

# Fundamental technologies for an autonomous mobile robot and its applications

Prof. Shoichi Maeyama

Faculty of Engineering and Design, Kagawa University

Email: maeyama.shoichi@kagawa-u.ac.jp



## Fundamental technology of an autonomous mobile robot

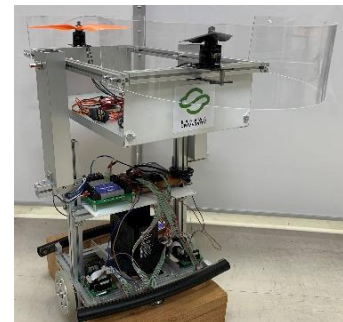
- SLAM (Simultaneous Localization and Map building) [1]
- Autonomous parking of ultra-small electric vehicle [2]
- Development of new mobile mechanism
- Path planning with various robot shapes and kinematic constraints
- Human interface for autonomous mobile robots
- Ascending /descending stairs by a crawler type robot



## Applications of an autonomous mobile robot

- Half-drone inverse pendulum transportation robot

A mobile mechanism by wheels is efficient on flat road surface but not for step climbing. A crawler is good for step climbing but inefficient on the flat road surface. On the other hand, drone can move in air but is limited on the payload and moving distances. Therefore, in this research, a new mobile mechanism combining wheels with drone is proposed and its autonomous control is researched to realize efficient movement on both flat surface and steps and overcome the limited payload.



- Cleaning robot of a fattening piggery

Environmental sensing for a cleaning robot of a fattening piggery are researched. Its environmental conditions include a long narrow corridor, various types of fences, and a light mist for cleaning. We focus on the development of a fence recognition system using a LiDAR and fence following algorithm by omnidirectional crawler type robot working in a real fattening piggery.



[1] Shoichi Maeyama, Yuta Takahashi, and Keigo Watanabe:” A solution to SLAM problems by simultaneous estimation of kinematic parameters including sensor mounting offset with an augmented UKF”, Advanced Robotics, 29:17, 1137-1149, DOI:10.1080/01691864.2015.1067645

[2] Tatsuya Kamiyama, Shoichi Maeyama, Kazuya Okawa, Keigo Watanabe, and Yasuyuki Nogami:” Recognition of parking spaces on dry and wet road surfaces using received light intensity of laser for ultra-small EVs”, Proceedings of the 2019 IEEE/SICE International Symposium on System Integration, pp.494–501, 2019,.