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# Progress Report on Detection Research in Japan

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Reviewed is progress in the fire detection technology in Japan after the 12th UJNR Meeting in 1992.

## 1. Study on the fire detection technology with the plural sensor's signal.

Takahashi et al. have developed a system to evaluate the probability of fire based on profile curve of temperature and smoke density.[1,11,23]

Hosokawa et al. have developed a system to distinguish real fire from false fire with fuzzy-reasoning based on data of temperature, smoke density, CO concentration and infrared radiation from human-body.[2]

Tamura et al. have proposed a technology to detect fire based on fuzzy expert system.[3]

Ito et al. have reduced the number of false alarms by making neural-network learn sensors' signal. This system is tuned not to respond to pulse-input.[4]

Hosokawa et al. have applied neural-network technique to tuning the membership function for their fuzzy expert system.[12,21,22]

The SECOM Co., Ltd. has developed the flame detector that works when both the strength of infrared and the strength of ultraviolet are over a definite level. The detector can reduce the number of false alarms without losing its' sensitivity.

Many researches have been made to develop a system which detect real fire using the data of temperature, smoke density, and/or the concentration of CO gas. Even though using these data, it left being difficult to discern smoke from fire and smoke from cigarette, or other source due to human activities. It is expected that development of technology to detect the existence of human within the area watched can solve the issue, if problems of privacy and costs are worked out.

## 2. Study on the fire detection technology using odor sensor, sound sensor and ray sensor.

Okayama et al. have tried to detect fire in the its' early stage using odor sensor.[5,6,7,8,14,15,16,17]

Waki et al. have investigated the burning sound and developed a technology to detect fire by sound. The equipment is set to be activated when value of square integration of sound spectrum (0.05-3Hz) from fire is over a threshold.[25]

Takahashi et al. have investigated the frequency and the amplitude of infrared signals from fire, and proposed a system which works only when the light input scatters.[20]

Fujiwara et al. have developed a technology to evaluate the heat release rate of fire using the output signals from a color video camera.[10]

In these researches, a lot of experiments under environmental noise have been conducted, and it is shown that countermeasures for the environmental noise are required in order to fire detector with odor sensor, sound sensor and optical sensor.

## 3. Study on the fire detection technology toward specific fires.

Tamura et al. have investigated the behavior of fire detection under the condition of a roof-fire of a cultural building thatched with the dry cogongrasses, the Japanese cypress and the like. This study showed that a suitable detector varied with the kind of roof material.[19]

Nakai et al. have applied a piezoelectric HCl sensor to detecting a PVC electric cable fire. This sensor responds to HCl gas (5ppm) in usual surroundings, and it becomes possible to detect a small PVC cable fire using this sensor.[18]

Noda et al. have investigated to detect an electric cable fire in a room which is well ventilated. The sensors used here are highly sensitive smoke sensor, HCl sensor and a general smoke detector.[24]

Ishii et al. have proposed a system which can detect a fire in the cable tunnel with optical fiber temperature sensor. They also tried to estimate the fire dimension using the sensor outputs.[29]

It is possible to adopt suitable sensors in addition to heat and smoke detector, in order to construct a fire detection system from specific subject. In future, it is anticipated that the application of this type fire detection system will be magnified.

#### 4. Study on fire modeling for the fire detection.

Satoh has simulated the fire gas flow in air-conditioned rooms with computer-fluid-dynamics model and investigated the effective setting up of fire detectors.[9,13]

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