

The Second Open Seminar, 2013

Presenter : Prof. Ta-Te Lin (National Taiwan Univ.)

**Title : “Uncovering Honey Bee Behaviors
Using an Intelligent Imaging System”**

Room: S-173, Faculty of Agriculture Building

Time and Date: 15:00~16:00, June 19 (Wed), 2013



Abstract: Honey bees are social insects and they are important pollinators in the nature. In particular, the activity of foragers flying in and out of the beehive to search food provides important information to understand the whole colony. Since colony collapse disorder has occurred at different countries in the world and has affected the number of honey bees and agricultural productions, we have developed an efficient system for honeybee behavior monitoring and analyses based on machine vision. This is the first imaging system in the world for monitoring and analyzing the in-and-out activity of honey bees as they pass through the entrance of a beehive. Unlike the radio frequency identification system (RFID), this system is designed to automatically record individual honey bee's behavior without interfering their regular activities. This system consists of infrared LED light sources, one infrared CCD camera, an acrylic passageway and a personal computer. The personal computer is connected to the CCD camera to record the honey bees' activity in the acrylic passageway that confines the path honey bees entering or exiting the beehive. In order to monitor honey bees individually, a unique label is attached to each forager. Two different types of labeling methods were developed in this research: one circular paper label and one laser engraved label. The circular paper label is a unique two characters encoded paper label attached to the dorsum of the bees' thoraxes. This labeling system has been proved to have 97.2% of detection rate and 94.5% of recognition rate on live honey bees. Furthermore, the foraging behavior of individual honey bee is monitored and the group foraging behavior is summarized and analyzed. It is found that the accumulated beehive departures are more frequent before midday and over 50% of foraging time is within three minutes. With the purpose of avoiding labels detaching from the honey bees, a novel laser-engraved labeling technique was also developed. The laser-engraved labeling approach has shown no damage to honey bees' condition, ability and behavior. With a newly developed image processing method, preliminary experiments show that the detection and recognition rate of laser-engraved label were 97% and 96.3%, respectively. These experimental results have demonstrated the feasibility and of this imaging system and the benefits it can provide to honey bees behavior analysis. This imaging system is cost effective and easy to implement. Furthermore, it can be further applied to different experiments to investigate the effects of insecticide and pathogens on honey bee's behavior. These experimental data would help to solve the colony collapse disorder mystery.

Anyone is welcome!

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