Design of an Arduino-Based Automatic Door Lock Using a Smartphone

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Article Info	ABSTRACT
Corresponding Author: Indra Philip Hutabarat E-mail: indraphilip12@gmail.com	The advancement of technology has encouraged various innovations to simplify human activities, including home security systems. One such innovation is the design of an automatic door lock system based on Arduino that can be controlled using a smartphone. This study aims to design and implement a more practical and secure automatic door lock system without the use of physical keys or keypads. The system utilizes the Bluetooth HC-05 module as a communication medium between the smartphone and the Arduino Uno microcontroller, which controls the relay and solenoid lock as the door actuator. The research methods applied include field research to collect empirical data and library research to establish theoretical foundations. The implementation results show that the automatic door lock system functions properly, allowing users to lock and unlock doors wirelessly through a smartphone application. This system is considered more efficient, practical, and capable of reducing the risk of losing keys or forgetting PINs found in conventional systems. **Keywords:** Automatic door lock, Arduino Uno, Bluetooth HC-05, smartphone, solenoid.

INTRODUCTION

The advancement of technology today has made everything easier to do. Many innovations have been developed by humans to assist in their work, which in turn drives technological progress. An automatic door is a type of door lock that can be operated in a practical and efficient way. In this case, the operation can be performed using a keypad controlled by a microcontroller. The automatic door makes it easier for users to unlock the door conveniently. Based on the current use of automatic doors, most systems still rely on keypads for home security. However, there are weaknesses in using keypads, such as the risk of forgetting the PIN required to unlock the door, which results in the door remaining locked. This situation causes difficulties for homeowners when they forget their PIN. Another drawback is that people nearby can easily see the PIN being entered on the keypad.

The purpose of this study is to design a door lock system that eliminates the need for physical keys. With this automatic door lock system, unlocking the door only requires the use of a smartphone. This system is very practical, especially for those who often forget or misplace their keys.

Literature Review

To further support the research to be conducted, data related to the issues discussed must be obtained. The following information may be helpful:

According to Abdul Basit et al (2023:1), a microcontroller is an IC (Integrated Circuits) chip that functions as a controller for electronic circuits and can store program codes to perform specific tasks desired by the programmer.

According to Boby Wisely Ziliwu et al (2022:9), to program an Arduino board, we need the Arduino's built-in IDE (Integrated Development Environment) application. This application is useful for creating, opening, and editing Arduino source code (Sketches; programmers refer to Arduino source code as "Sketches").

According to Miftachul Ulum et al (2019:2), the Arduino board is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.

According to Valentinus Galih Vidia Putra et al (2019:18), the advantages of using Arduino are:

1. It already has USB communication capabilities, so laptop users who do not have a serial/RS323 port can use it.
2. The programming language is relatively easy because the Arduino software is equipped with a fairly complete set of libraries.
3. It has ready-to-use modules (shields) that can be plugged into the Arduino board. For example, GPS, Ethernet, and SD Card shields.

According to Widodo Budiharto in Agus Sifaunajah et al (2023:2), a Bluetooth module is a device that functions as a connecting medium between an Android smartphone and a microcontroller that has a Bluetooth module embedded in it.

METHOD

To obtain data and solve existing problems, as well as to obtain the information needed to compile this final project, the author conducted several research methods, namely:

1. Field Research (Field Research)
   This is research conducted in the field to collect the necessary data and information.
2. Library Research
   This is a method of collecting data and materials by reading or studying books and other scientific written materials.

RESULT

Implementation
Definition of Implementation

In the Big Indonesian Dictionary (KBBI), implementation means execution or application. This relates to planning, agreements, and the application of obligations. Implementation is usually carried out after planning is considered complete. Implementation is not just an activity, but a planned activity to achieve a goal.

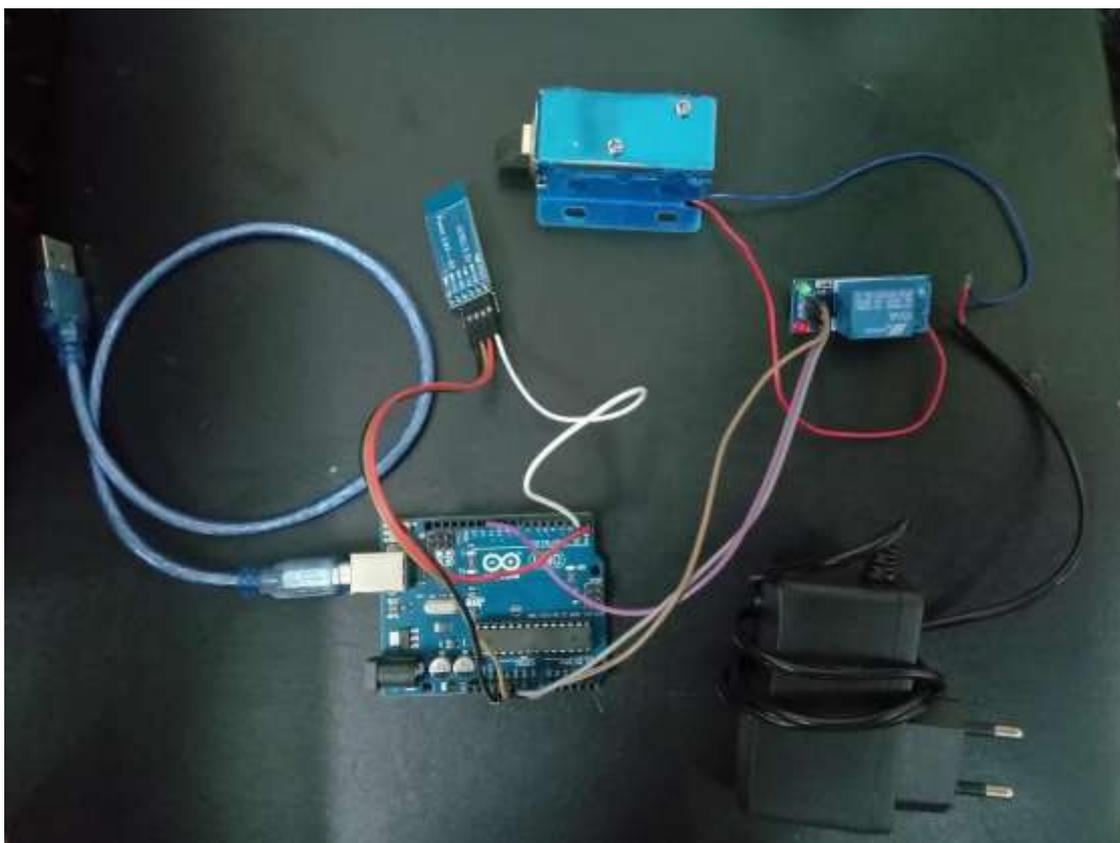## Arduino-Based Automatic Door Lock System Using a Smartphone

Figure 1. Arduino-Based Automatic Door Lock Circuit Using a Smartphone
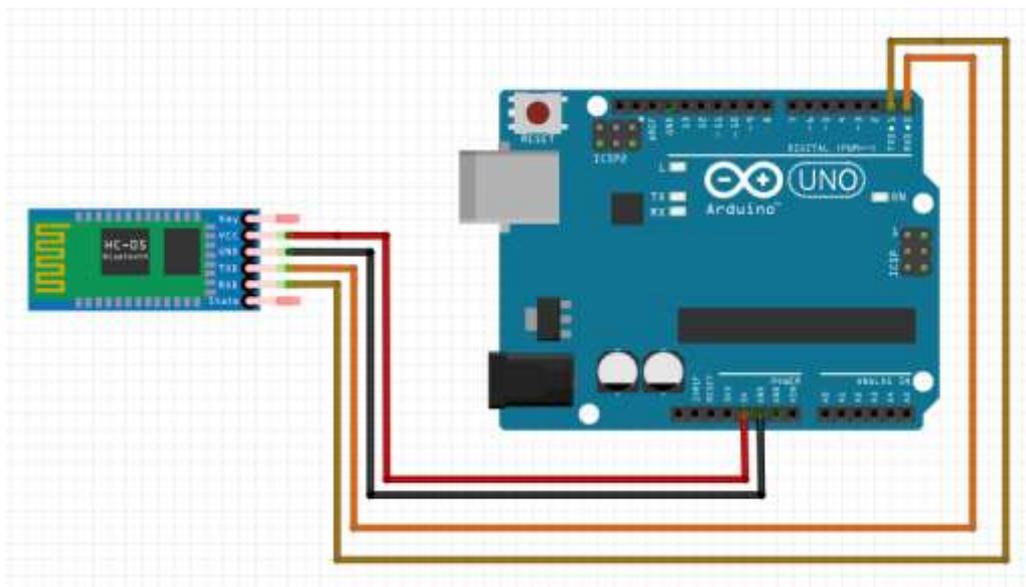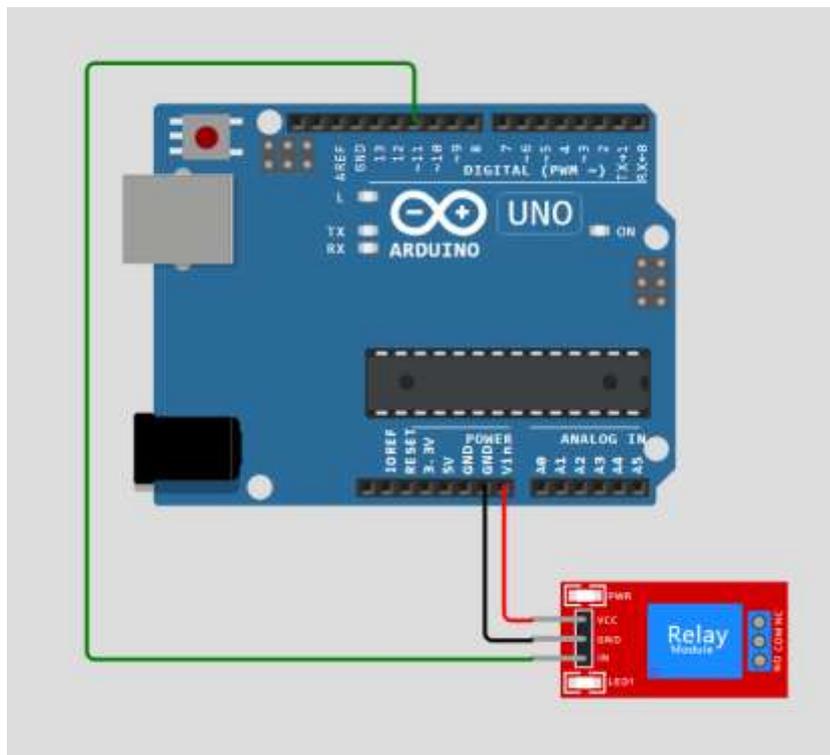
Arduino Circuit with HC-05 Bluetooth Module

Figure 2. Arduino Circuit with HC-05 Bluetooth Module

The Bluetooth module is used to connect smartphones to Arduino wirelessly.

Arduino Circuit with 5 Volt 1 Channel Relay Module

Figure 3. Arduino Circuit with 5 Volt 1 Channel Relay Module

A relay works by breaking and connecting the flow of electricity in a circuit. You could say that a relay functions as an automatic switch.

5 Volt 1 Channel Relay Module Series with 12 Volt Adapter and Solenoid Switch
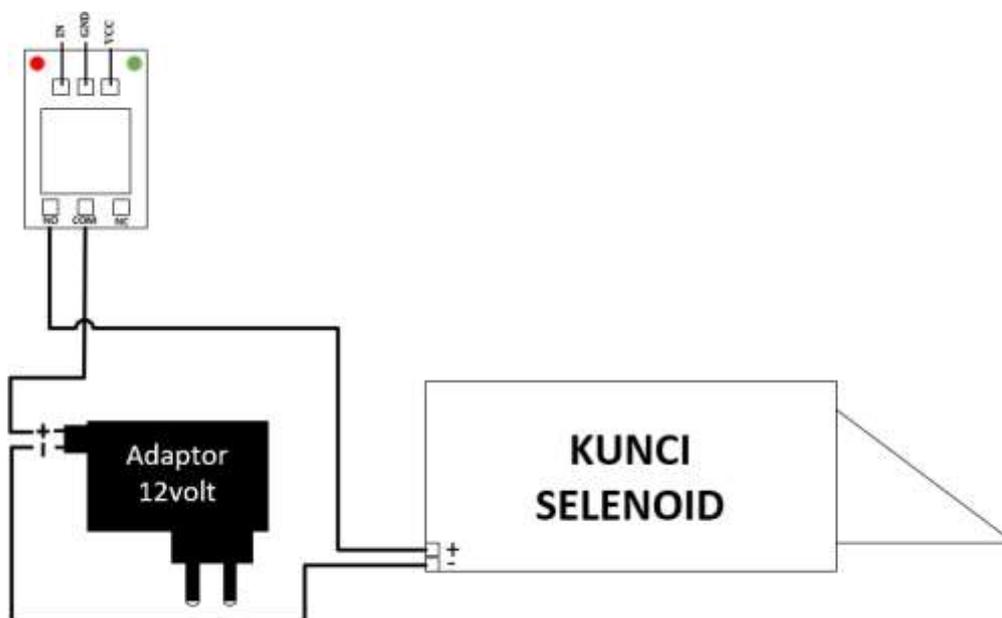
Figure 4. 5 Volt 1 Channel Relay Module Circuit with 12 Volt Adapter and Solenoid Switch

An adapter is a device that converts AC voltage to DC voltage. This means that

alternating current voltage is converted to direct current voltage. Adapters are also often referred to as battery or accumulator replacements. The function of an adapter is to convert high electrical current to low voltage.

A solenoid lock is an electronic device that works on the principle of electromagnetism. Solenoid locks generally use a working voltage of 12 volts. Under normal conditions, this device is in a closed state (locking the door), but when a voltage of 12 volts is applied, the lock will open.

Listing Program

```
1   String voice;
2   int
3   relay1 = 11  //relay1 berada di pin digital 11 pada arduino
4   ;
5
6   void setup() {
7   Serial.begin(9600);
8   pinMode(relay1, OUTPUT);    //relay1 sebagai pin output atau keluaran
9
10  digitalWrite(relay1, HIGH);  //relay1 menyala
11  }
12
13  void loop() {
14  while (Serial.available()){
15  delay(10);
16  char c = Serial.read();
17  if (c == '#') {break;}
18  voice += c;
19  }
20  if (voice.length() > 0) {
21
22  if(voice == "buka kunci") {digitalWrite(relay1, LOW);}  //kata kunci untuk membuka kunci
23  else if(voice == "kunci pintu") {digitalWrite(relay1, HIGH);}  //kata kunci untuk menutup kunci
24
25  voice="";}}
```

Figure 5. Overall Program

CONCLUSION

The conclusions that can be drawn from the Design of an Arduino-Based Automatic Door Lock Using a Smartphone are as follows: This automatic door lock can be created and operated using an Arduino Uno as the main control of the circuit, programmed with the Arduino IDE software, and using the Arduino Bluetooth Controller application as a controller to open and close the door lock by first connecting it to the HC-05 Bluetooth module. After testing, the door lock can open and close at a maximum distance of 7 meters without wall obstructions. If obstructed by a wall, the HC-05 Bluetooth module can connect at a maximum distance of 4 meters. The suggestions that can be taken from the Design of an Arduino-Based Automatic Door Lock Using a Smartphone are as follows: If it is to be applied to a larger door, a larger solenoid lock is required. This Arduino-Based Automatic Door Lock design has not yet fully become an optimal system, as there are still many shortcomings that need to be corrected and further developed, both in terms of system workflow and design. In creating the system, attention should be paid to the layout of components and wiring to ensure neatness. To achieve a

satisfactory design outcome, it is recommended to choose components that are accurate in type and value, as well as of good quality.

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