

PROCEEDINGS OF SPIE

# ***International Conference on Agri-Photonics and Smart Agricultural Sensing Technologies (ICASAST 2022)***

**Jiandong Hu**

*Editor*

**4-6 August 2022**

**Zhengzhou, China**

*Organized by*

Henan Agricultural University

Henan Electrotechnical Society

Henan International Joint Laboratory of Agricultural Laser Technology

*Sponsored by*

College of Information and Management Science of Henan Agricultural University

Henan Normal University

Henan University of Urban Construction

Huanghe Science and Technology University

*Published by*

SPIE

**Volume**

**12349**

Proceedings of SPIE 0277-786X, V. 12349

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at [SPIDigitalLibrary.org](http://SPIDigitalLibrary.org).

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *International Conference on Agri-Photonics and Smart Agricultural Sensing Technologies (ICASAST 2022)*, edited by Jiandong Hu, Proc. of SPIE 12349, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510657731

ISBN: 9781510657748 (electronic)

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time)

[SPIE.org](http://SPIE.org)

Copyright © 2022 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at [copyright.com](http://copyright.com). Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL  
LIBRARY**

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

# Contents

vii *Conference Committee*

---

## WIRELESS SENSOR SYSTEMS AND PRECISION AGRICULTURE SURVEYING AND MAPPING

---

- 12349 02 **Research on crop growth system of precision agriculture in field management based on wireless sensor** [12349-39]
- 12349 03 **Develop electrochemical biosensor to detect reverse transcriptase for human immunodeficiency viruses** [12349-2]
- 12349 04 **Design of marine aquaculture environment monitoring system based on wireless sensor network** [12349-38]
- 12349 05 **Wheat stripe rust remote sensing monitoring based on a new vegetation index** [12349-4]
- 12349 06 **Design of following on-board paving control system for silage corn harvesting** [12349-15]
- 12349 07 **FE-VIT: a faster and extensible vision transformer based on self pre-training for pest recognition** [12349-22]
- 12349 08 **Verification of total station by three-stage method for farmland basic mapping** [12349-6]
- 12349 09 **Determination of gravimetric water content of porous media based on time domain reflectometry** [12349-26]
- 12349 0A **Simultaneous detection of lead and cadmium based on a nanostructured conductive polymer sensor platform** [12349-42]
- 12349 0B **Wheat kernels quality testing based on improved YOLOX** [12349-51]
- 12349 0C **Research on pig behavior detection technology** [12349-37]
- 12349 0D **Detection of abscisic acid used SERS substrate based on silver coating gold nanoparticles monolayer** [12349-29]
- 12349 0E **Study on the distribution suitability of Chinese alfalfa based on Maxent model** [12349-52]
- 12349 0F **Analysis on the influencing factors of rural economy in Fujian Province** [12349-50]
- 12349 0G **An improved multi-head-attention and its application for feature extraction and classification as regards the fishery science and technology literature** [12349-23]

- 12349 OH **Research on dynamic visualization of environmental wind field based on OSGEarth-WRF model** [12349-3]
- 12349 OI **Supplementary study on ecological and biological characteristics of *Syzygium album*** [12349-17]
- 12349 OJ **Application and optimization of entropy in diagnosis for agricultural machinery bearing fault** [12349-35]
- 12349 OK **SERS of diazinon: a experimental and computational study** [12349-33]

---

**OPTOELECTRONIC TECHNOLOGY AND IMAGE CLASSIFICATION AND PROCESSING**

---

- 12349 OL **Preparation and properties of ZnO-based ultraviolet photodetectors** [12349-58]
- 12349 OM **Winegrape berry metabolome from Shangri-la River Valley and Shandong seashore base on gas chromatography time-of-flight mass spectrometry** [12349-43]
- 12349 ON **Theory and experiment for quantitative detection of melamine by surface-enhanced Raman spectroscopy** [12349-27]
- 12349 OO **Altum agricultural multispectral camera near-ground channel registration method** [12349-10]
- 12349 OP **Moth image segmentation based on improved Unet** [12349-30]
- 12349 OQ **Spectral fingerprinting based on HPLC-DAD and chemical pattern recognition for quality evaluation of *Polygonatum sibiricum* from different areas** [12349-14]
- 12349 OR **Synthesis of reticulated g-C<sub>3</sub>N<sub>4</sub> and its remarkably enhanced photocatalytic H<sub>2</sub> evolution performance** [12349-11]
- 12349 OS **High Performance Liquid Chromatography-Diode Array Detection (HPLC-DAD) method for the determination of three components in the leaves of *Stauntonia brachyanthera* from different regions** [12349-8]
- 12349 OT **Prediction of pear sugar content based on near infrared spectroscopy** [12349-1]
- 12349 OU **Flower image classification based on visual transformer** [12349-19]
- 12349 OV **Effect of ultrahigh pressure treatment on nutritional composition and micromorphology of garlic** [12349-21]
- 12349 OW **Estimation of farmland soil roughness based on digital photo processing technology** [12349-16]
- 12349 OX **Assessment and analysis model design for energy saving and carbon reduction of farmland arrangement project** [12349-40]
- 12349 OY **Forest carbon sequestration mitigates climate change** [12349-34]

- 12349 0Z **Construction strategy of China's agricultural risk management system under the background of COVID-19** [12349-20]
- 12349 10 **Research on optimization of temperature field of small pepper dryer** [12349-44]

---

**SMART AGRICULTURE AND OPTIMAL DESIGN FOR AGRICULTURAL IMPROVEMENT**

---

- 12349 11 **Application of non-measurement UAV in planning and design of rural environmental protection facilities** [12349-24]
- 12349 12 **Performance improvements of dual-arm cooperative harvesting robot** [12349-7]
- 12349 13 **Application of big data analysis technology based on Hadoop framework in agricultural soil improvement** [12349-31]
- 12349 14 **Research progress on mechanization of modern demonstration orchards and its trends of 5G application** [12349-28]
- 12349 15 **Estimation of peanut seedling emergence rate of based on UAV visible light image** [12349-5]
- 12349 16 **Research and experiment on automatic navigation control technology of intelligent electric tractor** [12349-25]
- 12349 17 **Research on the new operation mode of digital twin farm system** [12349-57]
- 12349 18 **Nondestructive identification of maize varieties using near infrared spectroscopy combined with machine learning** [12349-36]
- 12349 19 **Data analysis in intelligent farming take intelligent pig farming as an example** [12349-13]
- 12349 1A **Effects of different temperatures on post-harvesting crisp red plums under intelligent air conditioning storage** [12349-18]
- 12349 1B **Measurement and influencing factors of agglomeration degree of agricultural industrial chain in the context of internet +** [12349-48]
- 12349 1C **A pig tracking algorithm with improved IOU-tracker** [12349-49]
- 12349 1D **Design and analysis of a wireless power transmission system based on transmitter composite topology switching for agricultural drone applications** [12349-53]
- 12349 1E **Estimation of tobacco leaf chlorophyll content under different nitrogen levels using UAV-based multispectral camera** [12349-54]
- 12349 1F **Research situation and hot spot analysis of maize breeding in China based on literature measurement and patent layout** [12349-9]

- 12349 1G **Effect of intelligent high flux continuous casting and rolling technology on bending performance of rotary tiller for agriculture** [12349-32]
- 12349 1H **Agricultural pests target detection algorithm based on improved YOLOv5 model** [12349-56]
- 12349 1I **Research on greenhouse integrated water and fertilizer intelligent irrigation system based on STM32 and fuzzy control strategy** [12349-12]