

基于新概念多模式移动机器人的林业信息采集系统

姚舜 张家铭 阙江明 董蕊芳

(北京林业大学 100083)

摘要: 地面测量在森林资源清查工作中扮演着重要的角色。然而,由于地面测量技术和设备的不足,每木检尺工作仍然耗时费力。同时,复杂的林间环境对地面测量调查员的行动灵活性和安全性提出了挑战。本研究提出了一种林间作业系统,其中包括多模式移动机器人、视觉传感器以及样地规模树木实时定位和胸径测量算法。我们将新概念的多模式移动机器人与 RGB-D 相机集成,并将其应用于林间每木检尺任务。其中,多模式机器人能够顺利穿越森林中崎岖的地形,并在此过程中使用不同的移动模式来应对不同的路况,模式之间的切换是通过机器人与地面接触位置的变化而实现的。在图像信息采集方面,建立了一个基于无线局域网的图像传输服务器。可通过无线模块,将相机采集到的树木图像信息实时传输到上位机进行处理。提出了一个实时多木测量算法,该算法能够准确定位视野内的树木,并精确测量机器人前方四米范围内树木的胸径值。最后,研制系统的原型,并在多种不同的林地环境中进行了测试。实验结果表明,本文提出的系统可以顺利到达任务场地,并精确地对林区中的树木进行测量。

关键词: 移动机器人;多模式;林业信息采集

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Research on the mobile Forest Investigating System Based on the Multi-mode Robot

Abstract: Ground measurement plays an important role in forest resource inventory. However, limited by the equipment and technology, the measurement of trees is time-consuming and laborious, and the environment in the forest poses challenges to the mobility and safety of investigators. The research in this paper proposes a mobile forest investigating system, which is consisted of a multi-mode robot, an RGB-D camera, a wireless transmission module, and an upper computer. Firstly, the multi-mode robot can traverse through rough terrain directly with the brief mechanical structure. The switch between the mobile modes is achieved through the shape of the robot's touchdown link. Secondly, to collect the image of the trees, a wire LAN based server is established. The image collected by the camera could be transmitted to the upper computer. Thirdly, a real-time multi-tree measuring algorithm is proposed, which could locate trees and measure the chest diameter of trees within a range of 4m in front of the robot. Fourthly, a prototype of the robot is manufactured and tested in the forest environment. The result verifies that the system is able to perform the measurement task.

Key words: mobile robot; multi-mode; community structure; forestry information collection