2.5.14 Laboratory : Agricultural Process Engineering

Member :	Professor	Kondo, Naoshi, Ph.D
	Associate Professor	Ogawa, Yuichi, Ph.D
	Doctor's program	4
	Master's Program	3
	Undergraduate	6
	Other	2
	Post-Doctoral fellow	2
	Researcher	4

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Blood Vitamin A Level Measurement in Beef Cattle

Vitamin A (V.A) in cattle blood is an important indication of managing the beef quality in Japan. The V.A level should be maintained low level for the beef quality and kept above 30 IU/dl from 16 months to 24 months. Since the V.A deficiency (less than 30 IU/dl) induces serious diseases in cattle, it is essential to monitor the V.A level carefully. The conventional blood test is used for detecting the V.A level, which is time-consuming, expensive, and stressful to the cattle. Pupil color reflection is noninvasively investigated by several sensors for developing an optimum method to measure the blood V.A.

b) Machine Vision for Fruit Grading System

Algorithms are investigated for inspect round shape fruits such as tomato and citrus using TV cameras. Especially for citrus fruits, fluorescence images are acquired to detect rotten fruits, which is difficult to be find even by human eyes, because their skins contain fluorescent substances which can be reacted by ultraviolet light.

c) Comfort and Automation in Operations at Agricultural Facilities

Generally speaking, there are many kinds noise sources in agricultural facilities and operators often work under noisy conditions. Especially in grading systems, they are sometimes in more than 90 dB noise for more than several hours. To communicate with operators one another, a virtual low-noise space around operators' ears under noisy environment in facility

has been studied for keeping safety and comfortable working condition. Robotization and automation projects are being conducted in greenhouse or grading facilities. A tomato cluster harvesting robot and an asparagus harvesting robot in greenhouses are being developed.

d) Informatization of Agricultural Products

Grading systems are the largest sources to obtain many kinds of information on agricultural products. TV cameras and NIR inspectors can give us information added products by their images and spectral data. A mobile grading robot to which the grading function was installed has been investigated. In this project, a mobile citrus fruit grading robot was made as a trial. The grading robot can extracted fruit grading information as well as tree information while human operators harvest fruit and it immediately grade the harvested fruits. This makes not orchard management but tree management in the orchard and guides precision agriculture in citrus production.

A-2.Publications and presentations

a) Publications

Original Papers

- Naoshi Kondo, Makoto Kuramoto, Hiroshi Shimizu,Yuichi Ogawa, Mitsutaka Kurita, Takahisa Nishizu, Vui Kiong Chong, Kazuya Yamamoto : Identification of Fluorescent Substance in Mandarin Orange Skin for Machine Vision System to Detect Rotten Citrus Fruits, EAEF2(2): 54-59, 2009
- Naoshi Kondo, Kazuya Yamamoto, Hiroshi Shimizu, Koki Yata, Mitsutaka Kurita, Tomoo Shiigi, Mitsuji Monta, Takahisa Nishizu: A Machine Vision System for tomato Cluster Harvesting Robot, EAEF2(2): 60-65, 2009.
- HiroshiShimizu, Yukari Tsushima, Naoshi Kondo, Tomoo Shiigi, Takahisa Nishizu, Vui Kiong Chong: Classification of the stem elongation pattern in ornamental plants under the different day and night temperature conditions, EAEF2(2): 72-77, (2009.4)
- N. Kondo, K. Tanihara, T. Shiigi, H. Shimizu, M. Kurita, M. Tsutumi, V.K. Chong, S.Taniwaki : Path-Planning of Tomato-Cluster Harvesting Robot to Realize Low Vibration and Speedy Transportation, EAEF2(3):108-115(2009)
- M.Kurita, N. Kondo, H. Shimizu, P.P.Ling, P. D. Falzea, T. Shiigi, K. Ninomiya, T. Nishizu, K. Yamamoto: A double image acquisition system with visible and UV LEDs for citrus fruit, Journal of Robotics and Mechatronics, 21(4):533-540(2009.8)
- Naoshi KONDO, Koki YATA, Michihisa IIDA, Tomoo SHIIGI, Mitsuji MONTA, Mitsutaka KURITA and Hiromi OMORI: Development of an End-Effector for a Tomato

Cluster Harvesting Robot, EAEF 3(1): 20-24 (2010)

- Naoshi Kondo: Automation on fruit and vegetable grading system and food traceability, Trends in Food Science and Technology, Vol.21, Issue 3, 145-152 (2010.3), Advances in Food Processing and Packaging Automation, DOI: 10.1016/j.tifs.2009.09.002 http://dx.doi.org/10.1016/j.tifs.2009.09.002

- M. Aboonajmi, A. Akram, T. Nishizu, N. Kondo, S.K. Setarehdan, A. Rajabipour: An ultrasound based technique for the determination of poultry egg quality, Res. Agr. Eng., Vol.56, No.1: 26-32, 2010.

- Ogawa Y., Cheng L., Hayashi S., Fukunaga K.: Attenuated total reflection spectra of aqueous glycine in the terahertz region, IEICE Electronics Express, 6 (2), 117 - 121 (2009).

- Yoshida S., Kato E., Suizu K., Nakagomi Y., Ogawa Y. and Kawase K.: Terahertz Sensing of Thin Poly(ethylene Terephthalate) Film Thickness, Applied Physics Express, 2, 012301 (2009).

- Hayashi S., Shibuya T., Sakai H., Yasui T., Taira N., Ogawa Y., Otani C., and Kawase K.,: Portable and Tunable Terahertz-Wave Parametric Generator Pumped by Microchip Nd:YAG Laser, The Review of Laser Engineering, 37 (4), 278 - 289 (2009).

- Sato H., Ogawa Y., and Watanabe K.: Feasibility of the Quality Evaluation of Cheeses Using Terahertz Spectroscopy, J. Illum. Engng. Inst. Jpn., 93(8A), 481 - 486 (2009).

- Yoshida H., Ogawa Y., Hayashi S., Otani C., and Kawase K.,: Label-free detection of Allergens inMilk using a Metallic Mesh Sensor, J. Illum. Engng. Inst. Jpn., 93(8A), 487 - 491 (2009).

- Yoshida S., Suizu K., Kato E., Nakagomi Y., Ogawa Y.,and Kawase K.: A high-sensitivity terahertz sensing method using a metallic mesh with unique transmission properties, Journal of Molecular Spectroscopy, 256(1), 146 - 151 (2009).

<u>Reports</u>

- Naoshi Kondo: Image Utilization in Agricultural Fields- Machine vision in Bio-Produciton-, Image lab, Vol.20, No.9, 57-63(2009）

b) Conference and seminar papers presented

- ROBOMEC, JSME (4)

- CIOSTA Conference 2009, CIGR (4)

- The 1st International Workshop on Nondestructive Quality and Safety Evaluation of Agricultural and Livestock Products (1)

- BIO-ROBOTICS IV, IFAC (3)
- International Advanced Technology Congress 2009(1)
- 2009 ViEW Vision Engineering Workshop(2)
- JSAM Annual meeting (1)
- The 123rd meeting of Kansai Branch, JSAM(5)
- The 89th meeting of Chemical Society of Japan (1)
- The 56th meeting of Japanese Society for Food Science and Technology (2)
- The 34th International Conference on Infrared, Millimeter, and Terahertz Waves (1)
- PITTCON 2010 (1)
- The 57th spring meeting of Japan Society of Applied Physics (2)

A-3.Off-campus activities

Membership in academic societies

- Kondo, Naoshi : Visiting Researcher, Nanyo Fishery Research Center, Ehime Unviersity, Councilor, Kansai Branch, Japanese Society of Agricultural Machinery, Councilor, Japanese Society of Environment Control in Biology, Director, Japanese Society of Agricultural Machinery, Councilor, Robotics Society, Japan, Committee member of paper award, Japanese Society of Mechanical Engineering
- Ogawa, Yuichi : Visiting Researcher, Terahertz Sensing and Imaging Laboratory, RIKEN , Committee member, Committee on Applied Research of Infrared Radiarion for Food Safety, Illuminating Engineering Institute of Japan, Committee member, Division of Terahertz Spectroscopy, The Spectroscopical Society of Japan

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Scientific Research (B) : Kondo, Naoshi : Mobile grading robot for citrus production and control of observation satellite
- Grant-in-Aid for JSPS fellow : Kondo, Naoshi (Host Researcher) : Machine vision system for grafting robot of tomato seedling
- Challenging Exploratory Research : Kondo, Naoshi : Living fish volume measurement by Helmholtz resonance
- Publication of Scientific Research Results : Kondo, Naoshi : Agricultural Robot : Mechanisms and Practice

2.Other Research Grants

- Fundamental research for innovation creation, BRAIN：Kondo, Naoshi：Development of blood component measurement device and management system by use of pupillary reflex of beef cattle
- National Agriculture and Food Research Organization：Kondo, Naoshi：Development of lavorsaving technologies on controlled-environement horticultural production
- Nagasaki Prefecture：Kondo, Naoshi：Development of machine vision for asparagus harvesting robot

A-4.International cooperation and overseas activities

Membership in academic societies

- Kondo, Naoshi: Japanese Society of Agricultural Machinery (Director, Councilor, Editor in Chief, English journal editing committee)
- Ogawa, Yuichi: Japanese Society of Agricultural Machinery (Accountant profession, English journal editing committee)

International meetings(country,roles)

- Kondo, Naoshi：CIOSTA conference 2009, CIGR (Italy, Plenary speaker), The 1st International Workshop on Nondestructive Quality and Safety Evaluationof Agricultural Livestock Products (China, Invitation lecture), BIO-Robotics IV (USA, Invitation paneler), International Advanced Technology Congress 2009 (Malaysia, Keynote speech)
- Ogawa, Yuichi：The 34th International Conference on Infrared, Millimeter, and Terahertz Waves (Korea, Invited speaker), PITTCON 2010 (USA, Invited speaker)

Visiting Research Scholars

- Guest Research Associate 1（China）
- Guest Research Associate 1（Bangladesh）
- Guest Research Associate 1（United States）

B.Educational Activities(2009.4-2010.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level： Introduction to Agricultural and Environmental Engineering (Freshman), Agricultural Process machinery (Junior), Electric Engineering (Junior), Instrumentation and Measurement for Biological Objects (Junior), Introduction to Foreign Literature on

Agricultural Machinery (Junior), Laboratory course in agricultural machinery II (Senior),

- Graduate level: Seminar I on Agricultural Process Engineering (Master course), Agricultural Process Engineering, Laboratory Course in Agricultural Engineering, Seminar II on Agricultural Process Engineering

B-3.Overseas teaching

International students

- International students : Doctral 1 (China) Research Students 3 (China)

Lectures and seminars

- Kondo, Naoshi

Lecture on Robotics in Bioproduction Systems(Guest Professor) : College of Biosystems Engineering & Food Science, Zhejiang University(China)

C.Other Remarks

- Naoshi Kondo: exective board member, Japanese Society of Agricultural Machinery, councilor of Robotics Society Japan, councilor of Japanese Society of Agricultural, Biological Environmental Engineers and Scientists, Council for University Chartering and School Juridical Person, MEXT