

## Automatic Location System using Active IR-tag

Muneyuki Sakata  
Image Processing Laboratory  
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## Background

- ◆ Digitalization of medical service
  - Electronic medical chart
  - Wireless LAN, Mobile Computer
  - IC tag, Bar-code ...
- ◆ A large floor in a hospital is covered by limited number of nurses and effective collaborations are needed.
  - taking other's place
  - giving a hand
  - gather some others

## Location in hospital

- ◆ Hospital Staff's work is performed in the place appointed for each work.
  - Measurement of body temperature beside patient's bed
  - Preparation of intravenous drip or medicine in front of medicine cabinet
  - At a staff meeting around center table of nurse station
- ◆ Spatiotemporal location information implies the staff's activity

## Objective

Location system for nursing activity

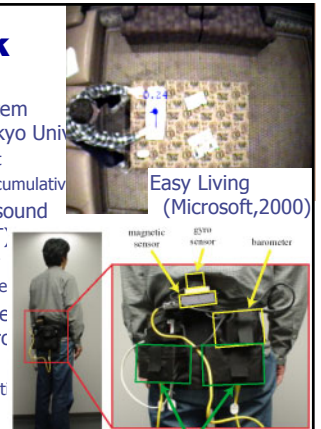
- ◆ Requirements
  - High accuracy  
ex.) in front of which desk, which part of the room
  - Don't disturb nursing work
    - ◆ Smaller user's equipments
    - ◆ Automatically tracking and identification
  - Simple infrastructure

## Expected utilities of location system

- ◆ The staff can ...
  - locate each other for correspondence.
  - make working report automatically.
- ◆ The manager can ...
  - monitor staffs' activities for organizing them effectively.
  - analyze the working performance to verify and improve the nursing work.

## Related work

- ◆ Autonomous positioning system (Konishi at al., Tokyo Uni)
  - No sensor in environment
  - × Large user's system / Accumulative
- ◆ Using Radio Wave and Ultrasound (Active Bat (AT&T), Easy Living (Microsoft,2000))
  - High positioning accuracy
  - × Too many sensors are needed
- ◆ Image processing using camera (Easy Living (Microsoft), Konishi at al., 2001)
  - User has no devices
  - × Need some action to identify



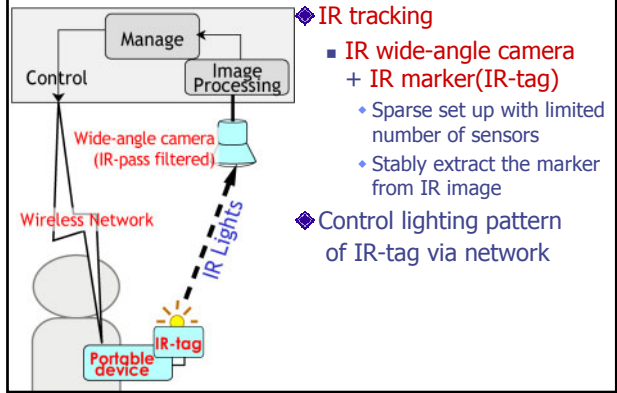
(Konishi at al., 2001)

# ALTAIR

(Automatic Location Tracking system using Active IR-tag)

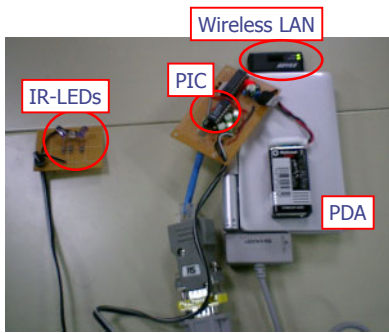
- ◆ Automatic locating and identification
- ◆ ~0.5m accuracy
- ◆ Simple infrastructure
- ◆ ALTAIR uses
  - Wireless LAN
  - IR-tag
  - IR-filtered wide-angle camera

# Proposed Method



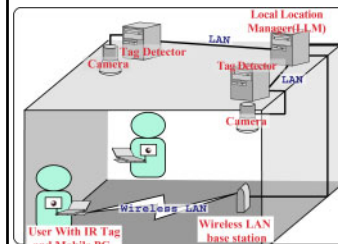
- ◆ IR tracking
  - IR wide-angle camera + IR marker(IR-tag)
    - ◆ Sparse set up with limited number of sensors
    - ◆ Stably extract the marker from IR image
- ◆ Control lighting pattern of IR-tag via network

# System (user's system)



- PDA (Zaurus, Sharp)
- Wireless LAN
- PIC
- IR-LEDs

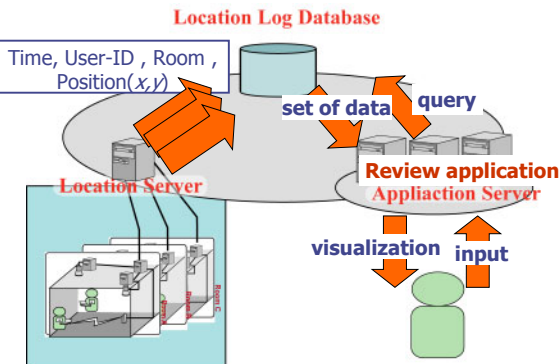
# System(one section)



- ◆ IR wide-angle camera
  - Tracks lights of all IR-tags
  - Calculates IR-tags' positions
  - Detects blinking IR-tag

- ◆ Local Location-Manager(LLM):
  - Merges information from cameras
  - Sequentially instructs IR-tags of all users to blink
  - Updates user location and identification

# System(servers)



# Sample application

◆ Trace the user's move

Room	User name
ME Room A311	Muneyuki P. Sato Yoshihiro Yasumuro Masataka Imura Yoshihisa Marube

date	from	to
2004-02-22	00:19	08:37
2004-02-23	00:20	08:38
	01:14	08:38
	01:29	08:40
	08:37	08:42
	08:38	08:43
	08:39	08:44

## Future Work

- ◆ Contiguous multiple area system
  - Detection of enter / leave a section using wireless network technology
- ◆ Review application
  - Analyze from various aspects
- ◆ Linking to other data resource
  - Video Streaming, Medical chart, Output of medical devices...

## Summary

- ◆ In order to achieve a nursing work effectively and analyze working performance, **dynamic monitoring** and **accumulating** staff's location are considerable.
- ◆ I proposed **automatic location tracking system using active IR-tag**.
- ◆ ALTAIR has both problems to be solved and capabilities to improve in my future work