Abstract
This project applies pattern recognition and face detection to omnidirectional wheeled mobile robots. The objective is to integrate image processing of different color spaces and pattern recognition of adaptive resonance theory for dual-robot patrol usage. Robots use Bluetooth to communicate each other, and use Wi-Fi to communicate with the control center. Robot movement control is constructed by fuzzy theory for obstacle avoidance. Experimental results show that the proposed control scheme can make the omnidirectional mobile robots take elevator automatically and perform security service. The movement of robotic arm is derived from inverse kinematics.

System Description
The system utilized two omnidirectional wheeled mobile robots to perform patrol task. Each robot carries its own camera to monitor surroundings and detect intruder. Object distance is used in fuzzy control to avoid obstacle during movement.

Experiment Results
The following figures show sequence of dual-robot patrol. Firstly, robots take elevator to its destination floor. The robots then move out of the elevator and perform patrol service. During patrol task, intruder is detected by the first robot. Warning message is sent to control center via Wi-Fi and to the second robot via Bluetooth by the first robot immediately.

Flowchart of the control sequence

Recognize elevator button: (a) Original RGB image, (b) Image of HSL color space with threshold, (c) Image with median filter.

A* path planning

(a) Robot-A detects button position from the path, (b) Move the arm to reach the button position, (c) Robot-B waits elevator, (d) Robot-A holds the elevator and Robot-B enters elevator, (e) Robots reach the desired floor, (f) Robots patrol in the hall way, (g) Patrol in the corridor, (h) Detect intruder.