

Title Design and control of an apple harvesting robot
Author Zhao De-An, Lv Jidong, Ji Wei, Zhang Ying, Chen Yu
Citation Biosystems Engineering, Volume 110, Issue 2, October 2011, Pages 112-122
Keywords Robot; apple; harvesting

Abstract

A robotic device consisting of a manipulator, end-effector and image-based vision servo control system was developed for harvesting apple. The manipulator with 5 DOF PRRRP structure was geometrically optimised to provide quasi-linear behaviour and to simplify the control strategy. The spoon-shaped end-effector with the pneumatic actuated gripper was designed to satisfy the requirements for harvesting apple. The harvesting robot autonomously performed its harvesting task using a vision-based module. By using a support vector machine with radial basis function, the fruit recognition algorithm was developed to detect and locate the apple in the trees automatically. The control system, including industrial computer and AC servo driver, conducted the manipulator and the end-effector as it approached and picked the apples. The effectiveness of the prototype robot device was confirmed by laboratory tests and field experiments in an open field. The success rate of apple harvesting was 77%, and the average harvesting time was approximately 15 s per apple.