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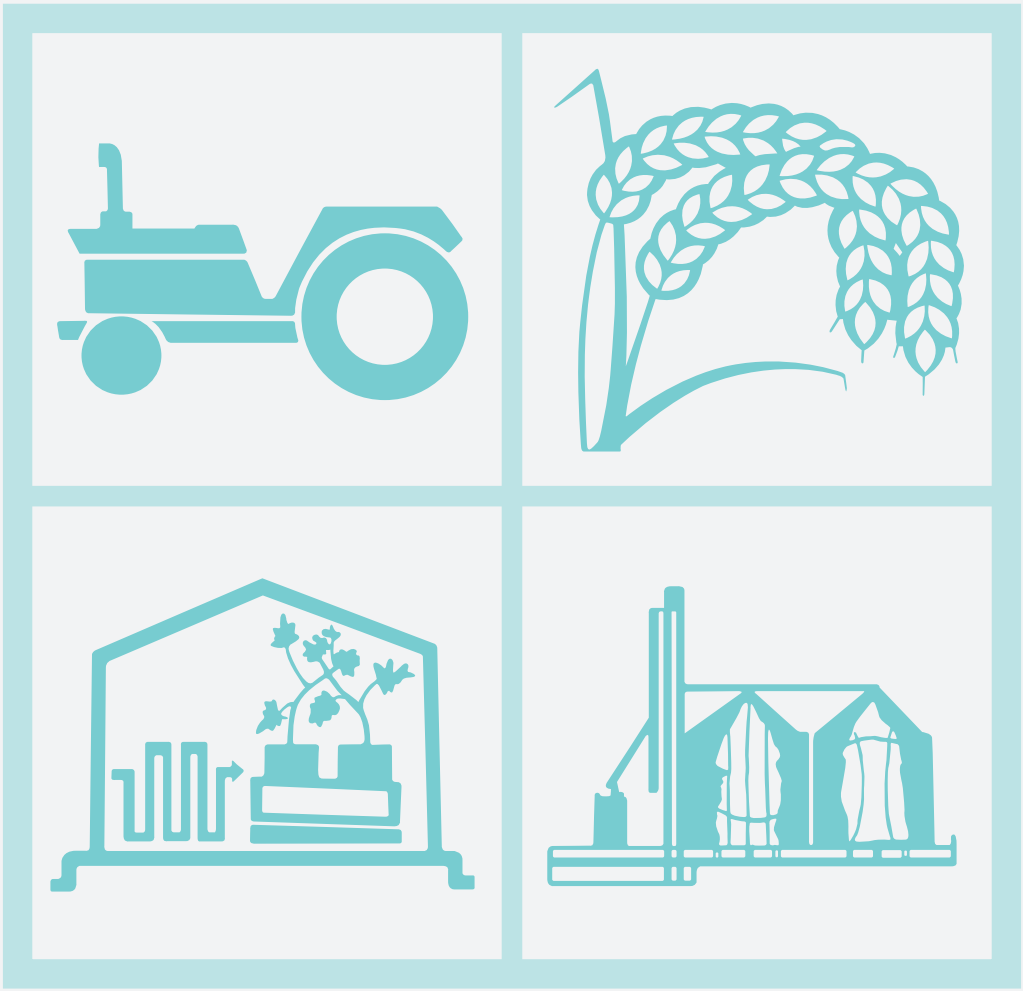

주최

(사) 한국농업기계학회
KSAM Korean Society for Agricultural Machinery

스마트팜 연구센터
Smart Farm Research Center

BAY 3 ▶스마트팜 시스템 및 신재생에너지 I

■ 좌장 : 문종필 연구관 (국립농업과학원) ■

9:00~9:12	89	**Theoretical Working Speed Analysis of a 1.54 kW One-row Biodegradable Potted Seedling Transplanting Mechanism** Md Razob Ali(Chungnam National University), Samsuzzaman, Eliezel Habineza, Md Shaha Nur Kabir, Mohammod Ali, Beom-seon Kang, Sun-Ok Chung*
9:12~9:24	90	**3D LiDAR-based Quantification of Phenotypic Traits and Land Characteristics in Rice Farming** Md Rejaul Karim(Chungnam National University), Mohammod Ali, Shahriar Ahmed, Md Shaha Nur Kabir, Md Nasim Reza, Justin Sung, Sun-Ok Chung*
9:24~9:36	91	**BES 융합을 위한 스마트온실 복합환경제어에 관한 연구** An Analysis of Smart Greenhouse Environmental Control for BES Convergence 91 전영광(강원대학교), 조라훈, 박선용, 김석준, 김대현*
9:36~9:48	92	**Classification of Pig Behaviour Experiencing Impaired Air Quality Due to Elevated GHG Concentration** Niraj Tamrakar(Gyeongsang National University), Jayanta Kumar Basak, Nibas Chandra Deb, Sijan Karki, Myeongyong Kang, Daeyeong Kang, Seong Woo Jeon, Hyeon Tae Kim*
9:48~10:00	93	**Seamless Integration of Lidar-Based SLAM and Rail-Centric Navigation for Precision Robotics in Greenhouse** Tean Chen(Chonnam National University), Pablo Vela, Omer Faruk Ince, Woo-Young Kim, Kyeong-Hwan Lee*
10:00~10:12	94	**Theoretical analysis of a wheel-driven dibbling mechanism for a single-row automatic pepper transplanter** Eliezel Habineza(Chungnam National University), Md Nasim Reza, Shahriar Ahmed, Md Razob Ali, Emmanuel Bicamumakuba, Seok-Ho Park, Sun-Ok Chung*
10:12~10:24	95	**강화학습과 빅데이터를 활용한 온실 환경 제어 알고리즘 개발** Development of Environment Control Algorithm in the Greenhouse Using Big Data and Reinforcement Learning 조라훈(강원대학교), 박선용, 김석준, 전영광, 김대현*, 박승영*
10:24~10:36	96	**구조성분을 이용한 농업부산물 반탄화 공정 시 질량 감소 모델 개발** Development and Validation of Mass Reduction Prediction Model using Structural Composition for Agrobyproudt Torrefaction 박선용(강원대학교), 김석준, 오광철, 김하은, 김선엽, 조라훈, 전영광, 김대현*
10:36~10:48	97	**Machine learning approaches in modeling of digestible energy demand in mature phase of swine** Nibas Chandra Deb(Gyeongsang National University), Jayanta Kumar Basak, Sijan Karki, Daeyeong Kang, Niraj Tamrakar, Eun-Wan Seo, Seong Woo Jeon, Hyeon Tae Kim*
10:48~11:00	98	**딸기 온실 에너지절감을 위한 PVT모듈과 공기 대 물 히트펌프를 결합한 냉·난방 시스템 개발** Development of a complex heating and cooling system using PVT modules and an air-to-water heat pump to save energy in strawberry greenhouses 이충건(농촌진흥청), 김성헌, 김형권, 문종필*
11:00~11:10		**Break Time**

Seamless Integration of Lidar-Based SLAM and Rail-Centric Navigation for Precision Robotics in Greenhouse

Tean Chen[1,3], Pablo Vela[1,3], Omer Faruk Ince[2], Woo-Young Kim[2], Kyeong-Hwan Lee[1,2,3*]

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Abstract

The efficient navigation of autonomous mobile robots in agricultural greenhouses poses a critical challenge for precision farming and crop management. In this study, we present a navigation platform designed specifically for greenhouse environments. Our approach leverages Lidar-based Simultaneous Localization and Mapping (SLAM) to create an accurate map of the greenhouse while incorporating strategically placed markers to identify the center points of rails within the facility. During localization, we exploit the known positions of these rail markers in a 2D space, eliminating the need for additional markers and reducing computational complexity. The navigation phase relies on our robust localization algorithm, which matches Lidar scans with a 2D occupancy grid map to provide real-time position information for the robot. Path planning is accomplished using the Timed-Elastic-Band (TEB) local planner algorithm for dynamic obstacle avoidance and the Dijkstra global planner for route optimization. Experimental results demonstrate the effectiveness of our approach, with an average localization error of less than 5cm and our system achieves an impressive trajectory tracking accuracy rate exceeding 96%, enabling the autonomous robot to efficiently and safely navigate to specific target locations within the greenhouse. In future work, we will conduct experiments in more complex greenhouse environments to improve localization accuracy in agricultural robotics and autonomous systems.

Keywords

Simultaneous localization and Mapping (SLAM), Timed-Elastic-Bend (TEB), Dijkstra Global Planner Algorithm

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