2023年第30期总405期

农牧业信息化专题

本期导读

前沿资讯

1．番茄收获机器人升级后速度提升8倍

学术文献

1.适用于大型榛子果园吸盘管理的自主喷洒机器人体系结构

2．自主柑橘收获机器人的开发、集成和现场评估

3.基于深度学习的烟草实时识别和喷雾系统的精细农业机器人喷雾器

4．农业智能机器人设计方案评价方法研究

会议论文

1．用于封闭农田自动耕作的自主农业机器人

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前沿资讯

1．Tomato harvesting robot after upgrade ‘eight times faster’(番茄收获机器人升级后速度提升8倍)

简介：机器人开发商Inaho Europe开发了一款新版本的番茄收获机器人。这家日本公司的子公司声称，这款机器人的速度因此“快了八倍”。这个机器人现在每小时能收获超过12公斤的西红柿。Inaho Europe正与荷兰种植者合作，加速自主番茄收获机器人的开发，他们分别是来自Kwekerij Duijvestijn的Nick Duijvestijn和来自TVA growers的Ferry Adegeest。该公司继续在两家荷兰番茄种植者的大棚中测试最新版本的自主番茄收获机器人，以验证经济可行性并进一步提高性能。由于增加了“集群收获”选项，机器人的速度更快。这个选项取代了单独收获西红柿的做法。Inaho致力于开发一种“价格合理”的多机器人概念。

提高收割速度

通过一次收割几簇西红柿，收割速度（kg/h）有所提高。这项正在申请专利的新技术通过减少收获大量番茄所需的时间，大大提高了生产力。

降低成本

在以前的版本中，机器人手臂一次收获一个水果，与人工相比，很难实现有竞争力的成本，这对机器人建设者来说是一个困境。然而，机器人制造商表示，随着集群收割的实施，现在有可能找到一种接近人力成本的更具成本竞争力的解决方案。

来源：Future Farming;
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学术文献

1 .An autonomous spraying robot architecture for sucker management in large-scale hazelnut orchards(适用于大型榛子果园吸盘管理的自主喷洒机器人体系结构)

简介：In this work, motivated by the precision agriculture (PA) paradigm, we address the problem of managing hazelnut suckering plants on a per-plant basis in a large-scale orchard. Suckering plants, or shortly, suckers, are basal shoots that grow at the base of a tree and compete with the tree itself for nutrients and water. Generally, in large-scale orchards, suckers are treated with the application of herbicide through spraying tractors that continuously spray the crops while navigating the whole orchard. This approach however does not consider the individual needs of each plant and it is definitely not environmentally-friendly since a lot of unnecessary solution is being drained in the soil. For this reason, we propose a novel fully autonomous sucker management architecture that is able to detect the presence of suckers for each plant, by relying on a You Only Look Once (YOLO)-based recognition system, reconstruct them in three-dimension and estimate the amount of herbicide solution needed for the specific plant, based on a data-driven approach.

The herbicide solution is applied using a ground robot equipped with an RGB-D camera and a spraying system. This approach allows to significantly reduce pollution and waste. Experimental results both for individual components and for the entire architecture in a real-world (1:1 scale) hazelnut orchard located in Caprarola, Italy, are provided to corroborate the proposed architecture.

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http://agri.ckcest.cn/file1/M00/03/5C/CsgkOYkHdN6APk_dAILCvDRNioA227.pdf

2．Development, integration, and field evaluation of an autonomous citrus-harvesting robot（自主柑橘收获机器人的开发、集成和现场评估）

简介：Citrus harvesting is a labor-intensive and time-intensive task. As the global population continues to age, labor costs are increasing dramatically. Therefore, the citrus-harvesting robot has attracted considerable attention from the business and academic communities. However, robotic harvesting in unstructured and natural citrus orchards remains a challenge. This study aims to address some challenges faced in commercializing citrus-harvesting robots. We present a fully integrated, autonomous, and innovative solution for citrus-harvesting robots to overcome the harvesting difficulties derived from the natural growth characteristics of citrus. This solution uses a fused simultaneous localization and mapping algorithm based on multiple sensors to perform high-precision localization and navigation for the robot in the field orchard. Besides, a novel visual method for estimating fruit poses is proposed to cope with the randomization of citrus growth orientations. Further, a new end-effector is designed to improve the success and conformity rate of citrus stem cutting. Finally, a fully autonomous harvesting robot system has been developed and integrated. Field evaluations showed that the robot could harvest citrus continuously with an overall success rate of 87.2% and an average picking time of 10.9 s/fruit. These efforts provide a solid foundation for the future commercialization of citrus-harvesting robots.

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3．Precision agricultural robotic sprayer with real-time Tobacco recognition and spraying system based on deep learning（基于深度学习的烟草实时识别和喷雾系统的精细农业机器人喷雾器）

简介：Precision agricultural techniques try to prevent either an excessive or inadequate application of agrochemicals during pesticide application. In recent years, it has become popular to combine traditional agricultural practices with artificial intelligence algorithms. This research presents a case study of variable-rate targeted spraying using deep learning for tobacco plant recognition and identification in a real tobacco field. An extensive

comparison of the detection performance of six YOLO-based models for the tobacco crop has been performed based on experimentation in tobacco fields. An F1-score of 87.2% and a frame per second rate of 67 were achieved using the YOLOv5n model trained on actual field data. Additionally, a novel disturbance-based pressure and flow control method has been introduced to address the issue of unwanted pressure fluctuations that are typically associated with bang-bang control. The quality of spray achieved by attenuation of these disturbances has been evaluated both qualitatively and quantitatively using three different spraying case studies: broadcast, and selective spraying at 20 psi pressure; and variable-rate spraying at pressure varying from 15-120 psi. As compared to the broadcast spraying, the selective and variable rate spray methods have achieved up to 60% reduction of agrochemicals.

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4．Research on the evaluation method of agricultural intelligent robot design solutions（农业智能机器人设计方案评价方法研究）

简介：Background：At present, agricultural robots are produced in large quantities and used in agricultural planting, and the traditional agricultural model is gradually shifting to rely on the Internet of Things and sensors to accurately detect crop growth information. The scientific and rational design of agricultural robots plays a huge role in planting and production efficiency, however, the factors affecting their design are complex and ambiguous, so it is necessary to use a rational evaluation system to make a preferential decision among multiple design options. Purposes：In order to reduce the subjectivity and blindness of program selection in the process of agricultural robot design, make the decision more objective and reasonable, and thus enhance the practicality and scientificity of the program, a new comprehensive evaluation method based on user requirements is proposed. Methods：First, after researching and interviewing users and farming operations, obtaining raw information on requirements, using the Kano model to classify the requirements and establishing an evaluation index system. Secondly, the combination of hierarchical analysis(AHP) and entropy weighting method is used to assign weights to the evaluation index system, calculate the weight value and importance ranking of each index, and carry out various program designs based on the ranking. Finally, the VIKOR method was applied to evaluate and rank the design solutions. Results：The new evaluation method can better complete the preferential decision of the agricultural robot design scheme and get a more perfect design scheme, which reduces the influence of human subjective thinking in the decision-making process. Conclusions：The method not only corrects the traditional evaluation method, but also effectively improves the accuracy and comprehensiveness of the design evaluation process. It also provides a reference for designers to preferably select design solutions and promotes the development of small mobile machines in the context of smart agriculture.

来源： PLOS ONE

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会议论文

1．Autonomous Agricultural Farming Robot for Automatic Ploughing in a Closed Field(用于封闭农田自动耕作的自主农业机器人)

简介：The objective of this project is to design an agricultural robot for automatic ploughing. In the domain of agriculture, robots are undoubtedly playing an essential role in the autonomous farming process. In agriculture, the use of robots is increasing production, and robots are becoming more common in the field. The ongoing project aims to develop an agricultural farming robot that can plough a closed area naturally and involuntarily. It uses a LiDAR sensor. The sensor detects obstacles in the field and detects field boundaries. The Raspberry Pi serves as the system's heart and brain, allowing for quick, precise, and autonomous movement. The rest of the processes could be automated in the future. The development of autonomous vehicle in agriculture has sparked growing attention in recent times. This robot will enable farmers in doing farming tasks more effectively and timely.
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