Development of Monitoring System of Lock-Key

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Abstract: Most of the damages made by the burglaries are due to the people that forget to lock their house. Even if the door was locked, damage of illegal invasion by picking is not few. In this study, we developed monitoring system of the lock-key using photo reflector. The system judges the locked state of doors in house by using a photo reflector. The user can confirm the Lock-Key state of doors by smartphone from anywhere. And the system has a device that trigger the alarm when user is going out without locking the door. This system sends the data of the Lock-Key states to the computer through wireless communication.

Keywords: damage of illegal invasion, monitoring system of lock-key, photo reflector.

1. Introduction
Victim of burglary has decreased year by year, but it still has about 58000 cases every year [1]. On average, it is happen about 160 cases per a day. In those cases, thief damage accounts for about 40%. Here, “thief” means invading the house and stealing things during the absence of the house owner. The most common method of thief is glass breaking. Surprisingly, the second most common method of thief is invading for unlock houses, and it account for 25% of thief cases. People consciously closed the entrance, but the key of a veranda and windows tend to remain open especially in summer [2]. Currently, as a measure to prevent thief, there are some ways that can be followed, such as

1. Introduction of intrusion detection device by professional [3].
2. Put a lot of auxiliary lock in addition to the main lock [4].
3. Strengthening the patrol at the place [5].

“Introduction of intrusion detection device by professional” is very expensive for general household. It has been introduced in many offices and shops, but there are only few houses that have been introduced in the general household. “Put a lot of auxiliary lock in addition to the main lock” does not make any effect if we forgot to close the door. “The patrol strengthening by region” requires a lot of labor. Therefore, we thought the system that is capable of eliminating the unlocking of door, and can be easily introduced to many houses can lead to a significant reduction of housing invasion damage. So we worked on this study.

2. Monitoring System of Lock-Key
2.1 Configuration of the entire
Fig. 1 shows the configuration of a circuit that was created. This system has the following functions.

(1) To set the threshold using the two buttons.
(2) To determine the locked state of the door by using the photo-reflector.
(3) To sense the presence of people by using the pyroelectric sensor.
(4) When we are going to go out without locking the door, the buzzer will alert the house owner.
(5) To check the locked state of the door from the smartphone.

2.2 Determining the state of key by the photo-reflector
First, we install a photo-reflector as shown in Fig. 3. Then we determine the threshold to detect the state of the lock-key. Sensor can judge the state of the lock based on the output of the sensor. First, push the red button when the door is
locked to determine the lock situation value. Second, push the blue button in the unlocked situation to determine the unlock situation value. We determine the threshold from the average of the two values. In this way, it is possible to know the state of the lock by comparing the threshold with the outputs that were done AD converting. Finally, it saves the output that was obtained to a text file.

2.3 Sensing the presence of people by the pyroelectric sensor and sounding the buzzer when an attempt to go out is made without locking the door Circuit is attached to the door or window as shown in Fig. 4, Fig. 5. This sensor senses the movement of people. This function is used mainly at the entrance. It is thought that when the sensor is activated, it would indicate that going out or entering the house. The system will judge that resident left the door without locking when the sensor became unresponsive. If this state stays for a long time, potential of thief damage is large. So it will trigger the buzzer to sound the alarm to inform of the unlock door.

2.4 Checking the locked state from the smartphone In this feature, we can check the state of key using smartphone apps. On the main page, you see latest state of the all keys. And on the sub-page, you see the time that each lock-key was operated. The information of the state of lock-keys are used the data that have been saved to a text file in section 2.2. Fig. 6 and Fig. 7 shows the example of the display screen.

3. Submission Preparation Checklist

Section 3.1, 3.2, and 3.3 show the experimental methodology. Section 3.1 shows the experimental methodology to check whether threshold is correctly set. Section 3.2 shows the experimental methodology to check whether photo-reflector correctly judge the lock-key states. And section 3.3 shows the experimental methodology to check whether the system work properly.

3.3 Experimental methodology of this system
We test the function to determine the threshold. We try 10 times practices to determine the threshold. Then, we confirm by using the results of section 3.1, whether threshold is correctly set.

4. Experimental Result
Section 4.1, 4.2, and 4.3 show the experimental result of section 3.1, 3.2 and 3.3.

4.1 Experimental result of the photo-reflector
Table 1, Fig. 8, 9 shows the experimental result of the section 3.1. Because locked values and unlocked values are different, we think this function can accurately judge the state of the lock-key.

4.2 Experimental result of the threshold
Table 2, Fig. 10, Fig. 11 shows the experimental result of the section 3.2. All thresholds are values that can be discriminated locked states and unlocked states from 3.1 graphs. Therefore, we think that threshold is set correctly.

4.3 Operating result of this system
All functions were operated normally.

5. Conclusion
We have proposed a new burglary prevention system in this study. By using this system, it will be able to greatly reduce the damage burglaries because we won’t go out of have without locking the door. On the other hand, this system

<table>
<thead>
<tr>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average (locked)</td>
<td>Average (unlocked)</td>
</tr>
<tr>
<td>Inside</td>
<td>233.9 mV</td>
</tr>
<tr>
<td>Outside</td>
<td>125.4 mV</td>
</tr>
</tbody>
</table>

Figure 8: Inside Outputs.
Figure 9: outside Outputs.
still has some challenges. For example, it is to downsize for easily installed. We consider that this system become easier to use at home by improving them. And, if this system becomes more common it would be a significant contribution to crime prevention.

References


