Automatic Door Lock Using Microcontroller

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Abstract. Home security is one of the common worries for anyone to have. Certainly, it is necessary to ensure the security of house from whether a thief or other crimes. One of the ways to ensure the security of house is by locking the door with a key. On one hand, key is one of the oldest forms of security, there are already various shapes and kinds of keys. On the other hand, key is not the most practical usage of security, either the person brings the key together with them or leave it somewhere else only they can know. This can be a problem if somehow, they lost the key or if the key got stolen. This can be solved with a help of technology like automation. This article is about designing an automatic door lock with a microcontroller called ESP32. This door lock can help locking the house door automatically by a simple click on your smartphone. It works by controlling the movement of the key when you want to whether locking or open the door by using a servo motor that are also controlled with a microcontroller thru a smartphone. The automatic door lock can be used as solution for home security and is more practical because you no longer need to carry a key.

INTRODUCTION

In conventional doors, the security mechanism used is a lever lock. In this mechanism, a key is needed which is used to open and lock the door manually. This is not practical if you always have to carry the key with you when you go. It will be even more worrying if the key is lost [1].

Technology that is developing rapidly is now giving rise to many new security systems, especially door security systems. This door security system can be a personal identification number (PIN), radio frequency identification (RFID), biometric sensors, and so on. For RFID, there are still weaknesses in the security system, which is similar to conventional locks, namely it requires a tag or card as a key to the system, so it still has to be carried and can be lost or damaged. For biometric sensors, it can be the most secure security system of the previously mentioned systems because it uses physiological characteristics, such as fingerprints, face, palms, irises or someone's voice as the key to the security system, however, the price of these sensors can be very expensive. For the PIN, it is necessary to remember the PIN that is installed, however, the elderly or the elderly will have difficulty remembering the PIN [2].

The above systems require the owner of the system key to open the door if a visitor comes and does not have or know the key of the system. If a family comes when no one is home then, they cannot open the door. Therefore, in order not to hesitate and want to buy a lost key, and to be able to open the door from anywhere you can get it to design a tool that is able to open and lock the door via a smartphone device.

RELATED WORKS

Ade Septryanti, and Fitriyanti in 2017 designed and build an Arduino Microcontroller-Based Automatic Door Lock Application Using an Android Smartphone [3]. Their design is focused on designing software on Arduino and Android using the Arduino IDE program, while for hardware there is an Arduino microcontroller as a processing module, then a solenoid as a door lock with a security system in the form of a QR Code. The way the whole circuit works, Arduino first reads the condition of the relay whether it is in LOW or HIGH conditions. If the relay is LOW, the solenoid will be closed. To open the solenoid, it requires scanning the QR Code on a smartphone which is then sent to Arduino via bluetooth so that Arduino can change the relay condition to HIGH which causes the solenoid to open.

Givy Devira Ramady and Rendi Juliana in 2019 designed an Automatic Lock System Using RFID Card Based on Arduino Uno R3 Microcontroller [4]. The design of the door lock system uses an RFID card instead of a key like in hotels and the processing module uses an Arduino, the lever lock is controlled by a servo motor as the door lock actuator. How the whole tool works, the RFID card is attached to the RFID sensor then the sensor will send a signal to the Arduino to rotate the servo motor so that the door opens.

Gifari Alim Prakasa and Aris Rakhmadi in 2017 designed a QR Code and Arduino Based Door Lock System Prototype [5]. The system is designed to reduce the cost of making an automatic security system so that a QR

code is used as a key and Arduino as a solenoid controller. The hardware used in the design includes Android as a QR code reader, bluetooth as a liaison between Android and Arduino, Relay and Solenoid as a system lock and LED as a door status display. The way the above system works, Android will first read the QR code. If it reads correctly, Android will send an authentication code to Arduino via bluetooth then turn on the LED and activate the relay to open the solenoid so that the door opens.

AUTOMATIC DOOR LOCK

Concept Description

This automatic door lock tool designed is a door lock system that is controlled using a smartphone via an application. The lock system will turn the key that has been installed in the keyhole so that the door can lock or vice versa.

The door lock system consists of a drive module, a processing module that has been integrated with bluetooth and WiFi modules as well as an application on a smartphone. On smartphones, the application used is the Blynk application which can be used to communicate with the processing module via a bluetooth or WiFi network. Bluetooth and WiFi modules are used so that communication between the smartphone and the processing module can be carried out over long distances or even without internet. For the processing module, the module will receive a signal from the smartphone and then use that signal to activate the drive module. The drive module which consists of a servo motor is attached to the key and then it will rotate clockwise or counterclockwise depending on the input signal sent by the smartphone. The block diagram of the automatic door lock can be seen in Figure 1.
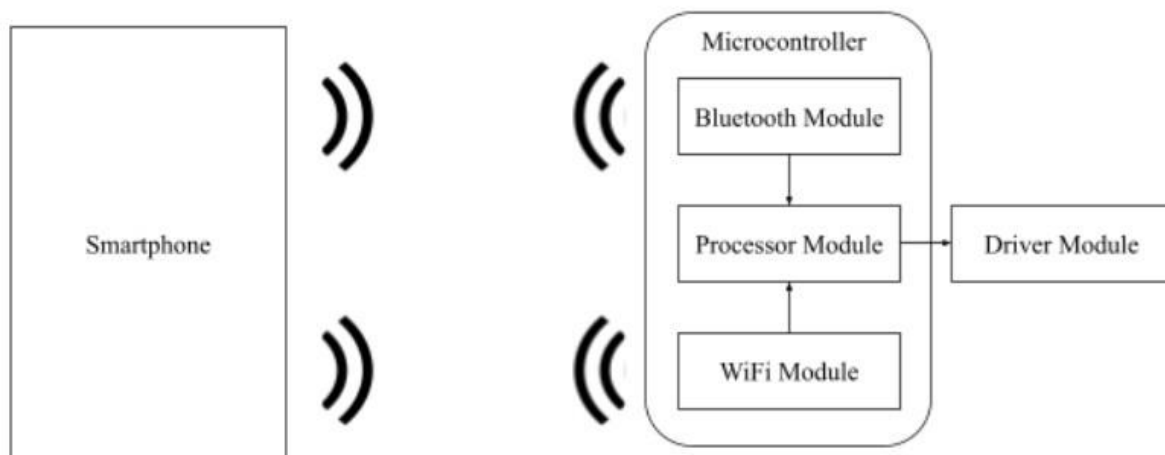

FIGURE 1. Block Diagram of The Automatic Door Lock

Microcontroller Module

Microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip. They have been developed for decades but the main paradigm hasn't changed all that time until the first decade of 21st century. The ubiquity of the internet has resulted in the appearance of services that offer to send, collecting and analyzing data from microcontrollers on the cloud services. In most cases connection between microcontroller and the Internet has been made through WiFi [6]. Microcontroller module used for this automatic door lock is ESP32. This microcontroller has integrated WiFi and Bluetooth. Features contained in the microcontroller can be seen in Figure 2.
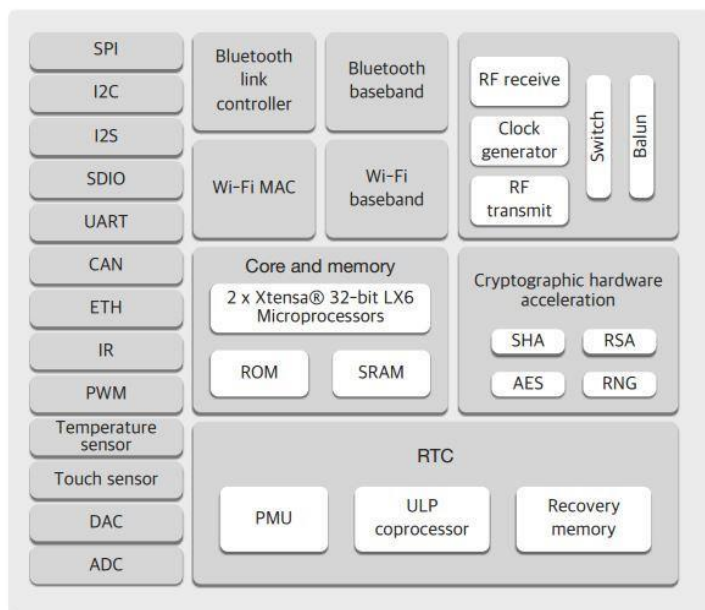
FIGURE 2. Features in Microcontroller

Driver Module

Driver Module is a module consists of a servo motor. Servo Motor is a device or rotary actuator (motor) designed with a closed loop feedback control system (servo), so that it can be set-up or adjusted to determine and ensure the angular position of the motor output shaft. The use of a closed loop control system on a servo motor is useful for controlling the movement and final position of the servo motor shaft. Simply put, the output shaft position will be censored to determine whether the shaft position is as desired or not, and if not, the input control will send a control signal to make the shaft position at the desired position.

The servo motor is composed of a DC motor, gearbox, variable resistor (VR) or potentiometer and a control circuit. The potentiometer serves to determine the maximum limit of the servo motor axis rotation. While the angle of the servo motor axis is set based on the pulse width on the servo motor control pin [7]. By varying the pulse width on the control pin, the motor can work in both directions (CW and CCW) and the angle of rotation of the rotor can be controlled. The diagram of servo motor can be seen in Figure 3.
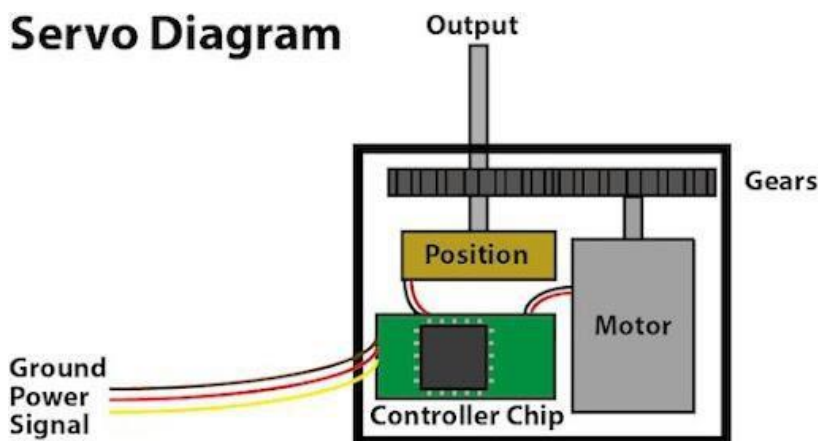

FIGURE 3. Servo Motor Diagram

CONCLUSION

The automatic door lock using microcontroller can be used as solution for home security. The design of this automatic door lock can open and lock conventional doors that are controlled via a smartphone device so don't need to carry a key and minimize the risk of losing the key. Then to make it easier to enter if there are family who come when no one is at home.

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