

Revitalization Center



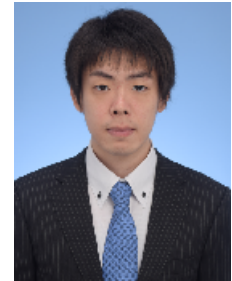
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Summary of Achievement

Refereed academic journal

- [ogawa-409-078-01:2016] Jun Ogawa Keita Nakamura Taku Matsumoto, Yoshiaki Oyama and Keitaro Naruse. Mechanism of generating drawbar pull of rod wheel on loose soil. *Artificial Life and Robotics*, 22:6, 2017.

Refereed proceedings of an academic conference

- [keita-n-409-078-01:2016] Keita Nakamura and Ikuya Shimbo. Formulation and solution method of tour conducting knapsack problem. In *Proceedings of the 2016 IEEE 5th Global Conference on Consumer Electronics*, pages 151–152, 2016.

Many studies for developing methods of solving have been done in the field of combinatorial optimization. However, it cannot simply apply these methods to real problems. For example, when a tourist decide to traveling schedule within a traveling time limit, he or she needs to select and travel tourist spots in order to be satisfied as far as possible. Such a problem cannot be solved by conventional solving method. In this study, the authors define this problem as TCKP (Tour Conducting Knapsack Problem). And the authors formulate and develop method for solving TCKP. Formulation and Solution method of TCKP are based on those of TSP (Traveling Salesman Problem) and knapsack problem. Numerical experiment is carried out in order to verify the effectiveness of proposed method. Experimental results show that it can be obtained the optimized solution within one minute when the number of tourist spots is 15 and fewer.

- [keita-n-409-078-02:2016] Keita Nakamura, Minoru Kimura, Takashi Anazawa, Taira Takahashi, and Keitaro Naruse. Investigation of weeding ability and plant damage for rice field weeding robots. In *Proceedings of the 2016 IEEE/SICE International Symposium on System Integration*, pages 899–905, 2016.

This paper reports our current development of 'Robo-ducky', the rice field weeding robots, which is inspired from rice farming with natural ducks. This paper presents (1) the improvement of motion ability of the robot by modifying the size of the robots, and (2) the investigation of weeding ability of the robot and damage put to rice plants in an agricultural scientific way such as counting up the number of seeds up from soil and defect rice plants accord-

ing to the number of robot weeding. These investigations show the robot has enough weeding ability in actual rice fields.

- [keita-n-409-078-03:2016] Haruna Nakazawa, Keita Nakamura, and Keitaro Naruse. Collision identification in weeding robot with acceleration standard deviation. In *Proceedings of the 2016 IEEE International Conference on Robotics and Biomimetics (ROBIO2016)*, pages 2026–2032, 2016.

Recently, in the background such as the organic agriculture has been focused for healthy life, a weeding robot for a rice field, called “Aigamo robot”, has developed in our research group. It stirs soil by moving on the rice field, and prevent weed seedling from establishing. For controlling it in autonomously, it needs to identify if it is at an edge on the field and makes a turn. However, GPS (Global Positioning System) module does not give us enough accuracy for the above identification. On the other hand, ultrasound sensors cannot use because the robot works in muddy soil which absorbs ultrasonic. Therefore, in this research, we develop a collision identification method by identifying if the robot is in motion or not with the acceleration sensor, and verify it in an actual rice field.

- [keita-n-409-078-04:2016] Taku Matsumoto, Yoshiaki Oyama, Keita Nakamura, and Keitaro Naruse. Frequency Based Modeling Drawbar Pull for Rod Wheel on Loose Soil. In *Proceeding of The Twenty-Second International Symposium on Artificial Life and Robotics*, pages 401–405, 2017.

This paper shows modeling the drawbar pull generated by rod wheel on the loose soil. In this rod wheel, rods are attached wheel in regular interval. This wheel does not touch continuously the soil. In other words, rods touch discretely there. And when rotational velocity is constant for this wheel, it touches periodically to the soil. In this study, we focus its periodicity and model the drawbar pull. And we obtain data for drawbar pull resolved by frequency analysis from experiment. In order to verify drawbar pull distribution by a rod, this paper focuses the number of rods is one. Drawbar pull which we model by frequency analysis is evaluated from accuracy.

- [ogawa-409-078-02:2016] Jun Ogawa, Miki Taira, Keita Nakamura, and Keitaro Naruse. Cellular Automaton Approach for Motion Pattern Analysis of Soft-bodied Agent. In *Proceedings of The 1st International Con-*

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ference on Digital Practice for Science, Technology, Education, and Management, page 4, 2018.

[ogawa-409-078-03:2016] Kizuku Mineta Jun Ogawa Keitaro Naruse Keita Nakamura, Daisuke Kai. Improvement for 3D Reconstruction Considering Passive Rotation by Towing Camera. In *Proceedings of The 1st International Conference on Digital Practice for Science, Technology, Education, and Management*, page 4, 2018.

[ogawa-409-078-04:2016] Keita Nakamura Fumiaki Abe, Jun Ogawa and Keitaro Naruse. Stable Pulling Out Strategy for Small Disaster Response Robot with Dual-arm. In *Proceedings of the 23rd International Symposium on Artificial Life and Robotics*, page 4, 2018.

[ogawa-409-078-05:2016] Keita Nakamura Haruna Nakazawa, Jun Ogawa and Keitaro Naruse. Distributed Localization by Camera Robots with Consensus Filter. In *Proceedings of the SWARM 2017*, page 6, 2017.

[ogawa-409-078-06:2016] Jun Ogawa Keitaro Naruse, Keisuke Hamatani and Keita Nakamura. Robot Sweep Path Planning with Weak Field Constrains under Large Motion Disturbance. In *Proceedings of the SWARM 2017*, page 6, 2017.

Unrefereed proceedings of an academic conference

[keita-n-409-078-05:2016] Keita Nakamura, Fumiaki Abe, Haruna Nakazawa, Yoshiaki Oyama, Keisuke Hamatani, and Keitaro Naruse. Automatic traveling for small weeding robot in paddy field with image processing. In *Proceedings of 2017 Spring Meeting for Japanese Society of Farm Work Research*, 2017.

[keita-n-409-078-06:2016] Haruna Nakazawa, Keita Nakamura, and Keitaro Naruse. Collision Identification in Weeding Robot with Acceleration Sensor. In *Proceedings of JSPE Semestrial Meeting*, 2016.

[keita-n-409-078-07:2016] Taku Matsumoto, Keita Nakamura, and Keitaro Naruse. Development and verification for driving force model of rod wheel in loose soil by decomposition of periodic component and nonperiodic component. In *Proceedings of the 34th Annual Conference of the Robotics Society of Japan*, 2016.

- [keita-n-409-078-08:2016] Yoshiaki Oyama, Keita Nakamura, and Keitaro Naruse. Improvement of self-localization and development of rod wheels in Aigamo robot for automatic traveling. In *The 5th Sustainable / Robotic System Design Workshop*, 2016.
- [keita-n-409-078-09:2016] Haruna Nakazawa, Keita Nakamura, and Keitaro Naruse. Identification stuck state for weeding robot by acceleration sensor. In *The 5th Sustainable / Robotic System Design Workshop*, 2016.
- [keita-n-409-078-10:2016] Fumiaki Abe, Keita Nakamura, and Keitaro Naruse. Presentation of the gripping point using image processing for a robot arm. In *Proceedings of the 305th SICE Tohoku chapter workshop*, 2016.
- [keita-n-409-078-11:2016] Kizuku Mineta, Keita Nakamura, and Keitaro Naruse. Verifying 3D reconstruction by towing camera with passive rotational motion for investigation of the building. In *Proceedings of the 305th SICE Tohoku chapter workshop*, 2016.
- [keita-n-409-078-12:2016] Keisuke Hamatani, Keita Nakamura, and Keitaro Naruse. Self-localization method for a super decentrlized camera robots system. In *Proceedings of the 305th SICE Tohoku chapter workshop*, 2016.
- [keita-n-409-078-13:2016] Shingo Kaminokado, Yoshiaki Oyama, Kizuku Mineta, Mami Yokokawa, Taku Matsumoto, Haruna Nakazawa, Fumiaki Abe, Takeru Honda, Keita Nakamura, and Keitaro Naruse. Investigation and factorial analysis of observation points distribution using GPS modules for weeding robot. In *Proceedings of the 305th SICE Tohoku chapter workshop*, 2016.
- [keita-n-409-078-14:2016] Yoshiaki Oyama, Taku Matsumoto, Keita Nakamura, and Keitaro Naruse. Investigation of dug soil volume by a rod wheel for weeding robot in tha paddy field. In *Proceedings of the 305th SICE Tohoku chapter workshop*, 2016.
- [keita-n-409-078-15:2016] Kizuku Mineta, Keita Nakamura, and Keitaro Naruse. Verifying 3D reconstruction by towing camera with passive rotational motion from time-series images. In *Proceedings of the 17th SICE System Integration Division Annual Conference*, 2016.

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- [keita-n-409-078-16:2016] Keisuke Hamatani, Keita Nakamura, and Keitaro Naruse. Self-Localization Method for a Super Decentralized Camera Robots System. In *Proceedings of the 17th SICE System Integration Division Annual Conference*, 2016.
- [keita-n-409-078-17:2016] Yoshiaki Oyama, Keita Nakamura, and Keitaro Naruse. Investigation of Dug Soil Volume by a Rod Wheel for Weeding Robot in the Paddy Field. In *Proceedings of the 17th SICE System Integration Division Annual Conference*, 2016.
- [keita-n-409-078-18:2016] Daishi Yoshino, Keigo Anma, Keitaro Naruse, Yuichi Yaguchi, Yutaka Watanobe, and Keita Nakamura. Implementation and application of Pub/Sub message communication of OpenRTM-aist using Solace. In *Proceedings of the 17th SICE System Integration Division Annual Conference*, 2016.
- [keita-n-409-078-19:2016] Yukinori Inoue, Yuichi Yaguchi, Keitaro Naruse, Yutaka Watanobe, Kizuku Mineta, Hung Pham Cuong, Keisuke Hamatani, Thisara Dharmasiri Pathberiyage Venushka, Yoshiaki Oyama, Haruna Nakazawa, Takaaki Mamiya, Taku Matsumoto, Keigo Anma, Daishi Yoshino, and Keita Nakamura. Development of sensor data collection base using RT components. In *Proceedings of the 17th SICE System Integration Division Annual Conference*, 2016.
- [keita-n-409-078-20:2016] Ken Sato, Yoshiaki Oyama, Kizuku Mineta, Keisuke Hamatani, Haruna Nakazawa, Fumiaki Abe, Keita Nakamura, and Keitaro Naruse. Self-localization of weeding robot for the paddy field by external observation cameras. In *Proceedings of the 3rd IPSJ Tohoku chapter workshop in 2016*, 2017.
- [keita-n-409-078-21:2016] Fumiaki Abe, Keita Nakamura, and Keitaro Naruse. Support for grasping objects using image processing for large disaster response robots. In *Proceedings of the second Conference for R&D Initiative on Nuclear Decommissioning Technology by the Next Generation*, 2017.
- [keita-n-409-078-22:2016] Hikaru Harasawa, Keita Nakamura, Jun Ogawa, and Keitaro Naruse. Controlling Framework for Intelligent Robot using FPGA -Sending system for emergency stop signal based on optical flow-. In *Proceedings of the 16th Complex System Micro Symposium*, 2017.

- [keita-n-409-078-23:2016] Ken Sato, Yoshiaki Oyama, Kizuku Mineta, Keisuke Hamatani, Mami Yokokawa, Taku Matsumoto, Haruna Nakazawa, Fumiaki Abe, Shingo Kaminokado, Takeru Honda, Keita Nakamura, and Keitaro Naruse. Navigation of rice field weeding robot by external vision sensor. In *Proceedings of JSPE Semestrial Meeting*, 2017.
- [ogawa-409-078-07:2016] Jun Ogawa, Hiroyuki Iizuka, and Masahito Yamamoto. Morphological Evolution of Soft Robots by Age-Fitness Pareto Optimization. In *Proceedings of JSPE Semestrial Meeting*, page 2, 2017.
- [ogawa-409-078-08:2016] Keita Nakamura Haruna Nakazawa, Jun Ogawa and Keitaro Naruse. Probabilistic re-route planning for robots whose movement by environment is uncertain. In *SICE SI 2017*, 2017.
- [ogawa-409-078-09:2016] Keita Nakamura Fumiaki Abe, Jun Ogawa and Keitaro Naruse. A drawing strategy considering sudden rotation center change for a dual arm robot. In *SICE SI 2017*, 2017.
- [ogawa-409-078-10:2016] Jun Ogawa, Keita Nakamura, and Keitaro Naruse. Biological expression by coupled oscillator system of fixed topology. In *SICE SI 2017*, 2017.
- [ogawa-409-078-11:2016] Jun Ogawa Fumiaki Abe, Keita Nakamura and Keitaro Naruse. Gripping Point Suggestion of Target Object by Ellipse detection Using Hough Translatefor Large Scale Remote Control Robot. In *2017 JSME Conference on Robotics and Mechatronics*, 2017.
- [ogawa-409-078-12:2016] Jun Ogawa Keita Nakamura Taku Matsumoto, Yoshiaki Ooyama and Keitaro Naruse. Modeling of Generating Driving Force Mechanism for Rod WheelInteracting with Particles in the Soil. In *2017 JSME Conference on Robotics and Mechatronics*, 2017.
- [ogawa-409-078-13:2016] Keita Nakamura Haruna Nakazawa, Jun Ogawa and Keitaro Naruse. The Proposal of Path Planning for Sweeping Robot with Movement Instability. In *2017 JSME Conference on Robotics and Mechatronics*, 2017.
- [ogawa-409-078-14:2016] Keita Nakamura Jun Ogawa Yoshiaki Ooyama, Taku Matsumoto and Keitaro Naruse. Modeling of bulldozed soil volume by rod wheel considering interaction by soil particles. In *2017 JSME Conference on Robotics and Mechatronics*, 2017.

Summary of Achievement

Research grants from scientific research funds and public organizations

[ogawa-409-078-15:2016] Jun Ogawa. Evolutionary Soft Robotics for Traveling Rough Terrain at Disaster Site, 2017-2020.

Academic society activities

[keita-n-409-078-24:2016] Keita Nakamura, 2016.

Japan Society for Precision Engineering (JSPE) Affiliate

[keita-n-409-078-25:2016] Keita Nakamura, 2016.

Member of public relations & information committee in Japan Society for Precision Engineering (JSPE)

[ogawa-409-078-16:2016] Jun Ogawa, 2017.

Industrial exhibition, ROBOMECH2017 Organizing Committee

Contributions related to regional education

[keita-n-409-078-26:2016] Instructor for RT middleware workshop in College of engineering, Nihon University (2017-01-27)

[keita-n-409-078-27:2016] Instructor for RT middleware workshop in University of Aizu (2017-03-10)

[keita-n-409-078-28:2016] Instructor for Robot hackathon trial in University of Aizu (2017-03-22, 23)