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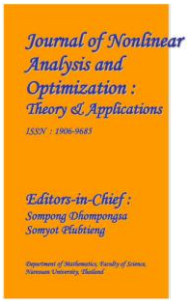

CELL PHONE CONTROLLED FINGERPRINT SOLENOID DOOR LOCK USING ARDUINO AND HC-05

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ABSTRACT
Now the whole world is in the grasp of COVID 19 and everyone is taking precautions wherever they can to prevent themselves from contracting this serious disease by following social distancing, wearing masks, using cashless transactions, and avoids touching anything to prevent the spread of germs. With the advent of technology, the normal locks are becoming things of the past and new biometric-based locks and RFID based locks are becoming more and more mainstream. Fingerprint-based locks and attendance record-keeping devices are used in most of the offices and colleges too but nowadays it is not advisable to do so due to this pandemic and so we are going to build a door lock by using a solenoid lock and control it using an android app over Bluetooth so that we don't have to touch the fingerprint sensor at all and just use your own phones to control the lock.
In this project, we are going to build a biometric lock using Arduino nano with Bluetooth Module. Solenoid lock, and Android phone. Apart from hardware, a mobile application is also used to scan and verify the fingerprint and send the confirmation ID to Arduino through Bluetooth.
Here we will use Smart Phone Finger Print Sensor to lock and Unlock the Door lock. We know that, the entire globe is infected with Covid 19, and everyone is doing everything they can do avoid contracting this serious sickness by adhering to social segregation, wearing coverings, using credit-only exchanges, and refraining from contacting anything to prevent the spread of germs. With the advancement of technology, traditional locks are becoming relics of the past, while new biometric based locks and Radio Frequency Identification (RFID) – based locks are becoming increasingly in common.

I. INTRODUCTION

1.1 Introduction

The unique finger impression-based locks, as well as participation record – keeping Devices, are used in the vast majority of offices and universities. However Due to the pandemic, it is no longer appropriate to do so. As a result, the proposed system uses a solenoid lock to make the door lock.
Aside from equipment, a mobile application is used to inspect and double check the finger impression and send the confirmation as well as I'd. To Arduino through Bluetooth. The entryway lock will be bolted and opened using smartphone fingerprint sensor.
Now the whole world is in the grasp of COVID 19 and everyone is taking precautions wherever they can to prevent themselves from contracting this serious disease by following social distancing, wearing masks, using cashless transactions, and avoids touching anything to prevent the spread of germs.
With the advent of technology, the normal locks are becoming things of the past and new biometric-based locks and RFID based locks are becoming more and more mainstream. Fingerprint-based locks and attendance record-keeping devices are used in most of the offices and colleges too but nowadays it is not advisable to do so due to this pandemic and so we are going to build a door lock by using a solenoid lock and control it using an android app over Bluetooth so that we don't have to touch the fingerprint sensor at all and just use your own phones to control the lock. So, let's get started.

In this project, we are going to build a biometric lock using Arduino nano with Bluetooth Module. Solenoid lock, and Android phone. Apart from hardware, a mobile application is also used to scan and verify the fingerprint and send the confirmation ID to Arduino through Bluetooth

1.2 Block Diagram:

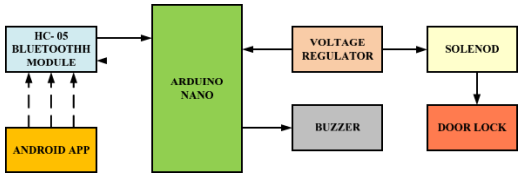

Figure 1. Block Diagram

Block diagram consists of HC-05 Bluetooth module to the nano by powering the device with a 5V power supply and connect the TX pin to RX pin of your microcontroller and RX pin to the TX pin of the microcontroller. You need to add a red LED to display the power status of the Arduino nano and a green LED to show if the door is unlocked. You also need to connect a buzzer. The connection diagram is also shown below for easy understanding. To control the solenoid lock, you need to use a control circuit that comprises an NPN Transistor and N channel MOSFET.

We will control the NPN transistor by connecting the D9 pin of the Nano to the base pin of the transistor via a 550 Ohm resistor to control the current flowing into the Transistor. When the D9 pin is pulled high, the transistor is turned on and the gate pin of the MOSFET is pulled to the ground, turning the MOSFET OFF that turn off the solenoid lock and when the D9 pin is LOW, the NPN transistor is off which means that the GATE of the MOSFET is pulled to 12V via a 2kOhm pull up resistor to turn on the MOSFET and power the solenoid lock. In this way, you can control the Solenoid lock using your 5V Arduino Nano. You cannot directly control the IRF540N MOSFET with 5V pins from the Nano as it is not a logic-level MOSFET so it won't fully turn on or off with 5V from the nano, hence we will use the BC547 NPN transistor to control the MOSFET.

II. HARDWARE DESCRIPTION

2.1Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328. It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

The Arduino Nano as the name suggests is a compact, complete and bread-board friendly microcontroller board. The Nano board weighs around 7 grams with dimensions of 4.5cms to 1.8cms (L to B). This article discusses about the technical specs most importantly the pinout and functions of each and every pin in the Arduino Nano board.

Arduino Nano has similar functionalities as Arduino Duemilanove but with a different package. The Nano is inbuilt with the ATmega328P microcontroller, same as the Arduino UNO. The main difference between them is that the UNO board is presented in PDIP (Plastic Dual-In-line Package) form with 30 pins and Nano is available in TQFP (plastic quad flat pack) with 32 pins. The extra 2 pins of Arduino Nano serve for the ADC functionalities, while UNO has 6 ADC ports but Nano has 8 ADC ports. The Nano board doesn't have a DC power jack as other Arduino boards, but instead has a mini-USB port. This port is used for both programming and serial monitoring. The fascinating feature in Nano is that it will choose the strongest power source with its potential difference, and the power source.

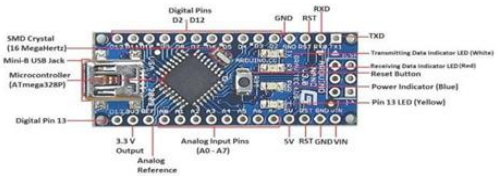

Figure 2.Arduino Pin Reference

III. HC-05 BLUETOOTH MODULE

The HC-05 is a popular module which can add two-way (full-duplex) wireless functionality to your projects. You can use this module to communicate between two micro- controllers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. There are many android applications that are already available

which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any micro-controller that supports USART. We can also configure the default values of the module by using the command mode. So if you looking for a Wireless module that could transfer data from your computer or mobile phone to micro- controller or vice versa then this module might be the right choice for you. However do not expect this module to transfer multimedia like photos or songs; you might have to look into the CSR8645 module for that.

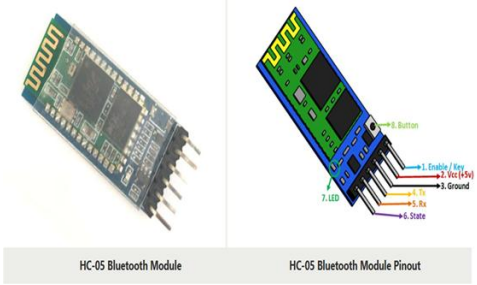

Figure 3. HC 05 Bluetooth Module

SOLENOID LOCK

The solenoid lock is also known as the Electric strike lock. It can be used to lock or unlock doors, cabinets, and drawer.

Inside the solenoid valve:

1. There is a coil of insulated copper wire which is wound in the shape of a hollow cylinder.
2. There is an armature inside the coil which moves freely.
3. When we pass the electric current to the coil it generates a magnetic field near it.
4. The movement of the armature depends on the magnetic field generated by the insulated copper coil.

Figure 4: Solenoid Lock

3.1 Buzzer

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

Figure .5: Buzzer

There are two types of buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp sound, the other
type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customized with help of other circuits to fit easily in our application.
This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated
+5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.

3.2 LED

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction. When the diode is forward biased, the minority electrons are sent from p → n while the minority holes are sent from n
→ p. At the junction boundary, the concentration of minority carriers increases.

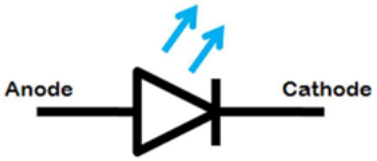

Figure 6.Symbol of LED

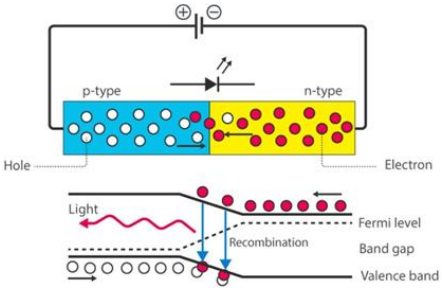

Figure.7: Working of LED

RELAY

A Relay is a device that opens or closes an auxiliary circuit under some pre-determined condition in the Main circuit. The object of a Relay is generally to act as a sort of electric magnifier, that is to say, it enables a comparatively week current to bring in to operation on a much stronger current. It also provides complete electrical isolation between the controlling circuit and the controlled circuit.

IV. CIRCUIT CONNECTIONS AND RESULT

4.1 Circuit Diagram:

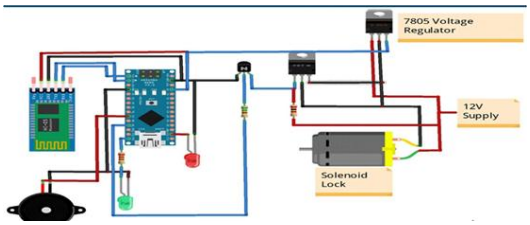

Figure .8: Hardware Circuit Diagram

The above circuit diagram shows how to interface and control a solenoid lock with an Arduino through a MOSFET. As shown in the above circuit diagram we need to connect the HC-05 Bluetooth module to the nano by powering the device with a 5V power supply and connect the TX pin to RX pin of your microcontroller and RX pin to the TX pin of the microcontroller.

We need to add a red LED to display the power status of the Arduino nano and a green LED to show if the door is unlocked. We should also need to connect a buzzer. If we give wrong fingerprint then the buzzer will On and make sound.

The prototype of the Cell-phone controlled solenoid door lock using Arduino and HC-05 is shown below:

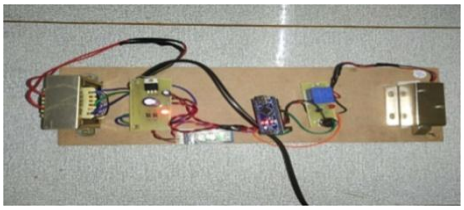

Figure 9.Working Module

4.2 Advantages

1. High security and assurance
2. Flexible system is customized and Flexible
3. Easy to use
4. Non transferable
5. Accountability

4.3 Disadvantages

1. Different biometric technologies need the use of different devices that have a range of cost.
2. Entry and delete fingerprints need to operate multiple steps, the program is too much trouble, convenience is not enough.
3. Performance can be fluctuated to dry, wet, dirty fingers.

4.4 Applications

1. Used in Biometric door locks
2. Theft protection
3. Safe lockers
4. Fingerprint security system in car
5. Office security

V. CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

The project work is successfully designed tested and a demo unit is fabricated. Since it is a demonstration unit, facility is provided only for single relay, but for real application hundreds of relays may be used depending upon the area of the field.

In this project work the required power supply for the entire circuitry is derived from the main source, since the circuitry to be installed at fields, and availability of conventional energy at fields may be difficult, therefore this

supply can be generated using solar energy. For this purpose suitable solar panel can be utilized for charging the battery and the stored energy from the battery can be utilized to generate required power supply for the circuitry.

10.2 Future Scope

1. Advancements in biometric identification management technology are moving so fast, In future we will make advancement and multi functions like SMS alert if authorized person try to lock the door.
2. Image recognizing process system and password system based.
3. Eye's retina for password which helps authorized persons for authentication for entrance so biometric technology makes individual convenient in real life

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