

Google Assistant-Enabled Smart Lock System Using NodeMCU ESP8266 for IoT

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Abstract

Security is an important aspect that needs to be considered in a smart lock system. Conventional key tools currently have low security levels and are vulnerable to attacks. Therefore, this research aims to design a smart lock security system that utilizes Google Assistant features from Google and the NodeMCU ESP8266 module based on the Internet of Things (IoT). By using Google Assistant, users can control this smart lock with voice commands. The NodeMCU ESP8266 is used as the main controller in this system, responsible for receiving commands from Google Assistant and controlling the smart lock mechanism. A prototype implementation was conducted to test the performance of this smart lock security system. In the testing phase, the system's performance was measured based on voice command responsiveness, response speed, and the security it provides. The test results show that this smart lock security system offers a higher level of security compared to conventional key tools, with a security satisfaction rate of up to 90% among the 10 respondents related to the use of this device. With this research, it is expected to enhance community security by introducing a safer and more reliable smart lock tool based on virtual assistant. This security system, utilizing Google Assistant features and the NodeMCU ESP8266, can provide ease and convenience for users while maintaining optimal security.

I. INTRODUCTION

The number of cases of theft of goods from 2022 was recorded as many as 822 cases throughout the year. This figure shows that theft cases are still happening around us, and of course the security we have is not very qualified to be able to prevent this theft [1].

Along with the development of technology that is increasingly sophisticated and makes it easier for humans to date, of course there have been many inventions that help the activities or activities we do so that they become more productive, and also effective in terms of time. It is possible that the tools created can help us to increase security in maintaining the personal belongings we have. One of them is a security tool in helping to keep a room safe from all acts of theft.

One type of maintaining security in a room that is vulnerable to being broken into by thieves is using a key to lock the door. The key is a metal made to be a tool to operate a door by inserting it into the main hole of the key to be put together and operated as a key. Of course, this security system has a very high risk of theft. Therefore, one of the ways to implement a security tool for a room is to implement a smart lock using the Internet, which will make the security level of a room have a higher percentage of security compared to the security methods that are still fairly old-fashioned and manual.

Many room security systems are already circulating in the community, but with the most affordable price above Rp.1,600,000, making people think twice about buying it [2].

Finally, researchers made a smart lock tool that uses the Google Assistant platform. The reason why researchers use the Google Assistant feature is because the features of Google Assistant are very widely known by the wider community, in fact, almost all people who live in this modern era use the features provided by Google to increase their productivity, and also about 500 million more people around the world use Google Assistant based on statements from Google, and also researchers see the features provided by Google in helping to design this security, rarely used by the public, especially in Indonesia, this is because in using the Google Assistant

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feature itself with the equipment they want to connect, they have to buy the equipment at a relatively expensive cost" [3].

The way this tool works is that the automatic door security tool will be connected to a platform called IFTTT which later from the IFTTT platform will be connected again to a website called Adafruit to be connected directly to the designed security tool using the API key provided by Adafruit.

Therefore, researchers made a technology tool "Designing a Smart Lock Security System with the Help of Google Assistant and NodeMCU ESP8266 Features Based on IoT" which is expected to provide comfort and convenience for users in increasing the security of their room.

With the advancement of technology becoming increasingly sophisticated and user-friendly, there have undoubtedly been numerous inventions that have aided our activities, making them more productive and time-effective. It is not unlikely that these inventions can also assist us in enhancing the security of our personal belongings. One such security tool is designed to help protect a room from theft. One way to secure a vulnerable room from break-ins is by using a lock to secure the door. Therefore, researchers have developed a technology device titled "Design of a Smart Lock Security System with the Assistance of Google Assistant Feature and NodeMCU ESP8266 Based on IoT." This device is expected to provide comfort and convenience to users in enhancing the security of their rooms.

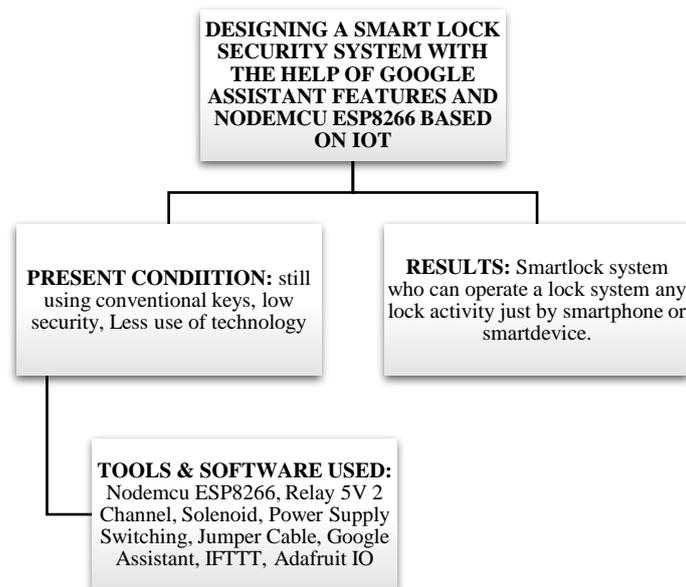


Fig.1 Thought Diagrams

This is a thought diagram about a smart lock system where with the current conditions, the keys are still used manually and there is still a lack of utilization in the use of technology around it, then with the existing results, a smart lock system is designed that makes it easier for prospective users to increase security, which in its design uses the tools & programs mentioned in the diagram.

II. METHODS

In this prototype, the method employed involves structured steps. Firstly, the planning phase is carried out by gathering data on environmental issues and planning the research that will focus on creating a smart lock. Next, the analysis stage is undertaken to analyse the necessary aspects required to address the previously identified problems. Following the analysis, the design phase follows, encompassing the design of research tools and the development of the necessary programming to ensure the tool functions properly. Lastly, the implementation stage involves direct testing of the tool on the object it is intended to integrate with. The goal of this stage is to ensure that the developed tool operates as instructed. If it does not meet the established criteria, the researcher will revise the tool's design until it functions properly as desired. Before that, we need to know 3 basic things that must be understood, before designing this smart key device, namely microcontroller, key and internet of things. Microcontroller is an integrated circuit that functions like a small computer designed to perform a specific task or operation. A microcontroller IC consists of several components such as a processor core (CPU), memory (RAM and ROM), and programmable input/output (I/O) devices. In general, the main function of a microcontroller chip is to perform programmed tasks using instructions stored in memory [4].

Then, A key is a device used to lock and unlock an object, such as a door, vehicle, or security system. Keys serve as tools to control access, allowing authorized owners or users to either unlock or lock the object [5].

The last one is Internet of Things. It was a subset of technology applications that allow you to control, communicate, collaborate with various hardware devices, transfer data over the Internet. So we can say that the Internet of things (IoT) is when we can connect things that are completely outside of human physical activity.[6]

After the 3 things that have been explained above, the following are several things that are needed to carry out the method that has been designed, start from the processor, NODEMCU ESP8266.

NodeMCU is an open source IoT platform consisting of Espressif System's ESP8266 System On Chip. NodeMCU can be summarized as an Arduino-like board that is connected to ESP8266. NodeMCU has packed ESP8266 into a board that has been combined with various features such as a microcontroller and the capacity to access Wi-Fi and also a communication chip in the form of USB to serial. So that programming only requires a USB data cable [7].

After the processor, there is a relay that plays a role in being able to open and close the electrical current in a switch that can conduct electricity at a predetermined voltage [8].

Then, we need the output of this device, we used Solenoid door lock, it was an electronic device that can be used to secure the door. Just like conventional door locks, solenoid door locks have two states, namely normally open (NO) and normally closed (NC). However, the solenoid door lock used by this researcher requires an electric current with a voltage of 12 volts in order to be operated for both states [9].

This device needs a power supply to make this device work, then we use Power Supply Switching. Refer to power supply systems that adopt switching technology. These power supply systems integrate an electronic switch to regulate power flow, and are commonly used as the main power source in electronic equipment. SMPS (Switched Mode Power Supply) is an alternative term often used to describe this type of power supply [10].

All the necessary tools have been obtained, the next method is preparation in terms of software, which will be used, first Google Home & Google Assistant. This is the mobile application that used to set up and control Google Home devices and other devices compatible with Google Assistant. What can be done using the Google Home App includes device configuration, home control, entertainment, and much more. Google Home itself is specifically used in this design as an initial configuration, so that Google Assistant can be connected with IoT devices [11].

Using Google Assistant for this device because it certainly has artificial intelligence support that can help users optimize interaction with the device by using the voice command, such as controlling home devices, this Google system is a conversation between the user and the Google Assistant itself, which makes two-way communication. Google Assistant can answer questions and respond to information requested by users, such as the climate conditions of a place, clock, location or place, and can also command operations in a smartphone itself [12].

Then, to connect the device and the software, it needs API keys to bridge between the program and the device, using IFTTT & ADAFRUIT IO. IFTTT (If This, Then That) is a web-based automation service that allows users to establish connections between various applications and online services. The concept of IFTTT is 'if this happens, then do that'. In other words, users can create conditions that can connect two different services or applications, so that when an event occurs in one service, it will trigger an action in the other. The examples of common IFTTT uses include connecting social media accounts to cloud storage such as Google Drive, synchronizing data between apps, or receiving email or text message notifications when certain events occur [13].

And the last one we using Adafruit IO Website. This is an Internet of Things (IoT) service platform developed by Adafruit Industries. The platform allows users to connect, manage, and control their IoT devices over the internet. Adafruit IO provides an easy-to-use user interface for integrating various equipment and sensors into IoT applications. With Adafruit IO, users can create data channels that can receive and send data from their IoT devices. This data can be monitored and tracked using the online dashboard provided by Adafruit IO. In addition, Adafruit IO supports various communication protocols such as MQTT and HTTP, enabling flexible integration with various platforms and devices [14].

III. RESULTS

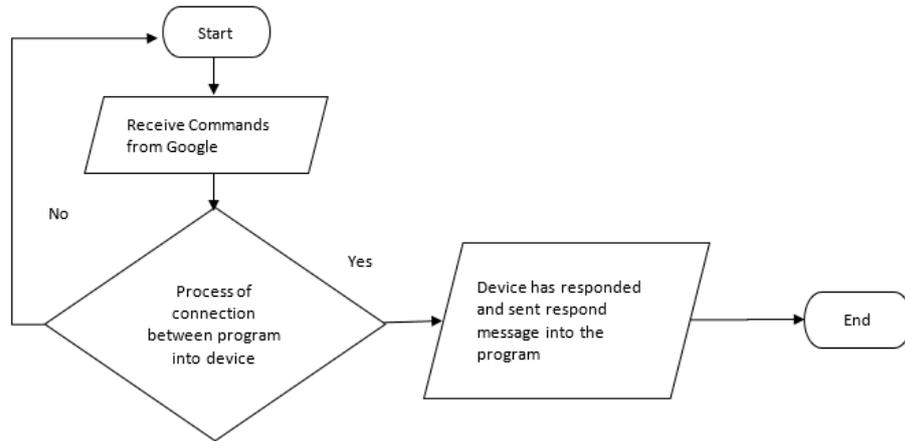


Fig.2 System Flowchart

In figure 2 is a flowchart design of how the system can running from the commands has received until the response what device sent.

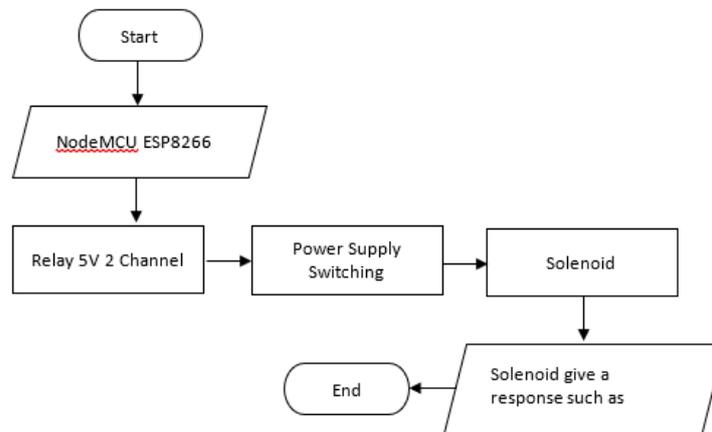


Fig.3 Device Flowchart

In figure 3 is a flowchart device of how device working from the main processor until the output device that give a response as instructed.

From the results of the conducted method, it was possible to create a prototype of a smart lock with the ability to operate the lock using the Google Assistant application as the basic interface for giving commands. With the planning results that have been analysed, functions or features have been provided to facilitate and enhance the efficiency of operating this prototype. This includes monitoring the lock's status and using voice commands to simplify the user's interaction with this smart lock. At this stage the researcher designs a prototype in order to facilitate the understanding process for users and also make it easier for developers if in the future this research

wants to be developed to be better. Wiring diagram is a schematic that describes the relationship between one component and another in detail. Here's the wiring diagram of smart lock system:

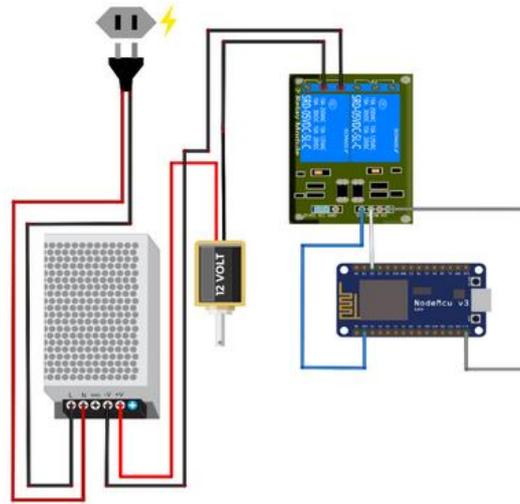


Fig.4 Smart lock system wiring

The following is an explanation of the Picture of smart lock system wiring for the circuit connection.

TABLE 1
 SMART LOCK SYSTEM WIRING

Relay 5V 2 Channel	
NODEMCU ESP8266	
1.	Pin VCC = Pin VIN NodeMcu
2.	Pin GND = Pin GND NodeMcu
3.	Pin In 1 = Pin D2 NodeMcu
Solenoid Door Lock	
1.	Pin VCC = Pin +V Power Supply
2.	Pin GND = Pin COM Relay
Solenoid Door Lock	
1.	Pin L = Cable – power plug
2.	Pin N = Cable + power plug
3.	Pin -V = Pin NO Relay
1.	Pin +V = Pin VCC Solenoid

The following is a sequence of how a smart lock operates, starting from issuing a command to the smart lock: activation process.

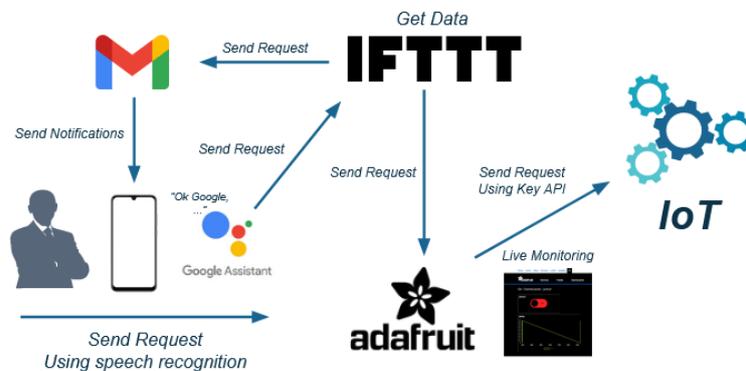


Fig.5 Smart lock system workflow

The workflow of how the smart lock system can work properly is from the Google Home application to configure the IFTTT application, which later IFTTT will synchronize the commands received from the Google Assistant application with the commands that have been made in the IFTTT application, if the same, then the command will be sent to ADAFRUIT IO through the connection configuration between the two, which when it is received by ADAFRUIT IO, will be forwarded using

the API key to be equated by the key that has been set in the tool program. If all goes well, the tool will respond by sending a message that has been set by sending via email.

IV. DISCUSSION

The integration of Arduino as a versatile hardware and software platform has revolutionized the development of microcontroller-based prototypes [15]. This research underscores Arduino's adaptability by showcasing its pivotal role in constructing a smart lock solenoid door system, synchronizing seamlessly with Google Assistant on smartphones. Simultaneously, the system leverages the Adafruit IO Website, establishing a comprehensive monitoring interface. This amalgamation demonstrates the potential of IoT, offering users remote door control through Google Assistant's voice commands while providing real-time monitoring and data analysis via Adafruit IO. Yet, amidst these advancements, critical considerations regarding data security and system reliability emerge as essential focal points for ensuring the seamless performance and widespread adoption of interconnected IoT solutions. Addressing these challenges effectively could pave the way for an era defined by interconnected IoT ecosystems, marking a paradigm shift in various industries.

V. CONCLUSIONS

Based on the results of the research and testing above, it can be concluded that the overall design has yielded a successful outcome. The design functions effectively according to the planned specifications and can reduce theft incidents through the use of an automatic smart lock operated via a smartphone, specifically utilizing Google Assistant. Furthermore, it enables the monitoring of all lock activities through the Adafruit website. Additionally, the automatic lock device has proven to meet user needs, as indicated by the questionnaire responses from 10 individuals. While the device functions well, there are still areas for improvement, such as the addition of supplementary sensors and further optimization of the device to enhance the maximum security of the lock.

REFERENCES

- [1] Dataku "Data Vertikal Kepolisian Republik Indonesia Daerah" 2022. [Online]. Available: http://bappeda.jogjaprov.go.id/dataku/data_dasar/index/447-jumlah-kasus-pencurian?id_skpd=39
- [2] mybest "10 Rekomendasi Smart Door Lock Terbaik" Friday July 2023. [Online]. Available: <https://id.my-best.com/136842>
- [3] Jati. Anggoro Suryo "Pengguna Google Assistant Tembus 500 Juta" Monday January 2020. [Online]. Available: <https://inet.detik.com/cyberlife/d-4851496/pengguna-google-assistant-tembus-500-juta>
- [4] Abadi, R "Mikrokontroler: Pengertian, Fungsi, Gambar, Jenis, Contoh" Thursday March 2023. [Online]. Available: <https://thecityfoundry.com/mikrokontroler/>
- [5] R. J. Fischer, E. P. Halibozek dan D. C. Walters, Introduction to Security, Florida: CRC Press, 2018.
- [6] A. Ramdhani dan I. A. Fahmy, "2 Pengertian Internet of Things Menurut Para Ahli dan Cara Kerjanya," Monday February 2023. [Online]. Available: <https://www.pinhome.id/blog/pengertian-internet-of-things-dan-pembahasannya-lengkap/>.
- [7] frans, "Apa Itu Nodemcu : Pengertian, Sejarah, dan Versinya," Monday April 2022. [Online]. Available: <https://www.anakteknik.co.id/rahasia1/articles/apa-itu-nodemcu-pengertian-sejarah-dan-versinya>.
- [8] A. Razor, "Modul Relay Arduino: Pengertian, Gambar, Skema, dan Lainnya," Friday March 2021. [Online]. Available: <https://www.aldyrazor.com/2020/05/modul-relay-arduino.html>.
- [9] Achmady, S., Qadriah, L., & Auzan, A., "JRR RANCANG BANGUN MAGNETIC SOLENOID DOOR LOCK DENGAN SPEECH RECOGNITION MENGGUNAKAN NODEMCU BERBASIS ANDROID" Thursday June 2022. [Online]. Available: <https://doi.org/10.47647/jrr>
- [10] S. S. Hidayatullah, "PENGERTIAN POWER SUPPLY SWITCHING DAN CARA KERJANYA," Monday July 2020. [Online]. Available: <https://www.belajaronline.net/2020/07/pengertian-power-supply-switching-dan-cara-kerjanya.html>.
- [11] Google, "Memperkenalkan aplikasi Google Home" Monday May 2023. [Online]. Available: <https://support.google.com/chromecast/answer/7071794?hl=id&co=GENIE.Platform%3DAndroid>.
- [12] I. Pangestu, "Mengenal Apa itu Google Assistant, Sejarah, Fungsi, kelebihan dan kekurangan," Wednesday September 2022. [Online]. Available: Mengenal Apa itu Google Assistant, Sejarah, Fungsi, kelebihan dan kekurangan.
- [13] IFTTT, "What is IFTTT?," Friday March 2023. [Online]. Available: https://ifttt.com/explore/new_to_ifttt.
- [14] Adafruit, "What is Adafruit IO?," Tuesday May 2023. [Online]. Available: <https://learn.adafruit.com/welcome-to-adafruit-io/what-is-adafruit-io>.
- [15] R. Setiawan, "Apa itu Arduino? Pahami Lebih Mendalam," dicoding, Saturday January 2022. [Online]. Available: <https://www.dicoding.com/blog/apa-itu-arduino/>.