# Automatic Lock Door With Voice Commands On Arduino-Based Android

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**ABSTRACT**

The key has an important function in the security system on the door which is the access to enter the room. To unlock a door, we usually need a key to open or lock a door. The purpose of this paper is to provide comfort or convenience in opening or locking doors with a more sophisticated and efficient security system using voice commands on Android. Automatic lock doors with voice commands on Android are a development of room door locks that still use conventional keys. This research uses the Arduino microcontroller as the brain of the solenoid used to lock the door and the magnetic switch is used to detect movement at the door, SIM800L is used to send notification messages in the form of SMS to registered admins. The method used is the prototype method, the prototype provides an overview to the user how the work flow in the system to be built. Application and tool testing is carried out to determine the performance of the applications and tools designed on the proposed system. The result of this research is a prototype automatic lock door with voice commands on Android based on Arduino Uno.

## 1. INTRODUCTION

The key is one of the defense tools that serves to protect the facility from the wearer or user. The use of keys for security is very widely used ranging from vehicles, rooms, cabinets, trims and others. The better the system [9] The security installed on a tool can further reduce the losses caused by damage and loss of items contained in the room. The process of unlocking the door or locking the door is generally done manually, we're going to need a key to unlock or lock the door. Of course, its security cannot be guaranteed in such a process. It is certainly not effective if we always have to bring the key with us and there will be many things that may happen if using conventional keys, among others, we forget to put the key or even risk losing the key.

Seeing from this for the security of a room on the Global Institute campus is still very minimal, where the general staff still use conventional keys to open all existing doors and also too many risks that may occur including the following:

1. The key will be lost or left behind.

2. Too much time to open a room door because the general staff must find a key that matches the keyhole of the door you want to open.

With the development of technology as it is today, conventional door lock systems can be replaced by electronic door locks made with a combination of Arduino [2] and Android [6].

Arduino [2] is an open-source single-board micro controller, and includes a major component, an AVR (Automatic Voltage Regulator) processor produced by atmel, and in implementing a code, Arduino [2] has its own programming language.

Android [6] is a Linux-based operating system, including operating systems, middleware and applications, and in the current technological system the operating system on Android is experiencing a very significant development. In the Android operating system the speech recognition feature has been given by Google for smartphone users can search using voice commands, which users only by saying a word or sentence then the user can use the search engine that has been found on Google.

Global Keys is an electronic key that can make it easier for users to use voice commands on Android. Voice commands transmitted over Android will be sent by Bluetooth [4] contained on the phone and received by the Bluetooth module [4] It's on Arduino [2]. If the voice command matches the command already in the arduino program [2] then the door will

open and if the voice command does not match the command already in the arduino program [2] then the door will be locked.

It's on Arduino [2]. If the voice command matches the command already in the arduino program [2] then the door will open and if the voice command does not match the command already in the arduino program [2] then the door will be locked. Magnet switches [8] are used to detect movement in a door, whether the door is open or closed. SIM800L [5] is used to send SMS notification messages to registered admins. Relay [10] is used to control the Solenoid [11] so that the door can be opened or locked. Jumper cables are used to connect between each component of the device. LEDs are used to give notifications in the form of light to the user whether the door successfully opens or not. Buzzer [7] is used to give a voice notification to the user whether the door successfully opens or not. The power supply [1] is used to give electric voltage to arduino. Stepdown [3] DC-DC is used to change the voltage of the electric current.

## 2. METHODS

### 2.1. Data Collection Methods

1. Interview

Conducting question-and-answer activities to general affairs staff of Global Institute who act as stakeholders in this research, in order to obtain more accurate data information will be discussed.

2. Method of Analysis

By studying the operation or mode of operation of an existing system in detail and determining the next stage of strategy, system analysis can be performed. System analysis can be done using 5 stages, including problem analysis, needs analysis, feasibility analysis, running system analysis, proposed system analysis.

3. Literature Review.

This method is done by collecting and studying theories derived from books and literature related to research.

### 2.2. System Development Methods

1. Planning

After the implementation of the system, activities related to the estimation of physics, labor and requirements are required to support the development of the system and support its operation.

2. Needs Analysis

Analyze the needs of software system users and develop the needs of software system users.

3. Design

Describes a picture of a new system that can solve the problems faced and acquired by choosing the best alternative system.

4. Development

This is the stage of writing a program that has been analyzed and designed.

5. Integration and Testing

Demonstrate a software system that meets the requirements specified in the functional processing document. Then in the test as a whole.

6. Implementation

Including the preparation of the implementation and implementation of software in the campus environment (user environment).

7. Operation and Maintenance

Describes the operation and maintenance of information systems in a campus environment (user environment).

### 2.3. Problems Faced

The problems faced by existing systems in this security system are:

1. The working system of the lock device is still manually, so it still requires a key to unlock and lock the door.

2. There are problems that arise if the key is left behind and lost, and the key can be easily duplicated.

3. Safety cannot be guaranteed.

4. Too much time to open a room door because the general staff must find a key that matches the keyhole of the door that want to open.

### 2.4. Troubleshooting

Based on the problems and analysis of service needs above, the researchers made an automatic door key prototype with voice commands on android-based arduino uno. The design was made to improve the quality of facilities and infrastructure and security of the head room of Global Institute. Thus, alternatives to solve the above problems need to be made electronic keys at Global Institute campus.

## 3. RESULTS AND DISCUSSION

### 3.1. Proposed New Procedures

The system that existing on the Global Institute campus, currently still found some problems faced, namely for security in locking and opening the door still using conventional keys where if using conventional keys for their own safety is still very minimal and also if you want to open or lock the door

must take a lot of time to find the key first among the many other door lock, there are problems that arise if the key is left behind, lost and the conventional key is easy to duplicate.

With this development analysis is an input in the system proposed by the author. With this development is expected to monitor and facilitate in opening or locking doors on the Global Institute campus. The author therefore proposes an automatic door lock system with voice commands on Android-based Arduino Uno.

## 3.2. Proposed Tool Design

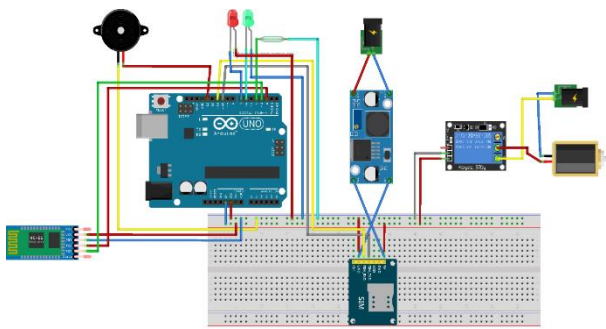Here's an overview for the design of the tools proposed by the author.



Figure 1. Overall Tool Plan

Based on Figure 1. The Overall Suite of Tools can be explained as follows:

1. Arduino Uno

This tool is used as a controller or brain that connects a series of other tools.

2. Solenoid

This tool is used for door locking or door lock unlocking. There are 2 cables that are in the solenoid, namely cables with positive electrical voltage and negative electrical voltage.

3. Jumper Cable

This tool is used to connect each component used.

4. Relay

Relays are used to control and command the solenoid, whether the door lock should be opened or closed. There are 3 pins in the Relay namely IN, VCC, GND. Pin IN is connected to the digital pin found on the Arduino and the VCC pin in the Relay is connected to the VCC on the Arduino, as well as to the GND pin in the Relay connected with the GND pin on the Arduino Uno.

5. Bluetooth HC05 module

This tool is used to media receiver data sent over Android and sent to Arduino. There are 4 pins in the Bluetooth module namely RX, TX, VCC, GND. The RX and TX pins on the Bluetooth module are connected to the RX and TX digital pins on the Arduino Uno. For VCC and GND on bluetooth modules are connected with VCC and GND pins found on arduino uno.

6. Buzzer

This tool is used to notify the user of a voice whether the door is successfully opened or not. There are 2 feet in the Buzzer, namely positive feet and negative feet. The positive foot on the Buzzer is connected to the digital pin on the Arduino, and the negative foot on the Buzzer is connected to the GND pin on arduinno uno.

7. SIM800L

This tool is used to notify messages sent to registered admins. There are 4 pins contained in SIM800L namely RX, TX, VCC, GND. The RX and TX pins on the SIM800L are connected to the RX and TX pins found on the Arduino Uno. The VCC and GND pins on the SIM800L are connected to the VCC and GND pins found on the Arduino Uno.

8. LED

This tool is used to provide notifications in the form of light to the user whether the door was successfully opened or not. There are 2 feet found on the LED, namely positive feet and negative feet. The positive foot found in the LED is connected to the digital pin on the Arduino Uno and the negative foot found on the LED is connected to the GND pin on the Arduino Uno.

## 3.3. System Design Diagram

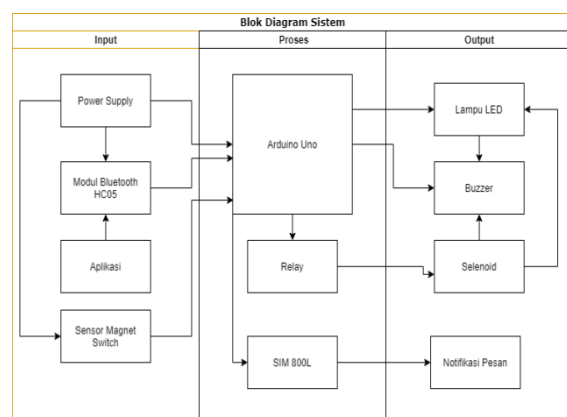Here is an overview of the proposed system design and is depicted in the form of a block diagram.



Figure 2. System Block Diagram Design

Based on Figure 2. The System Block Diagram design can be explained as follows.

1. Input

In this input process occurs when Bluetooth receives a data from the application sent via Bluetooth that is connected between the Bluetooth module and the Bluetooth device contained in the application and the data received by the Bluetooth module in the process in the Arduino Uno. This input process occurs also when the magnet switch sensor detects if the door occurs movement and movement in the process in the Arduino.

2. Process

At this stage Arduino receives input from the Bluetooth module and the switch magnet sensor. The data received from the Bluetooth module is in the form of command data and user data that wants to open the door. The data is divide into two variables, which is name and command. If the value of the name variable is not the same as the registered username and also the value of the command variable is not the same as the command sentence that has been set then the door cannot open and forward the command into the buzzer and LED light, and if the value of the name variable corresponds to the name that has been listed and also the value of the command variable is equal to the command sentence that has been set then the command will be forwarded to the relay and continued to the solenoid. At this stage, Arduino also receives input from the magnet switch sensor if the door lock is open and the door is moving then the command will be continued SIM800L module and provide notifications in the form of messages to registered admins.

3. Output

After doing the input and the process is already running, then the output will be generated in the form of red light notifications which means the door failed to open and the green light which means the door key was successfully opened and also managed to resusgate. Buzzers are used to provide sound notifications if the door lock is open and the door is locked, with a different time delay. This tool also provides notifications in the form of SMS messages sent, SMS sent if there is movement on the door read by the magnet switch sensor and echoes the name of the user who has opened the door.

## 3.4. Prototype Design Tools

Here is an overview of the automatic door key prototype with voice commands on Android-based Arduino Uno.
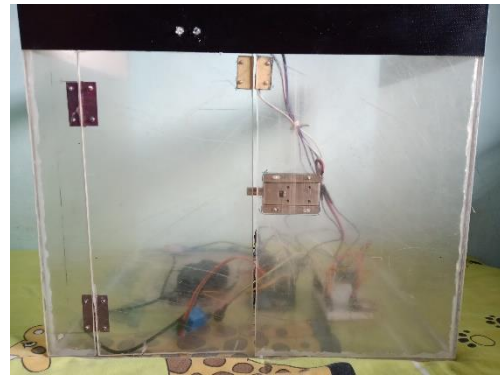


Figure 3. Design a Tool Build

The image above is an overview of the shape of the automatic door lock prototype proposed by the author. Here is a list of tools used in the creation of the proposed tool.

Table 1. Tool Components Used

| No | Tools and Materials | Quantity |
|----|---------------------|----------|
| 1 | Personal Computer (PC) | 1 Pcs |
| 2 | Mikrokontroler | 1 Pcs |
| 3 | IDE Arduino | 1 Pcs |
| 4 | SIM800L | 1 Pcs |
| 5 | Connection Sensor | 1 Pcs |
| 6 | Sound Sensor | 1 Pcs |
| 7 | Voltage Modifier | 1 Pcs |
| 8 | Connecting Board | 1 Pcs |
| 9 | Connecting Cable | < > 50 Pcs |
| 10 | Locking Motor | 1 Pcs |
| 11 | Power Supply | < > 3 Pcs |
| 12 | Solder | 1 Pcs |
| 13 | Tin | 1 Pcs |
| 14 | Acrylic | 1 Lembar |
| 15 | Builds | < > 10 Pcs |
| 16 | Hand phone | 1 Pcs |
| 17 | LED | 2 Pcs |
| 18 | Resistor | 2 Pcs |

## 3.5. Prototype Design Tools

After conducting system analysis and design on the proposed tool, the author will test the tool to determine the performance and results of the design and make improvements if any errors arise in the tool or system. Here are the test stages on the proposed tool.

1. Try The Bluetooth Connection App and Arduino

Bluetooth is used as a connection medium between applications and Arduino. Here are the results of connection testing between the application and Arduino. Here is an overview of connection testing on apps and Arduino.
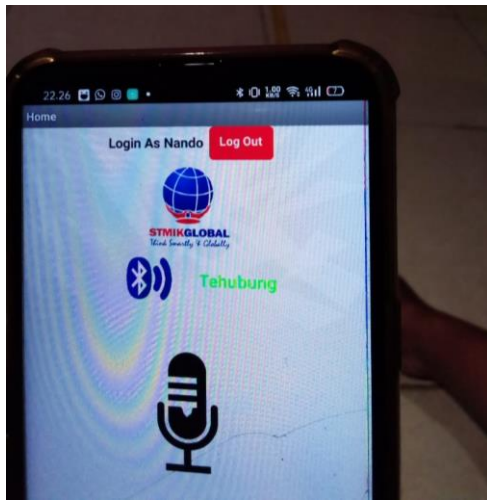


Figure 4. Bluetooth Connection Testing

Figure 4. Bluetooth Connection testing above is a view of the Global Keys application if connected to the Bluetooth module contained in Arduino. The authors tested four times at different distances. Here are the results of connection testing that has been done with different distances.

Table 2. Connection Testing Results

| No | Distance | Status | Time |
|----|----------|-----------|----------|
| 1 | 50 cm | Connected | 3 Sec |
| 2 | 100 cm | Connected | 2.67 Sec |
| 3 | 150 cm | Connected | 2,59 Sec |
| 4 | 200 cm | Connected | 2,98 Sec |

2. Voice Command Testing

Voice commands on this system are used to send commands from applications sent to Arduino via Bluetooth media. This voice command serves to control the door whether the door should be locked or must be opened. Here is an overview of voice command testing found in the Global Keys app.
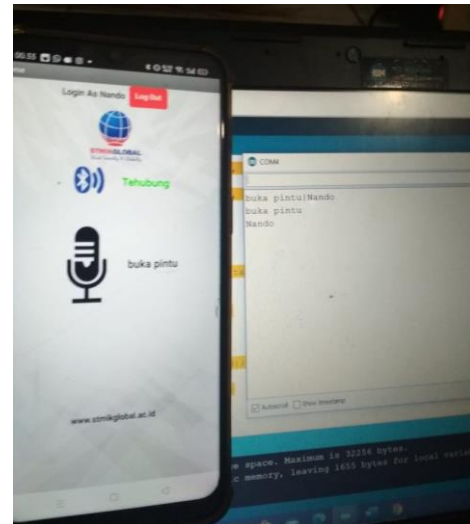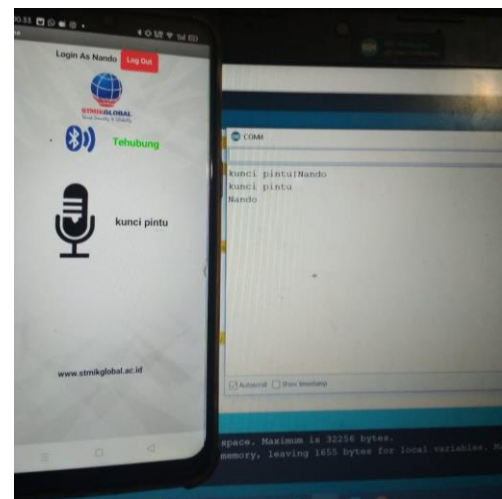


Figure 5. Open Door command



Figure 6. Door Lock command

Figure 5. Open The Door and Figure 6 command. The Door Lock command is an illustration if the user wants to open the door that is done in the Global Keys application. The command will be sent to Arduino with Bluetooth intermediate media. The authors tested four times at different distances. Here are the results of voice command testing that has been done at different distances.

Table 3. Voice Command Test Results

| No | Distance | Status | Time |
|----|----------|--------|---------|
| 1 | 50 cm | Sent | 3 Sec |
| 2 | 100 cm | Sent | 3.7 Sec |
| 3 | 150 cm | Sent | 6.2 Sec |
| 4 | 200 cm | Sent | 8.7 Sec |

3. Switch Magnetic Testing and SIM800L

Magnetic switches and SIM800L are interrelated components. Magnetic is used to read movements on doors and the SIM800L is used to send notifications to an SMS message. If the user pushes the door then the status on the magnetic is high and the door admin will get a notification message that the door that has been installed by this system has been opened, and if the door is closed then the status on the magnet will be low and the door will be locked automatically. Here is an overview of the SMS that was successfully sent.
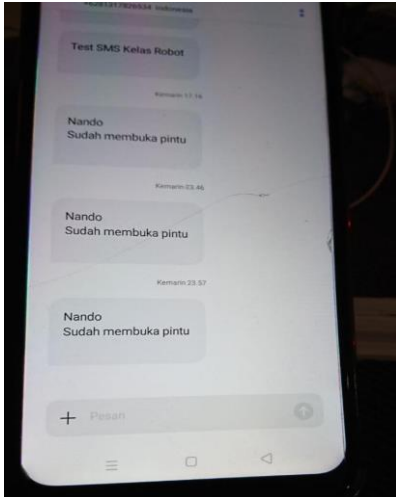


Figure 7. SMS Successfully Sent

The author tested twice on different providers. Here are the results of the voice command testing that has been done.

Table 3. Voice Command Test Results

| No | Provider | Status | Time Sent | Looking for Signals |
|----|----------|--------|-----------|---------------------|
| 1 | Telkomsel | Sent | 3 Sec | 5 Sec |
| 2 | Tri | Sent | 9 Sec | 10 Sec |

These results can vary due to network factors, because network factors greatly affect the sooner or later messages sent, and that affect network factors there are several types such as environmental factors, weather factors, provider factors and many more. The author can only test with 2 providers only because of the limitations of the card owned. To find a signal each provider results will be different. To find out sim800L get a signal is to look at the indicator light contained in the SIM800L module. If the SIM contained in the module has received a signal then the time span of the life of the first and second indicator lights is approximately 3 seconds and the next and if the SIM contained in SIM800L has not received a signal then the indicator light will blink 7 times with a time span of 1 second and there will be a 3-second pause and then repeat again until the SIM gets a signal. If the SIM800L has not received a signal also with a long enough time span, users can try to provide electric current from the outside by using a 9V 1A adapter, and if they still find a signal then the user is required to try with another provider.

## 4. CONCLUSION

Global Keys uses the help of MIT App Inventor tools to design and program applications online. In this Global Keys application there is a database that can be used offline and already embedded in the application.

The creation of an automatic door key prototype with voice commands on Android based on Arduino Uno is made using one Arduino Uno as the center of the process of managing commands received or to be issued. One Bluetooth HC05 module is used to receive data transmitted from the application through a Bluetooth connection contained on the smartphone and after receiving data from the application, the data is sent to Arduino Uno as an input that will be processed in the Arduino. In this design the author also uses the SIM800L module as a notification in the form of SMS messages sent to the admin as the person responsible for the room, the message is used to monitor anyone entering the room. Buzzer is used to give notifications in the form of sound if the door key is successfully opened then the buzzer will provide a sound notification, as well as if the door is locked then the buzzer will provide sound notifications with a different delay. Stepdown is used to change the voltage current received by the SIM800L module. Solenoids are used as a device to lock and open doors. Magnet switches are used to detect if there is movement in the door, if access is received and the door occurs movement then the process will send a message notification in the form of SMS from the SIM800L module sent to the managing admin. LED lights are used to notify the public whether access unlocks the door and locks the door or not.

From the results of the overall test of the system that it can be concluded that the automatic door key prototype with voice commands on Android runs normally according to the block diagram that has been compiled by the author.

There is few suggestions for next researcher:

1. Prototype automatic door locks with voice commands can be further developed using a power supply in the form of a rechargeable battery or charge to backup when the power goes out.

2. Use the latest SIM modules to minimize the occurrence of noise in messaging.

3. It uses a database server that can hold data on all applications so that data on one application and another application can be integrated.

4. To get the best results, the author recommends sending data or receiving data on Arduino and applications using wifi modules, to be more effective and save time.

5. Security and policy must be mutually sustainable or balanced.

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