Application AB-098

作品名稱
追風少年之溜冰機器人
The Speed-skating robot

隊伍名稱
冰上悍將 Blades of glory

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作品摘要

本作品完成一個可以遙控以及自主導航的溜冰人形機器人，可以實現向前滑行、向左滑行、向右滑行與穿著輪鞋進行爬起等高難度動作。本作品之系統元件示意圖如圖1所示，其使用CMOS感測器、加速度計、NIOS II發展板、伺服馬達、藍芽傳輸模組、與壓力感測器等硬體元件。在溜冰機器人的自我平衡上使用壓力感測器以及三軸加速度計，藉由模糊控制器分別控制踝關節及髖關節之自由度，讓機器人能夠藉由這兩個維度之調整達到自我平衡之目的。溜冰人形機器人之動作則是透過自行開發的人機介面來設計調整，包括：前進、向左滑行、向右滑行與爬起等基本動作。此外，人機介面上還可以接收感測器回傳的資訊，讓使用者可以了解機器人運作時的狀況。

本作品設計了一個藍芽控制介面，用以執行機器人的自主導航模式與遙控模式。本作品之自主導航功能藉由COMS感測器的影像資訊讓機器人能夠沿著白線自主導航，讓機器人的實用性更高。遙控模式則讓我們可以遙控機器人的動作，使其具有育樂之效果。本作品運用到相當多的技術，藉由這些技術的開發與整合才能完成我們的溜冰機器人系統。

■ 圖1、系統原件示意圖

Abstract

A skating robot is implemented in this project. The proposed skating humanoid robot can not only be controlled via Bluetooth, but also navigate by itself via vision system. Several difficult skating motions are built on the robot such as, slide forward, slide left, slide right and getting up.

This project implements the robot from the skating view point, which is different from the normal walking motions. Most of the researches of the biped robots are about how to implement the walking motions, such as walk and turn. The proposed robot is able to skate.

The used components of the driving system in this robot are displayed in Fig. 1. There are many electrical components including CMOS sensor, accelerometer, servo motors, Bluetooth component, and force sensor are mounted on the robot. The main processor of the robot is a Nios II. The motion of the skating humanoid robot is designed by using the user interface. A series of basic motions are designed for skating. These motions include slide forward, slide left, slide right and getting up.

A fuzzy controller is designed to control the ankle joint and hip joint by using the pressure sensor and accelerometer data. The robot with the fuzzy controller is able to auto balance by adjusting ankle joint and hip joint. An interface is implemented to transmit the sensor information to the users. It makes the users to understand the robot situation easier.

The robot can be set to the remote mode or the auto-navigation mode. When the robot is in auto-navigation mode, it is able to skate along white line autonomously. The robot uses the CMOS sensor to detect the white line. The robot is also able to be remote to do different motions in remote control mode via Bluetooth. The project integrates many different technology areas to implement this system, besides the experiment video shows that the system works very well.