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Fire Detection System Using Arduino Sensor

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Abstract Recently various types of disaster monitoring system using smart-phones are under active studying. In this paper, we propose a system that automatically performs the disaster and fire detection. Additionally we implement the Arduino-based smart image sensor system in the web platform. When a fire is detected, an SMS is sent to the Fire and Disaster Management Agency. In order to improve fire detection probability, we proposed a smart Arduino fire detection sensor simulation which searches the smart sensor inference algorithm using fuzzy rules.

Key Words : Disaster monitoring system, Disaster and fire detection, Arduino-based smart image sensor system, Management Agency, Fuzzy rules

1. Introduction

These days, many researchers are actively working to detect fires and disasters based on smart systems. In addition, there are some other researches to detect the flood and forest fire using drones to provide urgent messages in real-time to the disaster emergency center. Services using drones were developed by the military drone for the first time. Drone was derived from that of a bee buzzing in nature. Recently, some researchers are working to detect and analyze the fire combining advantages of smart phones and drones. We call it a smart video fire alarm system. However, the conventional fire detection system is determined by using a differential image. In this case, the error from the noise and illumination changes occurs and thereby the wrong judgment can be introduced. In this paper, we applied the fuzzy rule in order to solve these problems. In other words, the agent detection imaging experiments were applied to smart features.

This paper is organized as follows. In section 2, we explain fire detection theory using smartphone-based drones. In section 3, the computer simulation to improve fire detection probability is performed combining the fire detection sensor with the Arduino processor. Finally a conclusion is discussed in section 4.

2. Fire Detection Theory

Recently, many researchers have conducted studies to detect and analyze the fire automatically, which is called a smart video Fire alarm. However, conventional fire detector is generally determined using a differential image. But this method is surely introducing an error according to the noise and illumination changes. After all, that becomes the cause of the malfunction of the system.

Therefore, in this paper, we have to solve this problem, by studying the characteristics of the wavelength of the infrared ray generated from fire, heat, smoke and the like. Considering such characteristics, we study the accurate fire detection technology.

With detection technology, the most commonly used image processing methods is of

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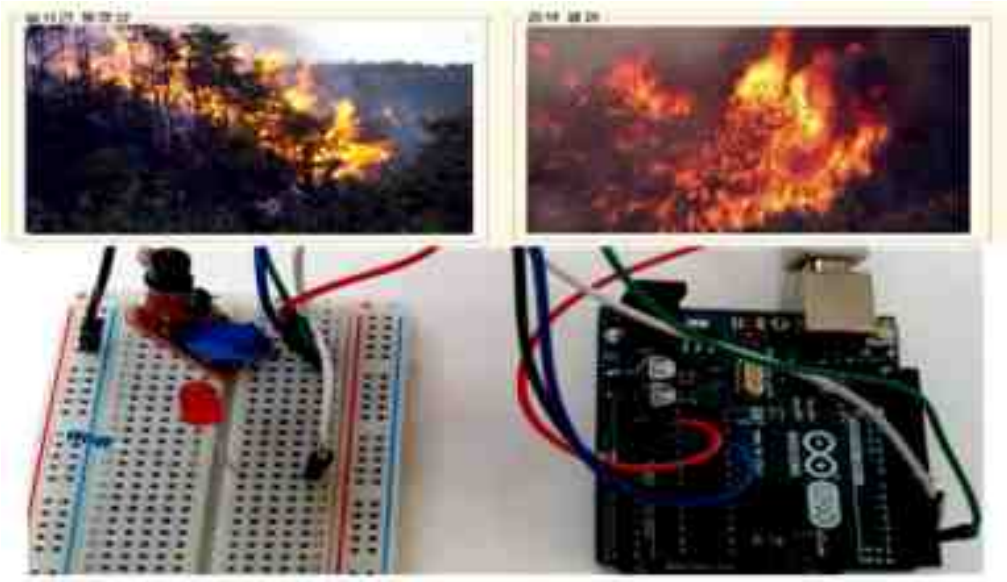

Fig. 1 Implementation of the Arduino sensor-based fire detection system

using a difference between the images. This method has the advantage that the processing speed is very fast. However, this method has the disadvantage of sensitivity to dust, mist, noise, and illumination.

In this paper, we propose a smart fire simulation image method using fuzzy rules in order to solve these problems.

In Fig. 1, using the Arduino sensor, we implemented a WEB-based disaster safety systems for fire detection, where we applied the fuzzy rule in order to solve these problems. In other words, the agent detection imaging experiments were applied to smart features.

3. Computer Simulation

In this paper, it is determined real flame presence precisely in the video fire detection using fuzzy rules. In order to be able to efficiently adapt to the dust, fog, illumination changes in the actual road, the intelligent fuzzy technique was simulated.

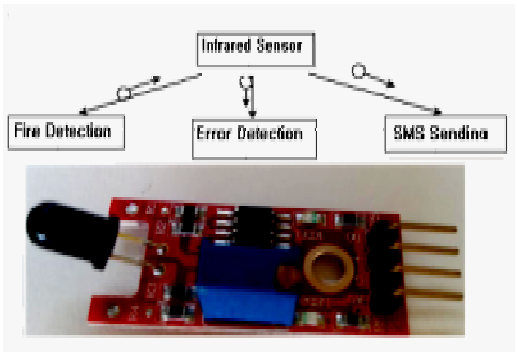

Fig. 2 WEB-based fire detection and SMS transmission system.

In addition, in this paper, we implement a wireless sensor network and WEB-based fire safety system for detecting disaster. In Fig. 2, if there is a fire, it describes the process of notifying the fire alarm system. Fire location is transmitted to the fire department or emergency Safety Authority.

```
int pirState = LOW;
// Save the initial state of the flame sensor (setting the first state to LOW)
int val = 0;
// Declaration for reading the sensor values
void setup () {
pinMode (Beep, OUTPUT); // Set up output Piezo buzzer
pinMode (flame, INPUT); // Set up the input phototransistor
Serial.begin (9600); // Set up Serial Monitor
pinMode (ledPin, OUTPUT);
pinMode (inputPin, INPUT);
pinMode (pinSpeaker, OUTPUT);
Serial.begin (9600); // Prepare for serial communication (9600)
}

val = analogRead (flame);
// Retrieves a value from a phototransistor
Serial.println (val);
// Phototransistor output to input serial monitor
if (val> = 1000)
If the input value is more than 1000 // phototransistor BEEP run, need to adjust to an appropriate value depending on the environment
{
digitalWrite (Beep, HIGH); // Piezo buzzer BEEP
} Else {
digitalWrite (Beep, LOW); // Piezo buzzer OFF
}

Rule: IF PA is t1 THEN C is B2: (FBAD)
fact:
PA is t1 '
conclusion: C is t2 ': (FCON)
PA: fire conditions
CON: Inference result judgment
FBad: Mobile Phone-based
Fire detection ERROR
uncertainty, fuzzy number representing the difference image
FCON: Mobile Phone
Fire detection final results
RULE
IF TEMP = High And
FIRE = Med And
IR = High And
UV = High And
SMOG = Med
Then
POS-FIRE = High
```

Table 1. Fire detection conditions using fuzzy rules

Fire condition		Flame Temperature	Flame Movement	Flame Size
Flame Condition	Y1H	Big	Med	Big
	Y2YM	Big	Med	Med
	Y3S	Med	Small	Small
Smoke Condition	Y2H	Big	Med	Small
	Y2M	Med	Med	Med
	Yy2L	Small	Small	Small
Ultraviolet rays Condition	Y3H	Big	Med	Big
	Y2M	Med	Med	Med
	Y1L	Small	Small	Med

Table 1 shows fire detection conditions by using an Arduino Sensor with various disasters, and condition Name of smart algorithms that automatically detect the fire. Therefore, this can accurately determine real flame presence in the automatic fire detection image, in order to be able effectively to adapt to the actual that may occur in road dirt and fog noise and car and the sun, the lens aberration, illumination changes, UV + IR reflecting the figures were simulated using FUZZY INFERENCE SYSTEM TOOL in MATLAB.

Table 2. Fire detection Identification

ID	Fire condition
1	Temperature SMALL MED BIG
2	Smoke SMALL MED BIG
3	ultraviolet rays SMALL MED BIG
4	infrared light SMALL MED BIG
5	ROI SMALL MED BIG

Table 3. Fire detection association rules

Association Rule	ID	Reliability
Temperature->Humidity	1,4	75%
Temperature->dew point	2,3	75%
UV-rays>Flame	1,3,4	50%
UV-rays<Flame	1,2,5	50%
UV-rays>Flame	1,5	60%
Smoke >Wind direction	2,3	40%

The reliability of the ID of the outcome of the association rules given in Table 2 are shown below in Table 3. In this research, in order to solve this problem, the infrared ray generated from the fire, because the detection by the sensor that detects a specific wavelength of ultraviolet light was studied ways to detect the accurate consideration of the heat than the fire or smoke. However, such a minute problem, a pixel value which is used to improve based on

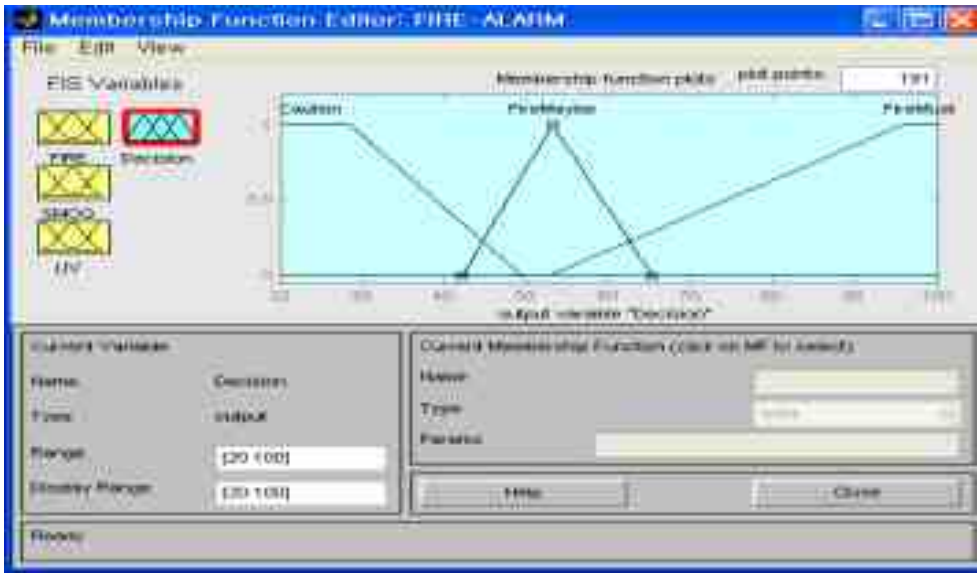

Fig. 3 Fire detection simulation using fuzzy rules

difference image technique is advantageous in that fast access for the pixels changes in the movement, but has the disadvantage that dust and mist noise and car light changes the sensitive. Therefore, it is determined accurately real flame presence in the automatic fire detection image in this paper, in order to be able effectively to adapt to the actual that may occur in road dirt and fog noise and car and the sun, the lens aberration, illumination changes, UV + IR reflecting the figures were simulated using FUZZY INFERENCE SYSTEM TOOL in MATLAB.

In order to accurately determine the flame and fire detection in images in this paper, to adapt effectively to noise and illumination changes, and simulate the UV + IR figures reflect the intelligent fuzzy techniques.

Fig. 3 describes the detection of fire simulation results using fuzzy rules for improving the noise and illumination changes disadvantages of the pixel value difference imaging technique. This paper adopted the real flame presence precisely in the video fire detection using fuzzy rules.

4. Conclusion

These days, the study to monitor various disasters based on the smart-phone has been made actively. In this study, the implementation of smart video platform on the web system in order to implement a system that can automatically determine the fire. When a fire was brought out, an SMS is automatically sent to the Fire Department and Disaster Management Agency. But the problem of the existing primary imaging method is that a malfunction can occur. In this paper, we build intelligent WEB platform that enables real-time techniques. To identify and report the malfunction for fire and other disasters, the fuzzy control algorithm was adopted.

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<Research Interests> Real-time Recognition, Tracking System