Development of an IoT-based Visitor Detection System

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Abstract— **In this paper, we proposed an IoT-based visitor detection system. It uses an IR sensor to detect human body and two ultrasonic sensors to locate visitor servo motor under the position. When a visitor is detected it drives camera module to locate the visitor. Recoded video and sensor data are stored in the Database. Saved data can see via the PC and Smart device. We developed the system using Raspberry Pi2 and sensor modules to verify the concept. It can track the visitor moving route and minimize the blind spots of the camera. And sensor data and recoded video are checked internet possible all remote location.**

Keywords; IR sensor, Ultrasonic sensor, IoT, Raspberry Pi

I. INTRODUCTION

A variety of digital smart home services have recently been provided as technology develops securing a resident's convenience. Moreover, as more attention has been paid to smart home security, various studies are being conducted on home security, particularly CCTV monitoring systems and home monitoring systems. [1-3]

However, most of the existing systems use fixed cameras which may have blind spots. [5-7]

In this paper, we suggests an IoT-based visitor detection system to minimize blind spots and to check all remote location. The proposed system is designed based on Raspberry Pi2 with a Web server, IR sensor, two ultrasonic sensor, and a camera module with a driving servo motor.

II. IOT-BASED VISITOR DETECTION SYSTEM

The IoT-based visitor detection system proposed in this paper used Raspberry Pi2 as controller, and IR sensor to detect a visitor. In addition, two ultrasonic sensors are used to locate the position of the visitor. The camera module was equipped with a servo motor to change the direction of the camera to the visitor. A web server is used to provide visitor information and sensor data to any internet-enabled remote location.

Figure 1 shows configuration of the proposed IoT-based visitor detection system.

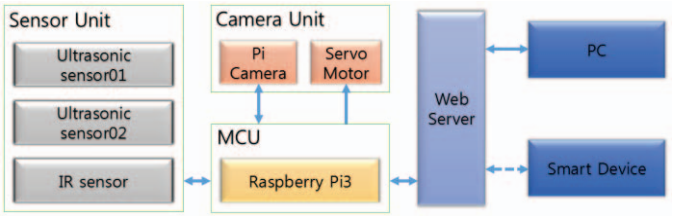


Figure 1. System configuration

When the detection system starts, it initializes the IR sensor and two ultrasonic sensors. The system determines the presence of a visitor from the data of the IR sensor. When a visitor is detected, the two ultrasonic sensors are activated to spot the location of the visitor. The system identifies the location of the visitor with the data from the ultrasonic sensors. And then, the camera moves the direction to the visitor by driving the servo motor where the camera is attached. The system controls the servo motor by supplying PWM current. The system stores recorded video and sensor data in database. The saved data can be seen from any remote location via internet.

Figure 2 shows flow chart of the IoT-based visitor detection system.

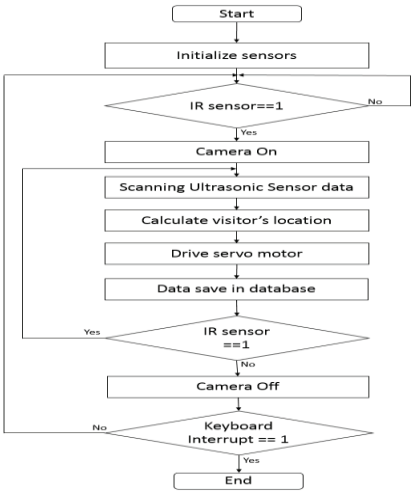


Figure 2. Flow chart of the Visitor Detection System

III. EXPERIMENTAL RESULTS

To test the proposed visitor detection system in an actual situation. We developed an experimental system as shown in Figure 3. We tested IR sensor, Ultrasonic sensors, the camera module, and the servo motor separately to validate each device. In addition, the monitoring to web and smart device was tested.

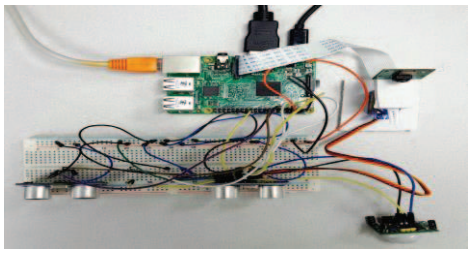


Figure 3. Experimental environment

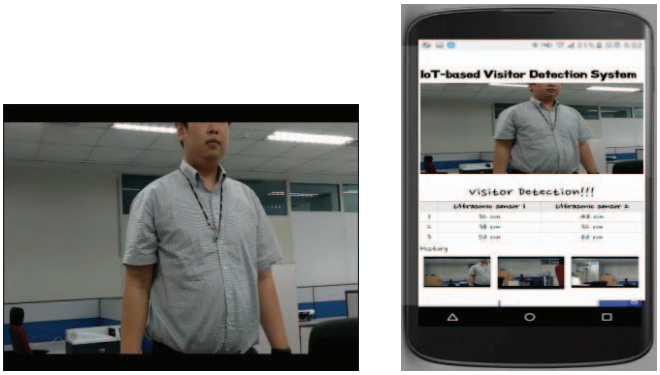
Next we used the Python language to implement the algorithm shown in Figure 2. Raspberry Pi2.

Table 1 shows the data values of the two ultrasonic sensors for each case. Case I is for visitor detection in ultrasonic sensor 1 side, and case II is for visitor detection in ultrasonic sensor 2side.

TABLE I. DATA VALUES OF THE ULTRASONIC SENSORS

Each case	Ultrasonic data value	
	Ultrasonic sensor 1	*Ultrasonic sensor 2*
Case 1 : Initialized data	50 cm	55 cm
Case 2 : Detected by Ultrasonic sensor 1	45 cm	49 cm
Case 3 : Detected by Ultrasonic sensor 2	47 cm	42 cm

Figure 4 shows the images of each situation. Figure 4 (a) is a screen shot after locating the visitor by using the system. Figure 4 (b) is a screen shot of same situation on smart device.



(a) After locating the visitor using ultrasonic sensors

(b) same situation on smart device

Figure 4. Recorded images

IV. CONCLUSION

We developed an IoT-based visitor detection system using IR sensor and two ultrasonic sensors to locate the visitor. It controls the servo motor to change the director of the camera for correct recording of visitors. It can also track the moving visitor to minimize the blind spots of the camera. And the recorded video and sensor data can be checked from any remote location using web browser.

For future works, we can extend this study for more than two ultrasonic sensors and an infrared camera to locate a visitor more accurately.

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