
Research Article

Smart Safe Deposit Box Based on Internet of Things

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ABSTRACT

The development of Internet of Things technology today is overgrowing in various fields, one of which is security. Safe-deposit box system is considered less safe because there is no warning to the owner. This study proposes a safe deposit box system that has a token security feature based on the internet of things. This system uses a webcam that functions to take pictures automatically. The image is sent to the server via the FTP protocol. It has two levels of users, namely admin, and guest. This system has a warning alarm, and notifications feature that works when the safe door is opened by force.

Keywords: internet of things, safe deposit box

Introduction

Today the crime rate is increasing, especially in cases of burglary money. One way that can be done to secure money and valuables is stored in a safe deposit box. A safe-deposit box is a cabinet made of iron and fireproof whose function is to protect valuables from theft. However, there are some cases of burglary safe deposit box that are published in the media. One case happen in the Kediri region Indonesia which police officer was found breaking into a money vault at the Headquarters of the District Police and the money was used disproportionately [1], and there were two cases of burglary that had not been revealed at the government office in the Tanjung Pinang area Indonesia [2].

The safe deposit box system is currently considered less safe because there is no

warning and notification system to the owner when a break-in occurs. From these problems, the IoT (Internet of Things) system design was made on the prototype of an Android-based system. Internet of Things is a concept that aims to expand the benefits of internet connectivity that is connected continuously [3]. Some IoT applications are used to build monitoring and controlling systems such as monitoring safety devices [4], weather [5], and industrial robot arm monitoring [6]. On this research, the prototype of a safe deposit box security system utilizing the internet as its communication media.

In contrast to previous research conducted [7] which use the AT89S51 microcontroller as a control unit and SMS as a communication medium, in this study we use Raspberry Pi as a controlling unit and internet network as a

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communication medium. Raspberry Pi is a mini-computer that can be used to run computer applications. This study aims to provide a sense of security to the user because it can monitor the security conditions of the safe deposit box via an Android smartphone.

System Design

The main components of this system consist of a sensor, controller, and actuator. The algorithm in the safe security system consists of two systems, namely the Android system and the safety system. Figure 1 shows the system diagram of a smart, safe deposit box.

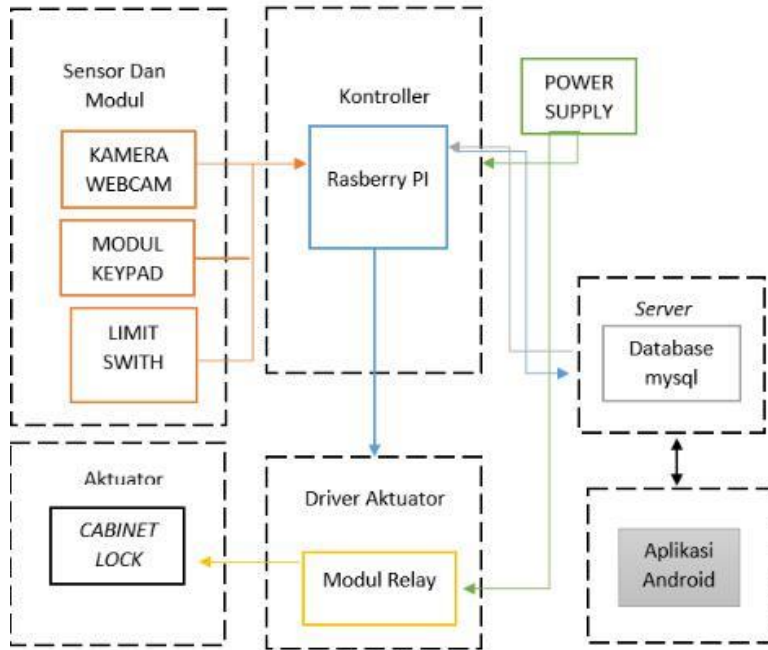


Figure 1. System diagram

Raspberry Pi functions as the central controller. Inputs that are connected to the Raspberry Pi board pin are Keypad, Limit Switch while the output is Buzzer and Solenoid Lock. The webcam is connected to the Raspberry Pi via a

USB port. The prototype design of the safe deposit box is made using wood, metal, and acrylic. The hardware connection is shown in Figure 2.

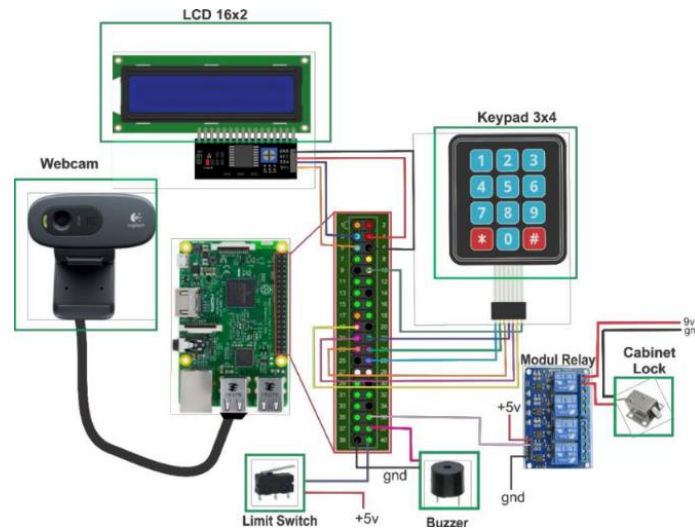


Figure 2. The hardware connection

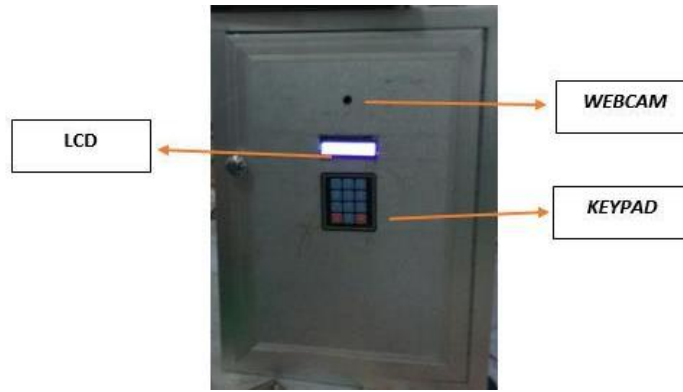


Figure 3. The prototype design

The safe deposit box has a length of 30 cm, the width of 30 cm and a height of 40 cm as figure 3 shows. On the outside part, there are holes for the keypad and LCD. At the top of the LCD, there is a hole for mounting the webcam.

The concept of IoT (Internet of Things) in a safety deposit system based on Android and Raspberry Pi is a safe deposit system can give warnings and notifications to their owners via smartphone Android. This system has two user levels, namely admin and guest. The safety system uses Keypad and Limit Switch as its control system. The keypad is used as input to unlock the safe. While the Limit Switch is used for media burglary safety. Users can open the safe door with type the token on the Keypad. Insert from Keypad detected by Raspberry Pi. When the token is typed, the system compares the token typed on the Keypad with the token on the server. If the token is correct, then the Raspberry Pi sends an active signal to Solenoid Lock, so the safe key is open. If the wrong token reaches three times, then The system sends a hazard condition to the database server. The next process Webcam will take pictures automatically. The image is saved and will also be

sent to the server via File Transfer Protocol (FTP) in Raspberry Pi. After sending to the server, the image will be stored on the server. Android application will read data from the database the server. After that, Android smartphones will give notifications to the admin. This safe system also features a Limit Switch and a Buzzer useful when someone tries to disassemble the safe door with then the alarm from Buzzer will sound.

Results and Discussions

We make Android applications using Android Studio Software. Testing was done by logging in to the database server login via the Android application and displaying data from the database through the application. Next is testing the connection of the Android application with the database server. This test aims to test the connection of the android application and database server by comparing the data contained in the android application with the data contained on the server. Figure 4 is a display of the contents of the Guest table in MYSQL database.

	id_guest	nama	user_name	password	email	fotoprofil
Ubah Salin Hapus	1	naufal	majdi	123	walkingofsuccess@gmail.com	1
Ubah Salin Hapus	2	aaa	nopalxx	123	walkingofsuccesss@gmail.com	1
Ubah Salin Hapus	3	aaa	nopal1	123	walkingofsuccesss@gmail.com	1
Ubah Salin Hapus	4	aaa	nopal2	123	walkingofsuccesss@gmail.com	1
Ubah Salin Hapus	5	aaa	nopal3	123	walkingofsuccesss@gmail.com	1
Ubah Salin Hapus	6	aaa	nopal3	123	walkingofsuccesss@gmail.com	1
Ubah Salin Hapus	7	aaa	majdi1	123	walkingofsuccesss@gmail.com	1
Ubah Salin Hapus	8	aaa	majdixxxx	123	walkingofsuccesss@gmail.com	1

Figure 4. Contents of a guest table on a database server

The guest login testing process is successful if the input data from the application is equal to existing data on the server. If true, the page will lead to the main guest page. To unlock a safe deposit box, the user must request a token from

the Android Application. The token used as a password to unlock the safe deposit box. This test uses a guest user to request tokens from the server. Figure 5 is the display of the request token application.



Figure 5. Main page display of android application

The user requests a token via the android application by pressing the Request Token button. The token will be deleted within 30

seconds. Table 4 is testing the token by opening the safe deposit box.

Table 4. Token testing

Value	Entry	Update	Token change	Safe key
7450	7450	0	Was successful	Was successful
3074	3074	0	Was successful	Was successful
7676	7676	0	Was successful	Succeed
2872	2872	0	Was successful	Was successful
2644	2644	0	Was successful	Was successful
1894	1894	0	Was successful	Was successful
7450	7450	0	Was successful	Was successful
3023	3023	0	Was successful	Was successful
7645	7645	0	Was successful	Succeed
2342	2342	0	Was successful	Was successful
9908	9908	0	Was successful	Was successful
6695	6695	0	Was successful	Was successful
4368	4368	0	Was successful	Was successful

... continued Table 4.

Value	Entry	Update	Token change	Safe key
2476	2476	0	Was successful	Was successful
5728	5728	0	Was successful	Was successful
5506	5506	0	Was successful	Was successful
2488	2488	0	Failed	Failed
2680	2680	0	Was successful	Was successful
8810	8810	0	Was successful	Was successful

Figure 6 is an image on the Raspberry terminal for the process of changing the token database from the Table above, where there is an error.

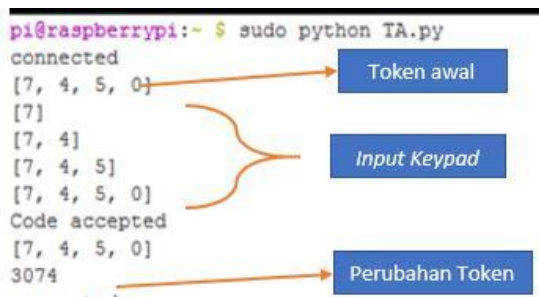


Figure 6. Testing token in lxterminal

Android Notification Testing

Android notifications are intended to provide a warning and notification to the owner through the Android smartphone. This notification system will appear if a forced door opening occurs. We make testing to open the safe deposit box by typing the password incorrectly three times. Figure 7 is the Android notification display.



Figure 7. Display notifications from the android application

Conclusion

This research developed a safe deposit box system equipped with a security system based on tokens. This system has two levels of users, namely admin and guest. The system can

provide notification along with a photo every time a password entry error occurs via the Android application. This security system has a warning alarm, and notifications are given in the form of alerts and photos to an Android smartphone if the safe door is opened by force. Data speed at notification depends on the internet connection provider.

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