# Intel-NTU Connected Context Computing Center Open House 2013 and Intel Innovation Day 2013 Showcase Highlights

## Introduction

This article reports on the annual events for Intel-NTU Connected Context Computing Center. Three focus research teams were highlighted; Future Agriculture, Intelligent Transportation and Smart Living. Those three teams were all fully supported by other projects in the center. Detailed research contents and its development are elaborated in the following passages. Our center is dedicated to integrate the research energy in technology application. Therefore, we sincerely welcome those who are interested in the field of Internet of Things (IoT) and machine-to-machine (M2M) jointly to build up and create more innovative technology for human beings.

## Event Report

- The director of Intel-NTU Center was interviewed by SET Finance Channel regarding the current development of the center, please refer to the link for the completed interview on line: http://youtu.be/AhKj6DrIrZ0

Intel-NTU Connected Context Computing Center (Intel-NTU Center) showcases its latest research on Internet of Things (IoT) and machine-to-machine (M2M) technologies in Open House 2013 on December 8 and Intel Innovation Day 2013 on December 11. Open House 2013 is held not only for demonstrating the cutting-edge technologies in IoT and M2M fields but also for outreaching the opportunities with the industry collaborations in Taiwan. 42 participants including 20 industries and 5 academic institutes showed up with their great interests. Those representatives were coming from many significant leading companies in the computer and information industry, such as Chunghwa Telecom, Panasonic Inc., AdvanTech Inc., HTC, and Delta Electronics, etc., and some other representatives were from Institute for Information Industry, Industrial Technology Research Institute and etc..

## Future Agriculture

Both events, Open House 2013 and Intel Innovation Day 2013 displayed the cutting-edge technologies from Intel-NTU Center in the themes of Future Agriculture, Intelligent Transportation, and Smart Living. The highlight demonstration in Future Agriculture is Automatic Greenhouse via M2M-based Sensing and Networking. The demo was in three parts. First, the self-organizing mesh networking allows the smart sensor devices to exchange data. Next, the demo showed the integration of security, anomaly detection and reconfigurability features to make the monitoring robust. The third demo illustrated how M2M technology enables pest control in greenhouse, plant physiological condition inspections, and intelligent control of greenhouse facilities. This demo showcased the Intel-NTU Center research on M2M-based automatic greenhouse monitoring system. This project has been reported on international media, such as BBC News and Discovery Channel, for its innovation to create the future of agriculture.

## Intelligent Transportation

For Intelligent Transportation, four significant research interests were demonstrated; they were Cooperative M2M Perception, Driver-type Classification, Visible Light Communication and Positioning and Vehicle Data Analytics. A video was presented to show the result of the collaborative neighboring map system. It showed that the uncertainty of the estimated location of moving objects can be significantly reduced with our system. Another research regarding transportation was to collect data of driving trajectories and to analyze the data including speed, gyro, acceleration and GPS information to develop the anomaly trajectory detection mechanism. Based on the detection result, we can identify bad driving behaviors and aggressive drivers. Embedded this mechanism into driving monitoring system may provide the early warning to the driver if he/she tend to be an aggressive driver.

The key demonstration here was to utilize CamCom, i.e., LED-to-Camera communications, to implement a highly accurate relative positioning system for vehicles. The system uses a light intensity modulated LED taillight as the transmitter, periodically broadcasting the vehicle's status as well as the dimension of its taillights, and a common rolling shutter camera to receive the message. At the receiver side, utilizing the received dimension information of the transmitter as well as photogrammetry, the relative position of the transmitter can be estimated. The positioning information can be utilized in many safety applications, such as blind spot information system and forward collision avoidance system. The demo showed how short digital message can be transmitted via our system to neighboring vehicles, which can be viewed as a "digital" vehicle horn.

Vehicles are standalone systems that perceive and react to the environment by human conscious. When considering networks of vehicles interacting with another, collaborative behaviors and proactive reactions are possible. A system modeling and reasoning about driving behaviors is capable of recognizing potential dangers and preventing accidents and collisions from happening ahead of the time. Connected vehicle networks turn each vehicle into a source of information and collectively improve situational awareness and driving safety.

## Smart Living

For Smart Living, Intel-NTU Center provided M2M Virtual Middleware for better usability and sustainability in wireless sensor networks. A novel progression framework addressed sustainability by providing an abstraction of the capabilities on top of existing devices. The abstraction layer makes it possible to reconfigure the networks, where necessary, automatically, without human intervention. Another highlight research related was Multi-view Video Summarization. A low-complexity multi-view video summarization technique is proposed to remove redundant content of wireless video sensors such that the compression and transmission power can be reduced. The demonstration show a case where 19 cameras were employed to monitor a hallway and a room as a surveillance application. With the proposed technique, 91.3% of the transmission bandwidth can be saved to generate a single short summary video clip of the content acquired by those cameras, and all the important events are well kept.





**Intel-NTU Connected Context Computing Center**

BL-7C, Barry Lam Hall,
1 Roosevelt Road, Sec. 4
National Taiwan University
Taipei, 10617 Taiwan
Tel: +886-2-3366-1467

http://ccc.ntu.edu.tw

**About the Editor**

Ching-Yu Wu

Editor of newsletter, Intel-NTU Connected Context Computing Center

**Photograph Credit**

Ming-Yi Wang

Intel-NTU Connected Context Computing Center