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Design Smart Door Locks With Internet Of Things Based On Pin Security Features

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Article Info	ABSTRACT
Article history:	Smart door lock systems have become an interesting topic of research in recent years due to the need for higher security when
Received Nov 20, 2023	accessing rooms or buildings. This research aims to design and
Revised Nov 24, 2023	implement a smart door lock system that uses an Internet of
Accepted Nov 30, 2023	Things (IoT)-based personal identification number (PIN) that can be controlled through the Telegram messaging platform.
Keywords:	The system is designed so that users can give commands via Telegram messages to open or lock doors securely. Users can
Door Lock	access the door without needing to be physically near it. In
ІоТ	addition, the level of security is enhanced by allowing only
PIN	authorized users to control the door via Telegram messages, as
Telegram	well as by implementing strong encryption and authentication mechanisms.
	In conclusion, this study succeeded in designing and implementing an IoT-based smart door lock system that can be controlled through the Telegram messaging platform using a personal identification number (PIN) as a security method. This system provides an efficient, secure, and practical solution for managing smart door access remotely. It is expected that this research can make a positive contribution to the development of smart door security technology and IoT applications at large.
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1. INTRODUCTION

The Internet of Things (IoT) is the application of modern technology in the field of electronics. The Internet of Things (IoT) is a technology that allows control, communication, and cooperation with various hardware through the internet network (Ibadurrahman, 2020). One of the developments in IoT is smart door locks. The smart door lock system has several benefits, such as providing better

comfort, more guaranteed safety, and security. By applying a smart door lock device to the door at home, The door of the house will be able to work automatically, opening or closing according to the needs of the user. Users can also control Smart Door Lock devices remotely through a communication channel such as the internet or Wi-Fi (Kurnianto et al., 2016).

In security, using conventional keys that are widely used by the public, it is easy to be paralyzed by perpetrators of crime. In addition, using conventional keys in security systems is also less reliable because conventional keys are easily lost in use, so this system is considered less practical and spans against theft (Annisya and Chandra, 2016). The use of conventional locks is also less effective because the door of the house is easily opened by thieves. At this time, the way for thieves to open the door of the house is increasingly developing (Septryanti and Fitriyanti, 2017).

So advances in electronic technology at this time also help in the development of reliable security systems. One application of smart home security is the application of a door lock control system. Therefore, for home security, a smart door lock system is needed. The Smart Door Lock system provides convenience, security, and comfort for homeowners. The advantages of the smart door lock system can overcome the potential for home theft, and the number of intruders who enter the house can be reduced (Prayogo and Dkk, 2015).

Summarized from various sources, the invention of the smart door lock type is always updated with technologies based on the hope of making things more efficient. Various systems have been developed and updated according to current technological developments. According to (Anton Yudhanaı, Sunardi2, 2018), the system works by registering fingerprints into a microcontroller, then the system verifies the fingerprints and opens the seledoids if they are correct. If the fingerprints are incorrect, the seledoids remain locked. But in this research, there is still a drawback, namely that when the fingerprint is damaged, the sensor cannot read it. Research by Atmojo, Sulistyanti, and Nasrullah (2013) is a home door security device using barcode technology. The way to use door security using this barcode is to detect codes in the form of images, but in the door security system using this barcode, there is still a high level of difficulty when the image codes begin to fade. Research from Juanto Rerungan (2014), also tried to develop the barcode system, namely a door security system using a PIN (Personal Indentivation Number). Whereas a door security system using this PIN will be able to replace the previous system, namely the system using barcodes, the door security system using this PIN will work by entering codes through the keyboard number (Carudin, Ramdani, Marisa, 2013).

The key application system using an IoT-based Personal Identification Number (PIN) is one of the electronic security systems designed to provide a solution to save time and effort and feel safe because residents of the house can open or close the door remotely on the door of the house (Prayogo and Dkk, 2015). This system uses an application on a mobile phone that is connected to a microcontroller for data processing. Key applications using IoT-based Personal Identification Numbers (PINs) can be made using minimal tools so that the specification of the system size can be applied to real objects (Brian Evans, 2011).

Based on this background, the author is interested in conducting research entitled "Design Smart Door Locks With Internet of Things Based on Pin Security Features."

2. RESEARCH METHOD

The research methodology used in this study is as follows:

a. Literature Study

The literature study aims to study previous research related to smart door lock systems, PIN security features, and the Internet of Things. Information obtained from literature studies can be used to determine the scope of research, develop system design, and determine test methods.

b. Needs Analysis

Needs analysis aims to understand the user needs of intelligent door lock systems. The information obtained from the requirements analysis can be used to determine the features to be implemented in the system and the technical requirements of the system.

c. Design

aims to produce an intelligent door lock system design with PIN security features based on the Internet of Things. The design of such systems must meet the needs of users and meet technical requirements.

- Implementation
 The implementation aims to implement the intelligent door lock system that has been designed.
 System implementation must be done carefully so that the system can run properly.
- e. Testing

The test aims to ensure that the intelligent door lock system can function properly and meet security requirements. System testing can be done using black box testing or white box testing methods.

f. The design of the tool utilizes the ESP₃₂ microcontroller for home security; it can be seen in the picture as follows:



Picture 1 Flowchart



Picture 2 Workflow of the entire lift

3. **RESULTS AND DISCUSSIONS**

Testing is carried out to find out whether the functions of the designed tools and applications run well or not. Testing carried out includes testing hardware and software (telegram applications) on smartphones. Researchers use an application telegram as a control medium online and a personal identification number (PIN) for offline key control.

3.1. Hardware and software specifications

The design that will be made consists of two main components, namely hardware and software, where each component is interconnected to be able to implement the tools made. For its application, hardware is needed to control a device that has been set on an l elegram application, in the form of an amplifier or other device that can be installed telegram. Below is the hardware used to make this system.

- a. The smartphone used is a Samsung A51, which has an Android version that supports the Telegram application.
- b. Selenoid is an electronic device whose working principle uses electromagnetics that function to lock and open security doors.
- c. Keypad, bfunction to perform Personal Identification Number (PIN) processing.
- d. The ESP₃₂ microcontroller is a device that functions as data processing and data control and is the main device in running all ranks.
- e. Buzzer has a function as an alarm sounder and an error detector in the application of a personal identification number (PIN).
- f. button, which functions as an emergency button tool to open the Selenoid.
- g. LCD, which functions as a medium to display successful and failed processes when opening a smart door lock.
- h. The 12 volt adapter has a function as a conductor of electric current to the ESP32 microcontroller.

In addition to hardware, there is software that aims to complement the hardware so that it can be used. starting from a program entry to the controller. Below is the software used:

- a. Telegram is an application that has the function of a liaison between IoT devices installed on smartphones and supports Android and iOS.
- b. Arduino IDE (Integrated Development Environment) is software that has a function as a text editor that can create, edit, and also compile code.

3.2. Installing the Telegram App on a Smartphone

The process of installing this application does not seem to need to be explained anymore because the process is the same as installing other applications on a smartphone. Then configuration is carried out on the t-elegram so that it can be connected to the IoT style. The first thing to do is to look for the bot on the search menu at the top of the display by clicking the symbol search menu on the display, then the author types the command "myid" on the search and enters the bot account named "IDBot."



Picture 3 Display on the bot account "IDBot"

After pressing the START button, it will start chatting with the bot account. The author types the command "/start" then continues the command "/getid," where the bot account replies to the command by providing the smartphone bot account ID.

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Picture 4 Smartphone ID request process

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3.2. Program Installation on an ESP NodeMCU 32 Device

On the NodeMCU ESP₃₂ device, the Telegram platform is implemented with a special library through the Arduino IDE software. The libraries used are the <LCD_I2C.h>, <Keypad.h>, and "CTBot.h" libraries. The library serves to facilitate use in writing programs. So there is no need to write a lot of code for the program. Below is the function of the library:

- a. <LCD_I2C.h>, is a library of LCD ox27.
- b. <Keypad.h>, is a program linking library on the PIN password entrapment Keypad.
- c. "CTBot.h", is a library that serves to connect NodeMCU ESP32 devices with the Telegram platform

Next, install a program that can connect the NodeMCU ESP₃₂ device with the Telegram app. The content of the program is to enter the authentication code that has been sent by the Telegram application to the previous email. Display the bot account "IDBot" and enter the wifi data that has been specified:



String ssid = "Kita";
String pass = "00000011";
String token = "6295181138:AAEUr1XIt2kZ2N_Ago7Usnfszpp8clt7_Ko";

Figure 4. Authentication Code and WiFi Data

Then to run the program, namely uploading the program into the NodeMCU ESP₃₂ device by clicking the arrow logo like the following amber.



Picture 6 Logo Upload Program

After that, wait for the program upload process to complete. If the program is successfully uploaded without failure, the Done Uploading reading will appear.

3.2. Hardware and software testing

This test has the aim of knowing whether the LCD can display the results of the ESP₃₂ NodeMCU process. LCD testing is shown in the following figure:



Picture 7 Display generated on the LCD

From the picture above, it can be seen that when the device is connected to an adapter or electricity, the LCD can display text that has been pre-set on the ESP₃₂ NodeMCU.

Next is door security testing. In this test, there is a process of running smart door lock control, where the test becomes 2 Yes, it is online and offline. At this stage, researchers will run door security testing online. This test, as a proof of whether the designed tool can run well for the Internet of Things (IoT) stem, will display the results of door security testing with a notification system using an electronic system with an internet network system. In the initial stage of testing, the first thing the author did was to connect the internet to run the NodeMCU program by hotspot on the smartphone to connect or connect the NodeMCU program that had been set up to the NodeMCU program.

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Picture 8 Connection wifi to the NodeMCU process

Then the author enters the Telegram application to run it. By entering the bot account "pintupassword," the author will start in the bot account chat with the command "open." Then the door opens and appears on the LCD layer with the command "Correct Password" and "Door Opened!"



Picture 9 The Bot account was used.

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Picture 10 Display on the LCD and also open the door.

There is also a notification reply on the bot account with the command "The door is opened." After opening, the lock will close again automatically with the command on the bot account "The door is closed."

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Picture 11 Display results on bot account commands

And also, if there is a mistake in writing the command to unlock the door, there is no response from the chat bot, and on the Smart Door Lock, there is no response to the command.

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Picture 12 Display results on bot account command not responding

At this stage, the author will run the tool program manually or offline. Researchers programmed the PIN on NodeMCU to be able to use it offline as an alternative to an online alternative. Where the PIN has been programmed, there are 3 passwords that have been created, namely: "0156CA," "5642CD," and "545423." where the password is used to unlock the Smart Door Lock tool.



Picture 13 Processes running tool using PIN

In the picture above, the author clicks the correct password command on the keyboard to run the program. The author must click the command on the keyboard with the symbol "#" to run the program.



Picture 14 The results of the opening process

Then the result will open, and there is a notification on the LCD layer in the image, and there is also a notification on the smartphone that has been designed to let people know that the door has been opened through the telegram.



Picture 15 Notification on the smartphone if opening the device using a PIN

If there is an incorrect PIN or password implication that has been programmed, the door does not open, and there is a notification "Wrong Password," "Repeat Again," and also the buzzer will activate that there is an incorrect impeplication in inputting the PIN or password.



Picture 16 A notification results on the LCD if an error occurs.

Get a notification on the owner's smartphone if something goes wrong in the application of the PIN or password. Below are the results of the Selenoid and Buzzer tests.

No	Command	Selenoids	Buzzer
1	VALID	ON	OFF
2	INVALID	OFF	ON

CONCLUSION 4.

The conclusions that can be drawn about the design of smart door locks with Internet of Things-based pin security features are as follows::

- The use of this system runs as expected, such as opening the door through a command using a a. configured application. It can also use a pin number that has been set so that the door can only be accessed by certain people.
- b. A telegram application is equipped with a notification if someone opens or closes the door.
- Door security is done using three types of pin numbers. Pintu will be closed when you make a C. mistake when entering the pin number and sounding the buzzer.

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