“FCFJ” joints to accelerate the movement of humanoid robots while maintaining their balance

Abstract

The aim of this project is to improve the efficiency of the knee joints of one of the forms of Humanoid Robots, Bioloid PREMIUM, to perform regular tasks with greater balance when increasing the speed of movement by adding the innovative (FCFJ) joint inspired by Flat Cube Fidget.

This study comes to examine the efficiency of the (FCFJ) joint in performing the movements performed by the robot to a certain speed limit. And to reveal the speed limit that the robot can reach while successfully performing the task.

If the robot can perform the same tasks at a speed exceeding the speed at which the traditional (Revolute) joints fail while maintaining balance, the efficiency of this joint is greater than traditional joints.

After conducting the experiments, the (FCFJ) joints accelerated the robot by 22% as the Bioloid – Humanoid robot was programmed to rise from a sitting position, and the task was completed without the robot falling using the traditional robot joint. Within 1.8 seconds as a threshold for the success of the experiment, when accelerating the motors to reduce the time to complete the task, the robot was unable to balance, so it fell and failed (with the traditional joint) to perform the task.

The experiment was repeated using the FCFJ joints, and the robot was able to complete the task within 1.4 seconds as a threshold for the success of the experiment. This was done without changing the design or programming, as only the joint was replaced.

Introduction

The diversity of life tasks has created a need to form a robot to move like a human. This formation faces many complexities, the most important of which is the movement of the joints resulting from the precision of their design in humans and the speed of processing and analyzing information in the brain. Currently, Humanoid Robots are used with the elderly and children, guidance and reception, and they are assigned life tasks that require a limited amount of movement, so they appear to resemble a sick human being while moving. Therefore, they have not entered widely into military and industrial fields, but robots have been developed that simulate animals to solve the problem of balance and weight and have proven highly efficient in this. Therefore, researchers are trying to develop more realistic movement methods for Humanoid Robots through a revolution in the design of mechanical joints that have shown a lot of efficiency and durability in the dynamics of life movement, such as the UNIVERSAL JOINT, which has easily been able to impose itself in many mechanical engineering applications.

Motivation

The knee joints of one of the Humanoid Robots, Bioloid PREMIUM, have been improved to perform routine tasks with greater stability at increased speed by adding the innovative Flat Cube Fidget-inspired FCFJ joint.

Methodology

A study was conducted to examine the efficiency of the (FCFJ) joint in performing the movements performed by the robot to a certain speed limit. The speed limit that the robot can reach while successfully performing the task was revealed.

If the robot can perform the same tasks at a speed exceeding the speed at which the traditional (Revolute) joints fail while maintaining balance, the efficiency of this joint is greater than traditional joints.

After conducting the experiments, the (FCFJ) joints accelerated the robot by 22% as the Bioloid - Humanoid robot was programmed to rise from a sitting position, and the task was completed without the robot falling using the traditional robot joint. Within 1.8 seconds as a threshold for the success of the experiment, when the motors were accelerated to reduce the time to complete the task, the robot was unable to balance and fell and failed (with the traditional joint) to perform the task.

The experiment was repeated using the (FCFJ) joints, and the robot was able to perform the task within 1.4 seconds as a threshold for the success of the experiment, and this was done without changing the design or programming, as only the joint was replaced

Applications

Developing humanoid robots used in the field of childcare, patient care, the elderly, and service fields in restaurants, hotels, companies, and hospitals so that their movement becomes more balanced, fast, and realistic, which is reflected in the quality of the service provided.

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