humans in ways that were not previously possible. Existing robots, whether they be of the fixed, wheeled, or crawler kind, are not equipped to deal with the challenging environments, harmful tasks, and low-added-value activities that are demanded of people. It is speculated that if individuals had these activities done by robots instead of them, they would have more time to devote to creative endeavors.

Furthermore, it is reasonable to anticipate that the humanoid form and humanlike motion will attract individuals and that the interaction with the humanoid will be both entertaining and therapeutic. Humans rely heavily on body language as a means of communicating "intent." This relates to the subsequent Avatar feature.

Despite these hopes, almost 25 years after P2's introduction, no humanoid robot has been deployed outside of research and communication roles. This is due to the fact that humanoid robots are not yet technologically advanced enough to be used in an environment so unstructured that traditional robots cannot handle it, and there is no need to employ them in a structured setting such as a normal factory.

The goal of this Research Topic is to showcase practical applications of humanoid robots, and to that end, it presents two projects aimed at enhancing the skills essential to the operation of humanoid robots and one project aimed at using humanoid robots to distant services.

Up until fairly recently, the vast majority of humanoid robots relied on a technique in which the joints were precisely position controlled as well as position instructions were modernized utilizing joint velocities that were determined using inverse kinematics. This method has since been superseded by a more advanced method. Methods that govern joint torques and systems that update position instructions by applying inverse dynamics computations to determine joint accelerations have been developed very lately. These systems were created quite recently. These three strategies were tested by Ramuzat., et al. on the same hardware stand, and the researchers described the pros and cons of using each technique. It was discovered that the method that utilizes torque control has benefits in terms of effortlessness of trajectory following, power utilisation, as well as passiveness. The technique that combines position control and reverse kinematics was found to be the method that requires the least amount of computational effort. Recent advancements advances in computer processing power have made it feasible to conduct inverted dynamics-based torque control at one kilo Hz. It is conceivable that torque management will become the norm for joint control in the near future, and it is possible that this change may occur sooner rather than later.

Humanoid robots need multicontact technology to move in unstructured surroundings where existing robots struggle to operate. By actively putting various body parts into contact with the environment, humanoid robots are able to maneuver in restricted locations where wheeled robots with big footprints are unable to reach the area. The Posture Generator is one of the most important positions in motion production with a multitude of interactions. Calculating the joint angles that will allow a particular set of connections to be realized while avoiding collisions with either the environment or the robot itself is a challenge. This process must be computationally efficient since it is often used in the generation of multi-contact motion. Collision avoidance was formerly a requirement in the inverse kinematics solver. When nearby barriers, such as narrow tunnels, increase the amount of restrictions, calculation performance lowers. Michele M., et al. (2022). described a method that uses an adaptive accidental velocity vector producer to generate a location that does not result in collisions.

In recent years, the use of avatar robots to carry out remote service work has attracted a significant amount of attention. One reason for this is the influence that COVID-19 has had. In a public setting, Baba., et al. compared the implementation of face-to-face service delivery with that of avatar-based service delivery in terms of perceived hardship. When the service was supported by an avatar robot rather than a person, the perceived level of burden was much lower than when a human was responsible for providing the service.

Additional research and development are necessary in order to realize the goal of giving humanoid robots the ability to independently do tasks that are now challenging for other robots, moreover, it is likely that achieving this target would need more time than originally anticipated. It is considered that using humanoid robots as avatars would be a realistic technique for expediting the industrialization of humanoid robots. This belief comes from the fact that such a plan has been proposed. When humans use the robot as an avatar, they will be able to do challenging or dangerous job in an environment that is both safe and pleasurable. In addition, humans may remotely compensate for the robot's lack of context understanding and higher-level deciding. By producing and using humanoid robots in the real world, we can forecast the start of a virtuous cycle that will lower costs while boosting dependability and autonomy.