Multiple Humans recognition of Robot aided by Perception Sensor Network

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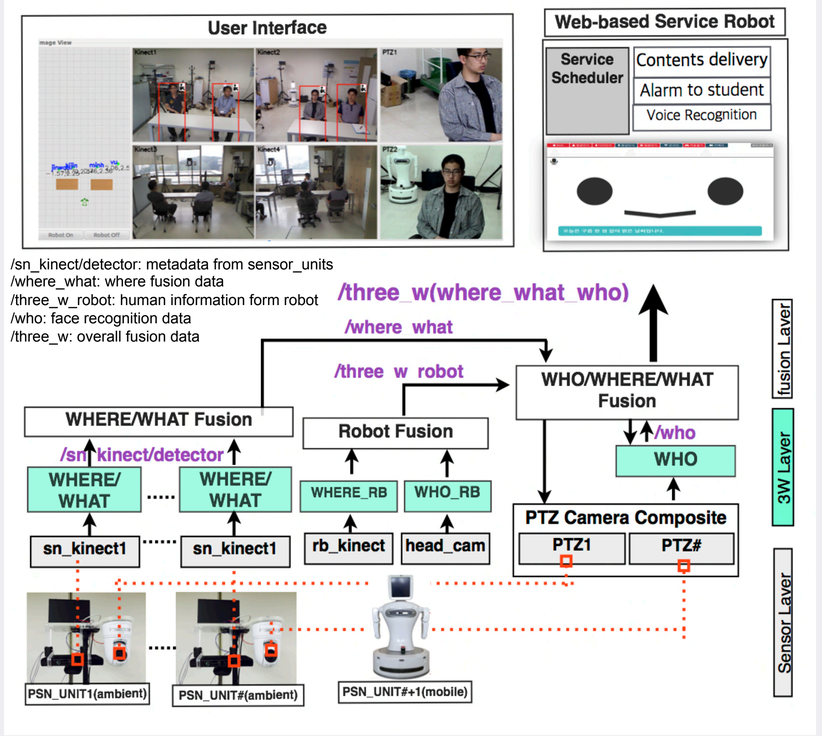
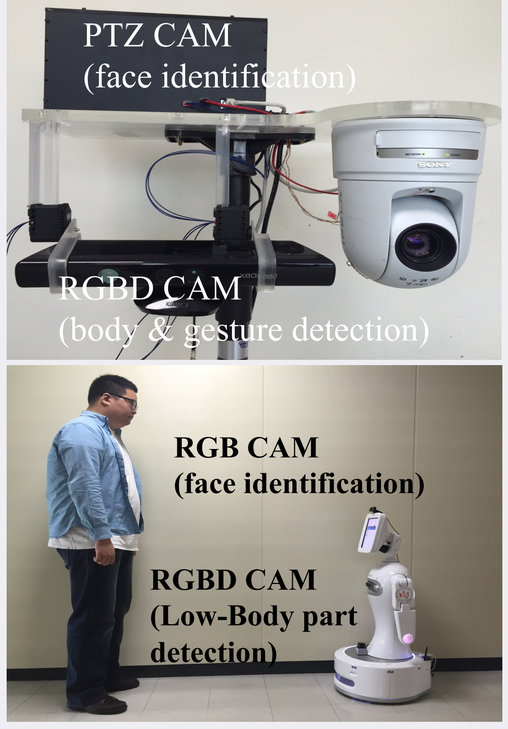
INTRODUCTION

- In this work, we proposed a general **Perception Sensor Network** (PSN) framework for recognition of multiple humans' **three_w** information such as **where**, **who** and **what** information.
- **PSN** system is composed of **ambient** and **mobile sensor units** and three_w information is transferred among sensor units by using **global location** and **reliability** driven **fusion method.**
- Based on simple state transition model and three_w from PSN, **robot** conducted a **lecture service** to students with an attitude warning.



Sensor Network Framework]

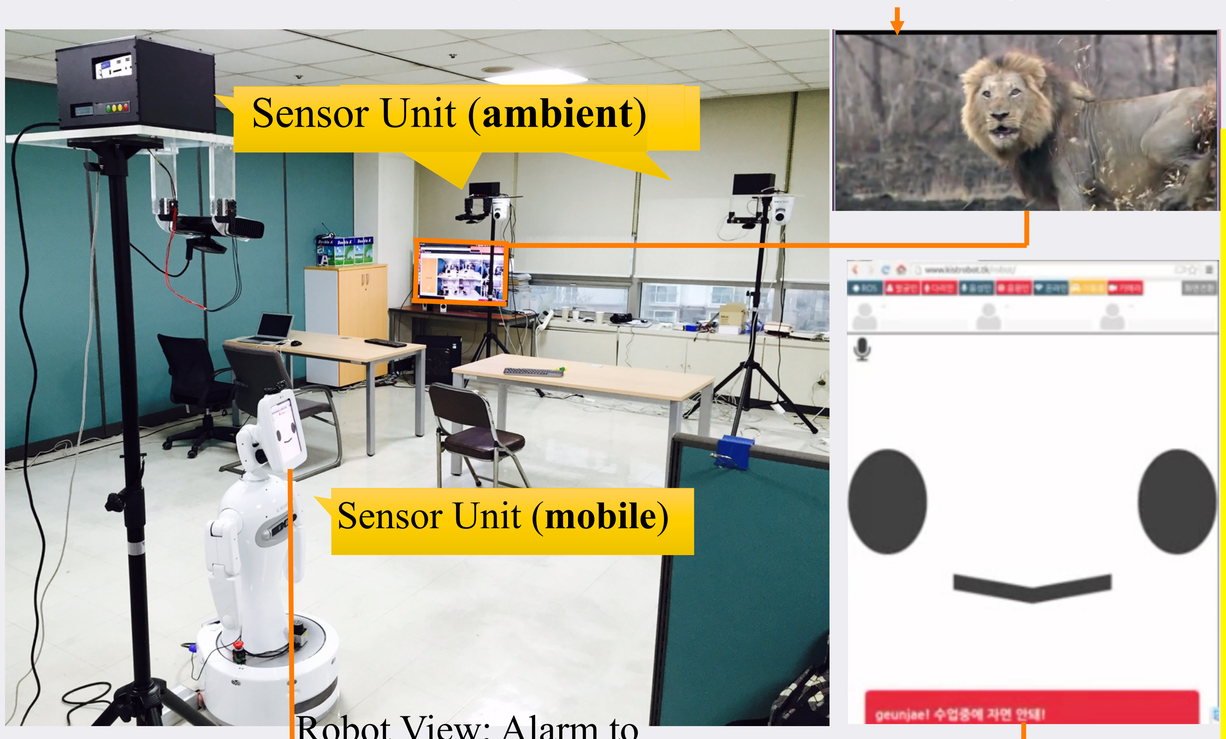


[Ambient and Mobile Type sensor units]

- Features of **Mobile** type **Sensor Unit**
  - The Robot naturally notices human's presence with a partial body part because of natural robot's sensing view.
  - We utilized a **low-body-part detection** by RGBD camera for human detection of the robot.
- Features of **Ambient** type **Sensor units**
  - Detect both relative position of human body and human gesture with OpenNI driver of RGBD camera.
  - Sensor units are installed in an overlay manner for the coverage extension.
  - This system is reproducible by motor-based pose control and the stored parameters.
- **Similarities** of humans are defined, considering interaction area
  - If distance is shorter than a threshold and these measurements are aggregated to an effective measurement according to the reliability criteria.

LECTURE SERVICE SCENARIO USING PROPOSED PSN SYSTEM

Lecture Content Play control of TV under Robot Signaling



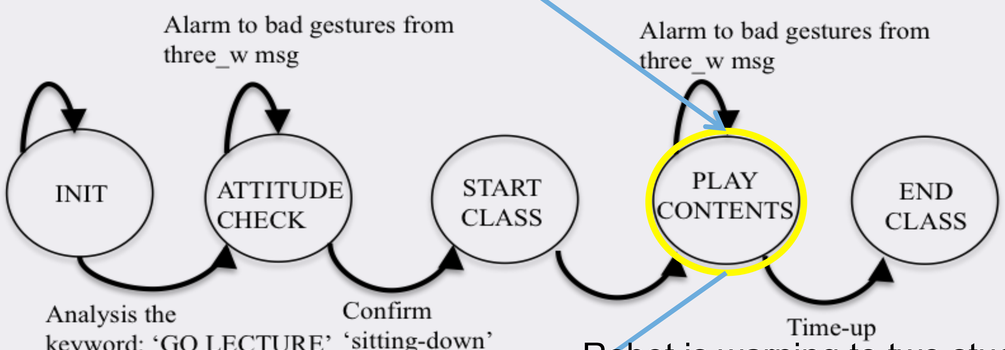
Robot View; Alarm to students about their inappropriate gestures

/three_w information of students; Geunjae, vu, minh are {sleeping, standing, sitting} and their global location is depicted in the gui.

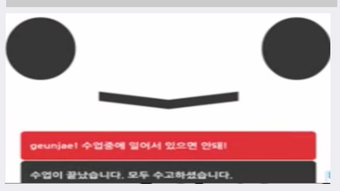
- We assume that **robot** is an **assistant teacher** in a **classroom** and robot gives a **lecture** based on the **video content** control without a supervisor.
- Basically, robot **warns** to students their **bad attitude** during **lecture** aided by **PSN**'s human information. Warnings encourage students good gesture during lecture. We utilized a voice alarm to students by using Text-To-Speech (TTS) Google API.

<State Transition>

- ❑ Robot service is initiated by teacher's voice command such as 'go lecture'. We utilized Speech To Text (STT) from Google API for a keyword analysis.
- ❑ Confirmed that all students are sitting down, robot state is changed to start class and an educational content is played on a remote TV monitor in the figure.
- ❑ Robot continuously alarms to the specific student that has bad gesture such as standing or sleeping.



Robot is warning to two students who have bad gestures given that a lecture is started and content is playing.

INIT	'GO LECTURE' |INIT	ALARM |ATITUDE CHECK	START CLASS	ALARM |PLAY CONTENT	END CLASS
					
(Blinking eyes)	(GO LECTURE) YES, Teacher. I will.	Vu! We can't start class since you are sleeping.	Now ,a lecture will be started shortly	**Guenjae! Don't sleep in class. Vu! Don't' stand up in class**	Lecture is over

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