2023年第29期总404期

农牧业信息化专题

本期导读

学术文献

1．基于改进遗传算法的移栽机器人全覆盖路径规划

2．自动农用车路径跟踪控制的建模与控制方法:现状与挑战综述

3．欧洲利益相关者对精准杂草控制实施潜力的看法：以激光处理的自动驾驶汽车为例

4．温室农业机器人的自主定位与导航

会议论文

1．咖啡作物病虫害检测的卷积神经网络模型

2．自主施肥移动机器人

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学术文献

1．Field Complete Coverage Path Planning Based on Improved Genetic Algorithm for Transplanting Robot(基于改进遗传算法的移栽机器人全覆盖路径规划)

简介：The Complete Coverage Path Planning (CCPP) is a key technology in the field of agricultural robots, and has great significance for improving the efficiency and quality of tillage, fertilization, harvesting, and other agricultural robot operations, as well as reducing the operation energy consumption. The traditional boustrophedon- or heuristic-search-algorithm-based CCPP methods, when coping with the field with irregular boundaries, obstacles, and other complex environments, still face many problems and challenges, such as large repeated work areas, multiple turns or U-turns, low operation efficiency, and prone to local optimum. In order to solve the above problems, an improved-genetic-algorithm-based CCPP method was proposed in this paper, the proposed method innovatively extends the traditional genetic algorithm's chromosomes and single-point mutation into chromosome pairs and multi-point mutation, and proposed a multi-objective equilibrium fitness function. The simulation and experimental results on simple regular fields showed that the proposed improved-genetic-algorithm-based CCPP method achieved the comparable performance with the traditional boustrophedon-based CCPP method. However, on the complex irregular fields, the proposed CCPP method reduces 38.54% of repeated operation area and 35.00% of number of U-turns, and can save 7.82% of energy consumption on average. This proved that the proposed CCPP method has a strong adaptive capacity to the environment, and has practical application value in improving the efficiency and quality of agricultural machinery operations, and reducing the energy consumption.

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http://agri.ckcest.cn/file1/M00/10/2E/CsgkOGSwteyAPPgGAVHe7mLvzOw487.pdf

2．Modelling and Control Methods in Path Tracking Control for Autonomous Agricultural Vehicles: A Review of State of the Art and Challenges(自动农用车路径跟踪控制的建模与控制方法:现状与挑战综述)

简介：This paper provides a review of path-tracking strategies used in autonomous agricultural vehicles, mainly from two aspects: vehicle model construction and the development and improvement of path-tracking algorithms. Vehicle models are grouped into numerous types based on the structural characteristics and working conditions, including wheeled tractors, tracked tractors, rice transplanters, high clearance sprays, agricultural robots, agricultural tractortrailers, etc. The application and improvement of path-tracking control methods are summarized based on the different working scenes and

types of agricultural machinery. This study explores each of these methods in terms of accuracy, stability, robustness, and disadvantages/advantages. The main challenges in the field of agricultural vehicle path tracking control are defined, and future research directions are offered based on critical reviews. This review aims to provide a reference for determining which controllers to use in path-tracking control development for an autonomous agricultural vehicle.

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3．European stakeholders' perspectives on implementation potential of precision weed control: the case of autonomous vehicles with laser treatment(欧洲利益相关者对精准杂草控制实施潜力的看法：以激光处理的自动驾驶汽车为例)

简介：杂草控制是一项基本的农业实践，通常通过除草剂和机械除草器来实现。由于这些工具对环境的负面影响，世界各地正在开发和采用替代解决方案。随着最新技术的发展，一种基于自动激光的除草系统(ALWS)现在为可持续的杂草控制提供了可能的解决方案。然而，除了最近的性能证明之外，人们对这种系统的采用潜力知之甚少。本研究采用混合方法评估了ALWS的采用潜力。首先，确定了影响ALWS采用的六个宏观环境因素。这一评估被称为政治、经济、社会、技术、法律、环境(PESTLE)分析，并以由专家协商发起的文献审查的形式进行。其次，在四个焦点小组讨论(n = 55)中，使用优势，劣势，机会，威胁(SWOT)分析评估了一系列欧洲利益相关者对ALWS的看法。PESTLE和SWOT分析中确定的因素随后被合并，以提供对ALWS采用潜力的全面概述。人工减少，精密处理和环境可持续性被认为是ALWS最重要的优势。高成本和性能不确定性被确定为主要弱点。为了促进ALWS的采用，本研究建议:(1)应向农民传达具体的技术和经济绩效结果。(2)提高农民精准农业知识水平。(3)应充分利用有利于非化学方法和有机产品高需求的政策优势。本文还广泛讨论了监管障碍、对涉及的人和机器的安全构成的风险、技术挑战和要求，以及与采用ALWS相关的政策建议。

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4．Autonomous Localization and Navigation for Agricultural Robots in Greenhouse(温室农业机器人的自主定位与导航)

简介： Agricultural robots are an effective way to solve the increasingly prominent shortage of agricultural labor. To meet the needs of practical applications, agricultural robots must be able to locate autonomously and move from one place to another automatically. A map-based autonomous localization and navigation system for low-speed agricultural robot in medium-sized greenhouse is developed in this paper. By the perception of on-board sensors, the developed system can build and update environmental map timely, estimate

robot's pose precisely, locate and navigate autonomously. To effectively solve the SLAM problem, RBPF-based nonparametric solution is adopted, and its evolution is also described systematically and concisely. Relevant tests were carried out in greenhouse and laboratory corridor respectively to verify the feasibility of the developed system, and the results show that the autonomous localization and navigation system can not only build consistent environmental map, but also autonomously plan the moving paths to goal positions. By taking calibrated landmarks as benchmarks, the performance of autonomous localization is evaluated, and the corresponding evaluation tests show that the autonomous localization precision in both environments can reach centimeter level. The centimeter level localization precision of the developed system can fully meet the requirements of the operations in the greenhouse. Furthermore, tests shows that the unfavorable environment, such as uneven, unstructured and illumination uncertain, resulted in lower autonomous localization precision in the greenhouse than in the laboratory corridor.

来源： WIRELESS PERSONAL COMMUNICATIONS

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http://agri.ckcest.cn/file1/M00/03/5C/CsgkOYkHZ5eAYY4vABcyZqIjYCg083.pdf

会议论文

1．Convolutional Neural Network Model for the Detection of Diseases and Pests in Coffee Crops(咖啡作物病虫害检测的卷积神经网络模型)

简介： The early detection of diseases and pests in coffee crops by means of artificial vision and pattern recognition brings with it the ease of inspection and the reduction of crop losses in coffee plantations. This work proposes a model based on neural networks that is capable of detecting coffee leaves in an image and also classifies them into the most common diseases in the Panamanian tropics. The coffee leaf disease classification model is able to classify the following diseases: Cercospora leaf spot, leaf rust, leaf miner and phoma. This model obtained an accuracy of 100% and a loss of 1.6 x 10(-5) during the training phase. Subsequent to the training phase, a validation of the model was performed; during this phase, an overall accuracy of 90% was obtained for each of the diseases and pests. In future work, it is desired to implement this architecture in the vision system of the agricultural robot. The vision system will allow farmers to effectively inspect and manage their crops.

来源：2022 8TH INTERNATIONAL ENGINEERING, SCIENCES AND TECHNOLOGY CONFERENCE, IESTEC；

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全文链接:

http://agri.ckcest.cn/file1/M00/10/2E/CsgkOGSwvJ-AXnLJAAvrFGFkWM0036.pdf

2．Autonomous Fertilizer Spraying Mobile Robot（自主施肥移动机器人）

简介：The agricultural sector plays an important role in our modern society and demands the involvement of technology to improve farming methods and crop yield. Farmers mostly rely on manually operated equipment, and tasks such as spraying fertilizers are performed by the laborers. It may be cost-effective but can cause serious health issues due to prolonged exposure to such chemicals. This paper is a simulation-based approach to the basic design and testing of a mobile robot that can autonomously navigate and spray fertilizers in a controlled outdoor environment. These robots commonly use a LIDAR sensor, and wheel encoders for mapping, localization, and navigation; with packages like Simultaneous Localization and Mapping (SLAM), GMapping, and Adaptive Monte Carlo Localization (AMCL). The simulation is done using Gazebo and RViz where the environment consists of three distinct crop strips. The tests done were mainly regarding reliability of the path planning process and dynamic obstacle detection.

来源：2022 IEEE 19TH INDIA COUNCIL INTERNATIONAL CONFERENCE, INDICON

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