# Advanced Smart Lock System for Multi User Environment Using Nvidia Jetson Nano

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### ABSTRACT

In today's world, security has become a major concern for anyone's home or office. An important aspect of this is fingerprint identification. Every human has its own unique fingerprint which can play major role in making home security or office security better. So, in this paper we propose an upgrade for the normal lock to an android based biometric lock. The proposed system uses the concept of advanced android programming to implement this system. The technologies used in this system are low power and present in almost all gadgets

**Keywords**
Android app,door lock

## Introduction

Unauthorised access is a severe threat for office or home. It is difficult for us to completely secure our assets manually. Several methods are used for providing security to house or office but some require manual access which can be accessed and some password protection system can be cracked. In this situation fingerprint system can be utilised as a more reliable form of security. A lock is a necessity for any door. The classic lock that is still being used, it has many flaws, these flaws are easy to abuse and hence anyone can break these locks without much effort. These locks are susceptible to lock pickers, key duplication, etc. To overcome these flaws, we devised a system that will ask for the user's biometrics on the user's mobile device and thus add a layer of security that is immensely difficult to overcome for any attacker.

There have been tries to make this kind of system possible but the authentication device was always fit on the door itself which made it easy to break and overcome. Some of these devices li [2] use passwords and pin-codes as an authentication policy, some locks used face recognition technology while others used other biometrics like finger print. But these were all fitted on the door. Our system has the entire authentication present on the user's mobile device thus making for a much more secure and reliable locking mechanism.

**System Architecture:**
The proposed system is composed of-
1) The Lock(including kit)
2) The Mobile Application

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**1) The Lock**

This lock will be present on the door. The components used in this Lock are

    i)        Nvidia Jetson Nano
    ii)      Bluetooth adapter
    iii)     A base lock
    iv)    Micro-servo Motor
    v)     PCA9685 Interface
    vi)    Jumper Wires

i) **NVIDIA Jetson Nano:** The NVIDIA Jetson Nano is responsible for keeping the code and controlling the movements of the lock. It is a cheaper alternative to raspberry pi, and it can easily do all the work required without any issues. NVIDIA Jetson Nano plays a vital role in  developing several  new small, low-power AI systems. It opens new worlds of embedded IoT applications, including entry-level Network Video Recorders (NVRs), home robots, and intelligent gateways with full analytics capabilities. NVIDIA® Jetson Nano™ Developer Kit is a powerful,small computer that allow the user to run multiple neural networks simultaneously for applications like object detection, segmentation, and speech processing, image classification.

It can be used by inserting a microSD card with the system image, boot the developer kit, and begin using the same NVIDIA JetPack SDK is implemented in the entire NVIDIA Jetson™ family of products. JetPack is suitable with NVIDIA's  AI platform for implementing and deploying AI software, reducing difficulties and effort for developers
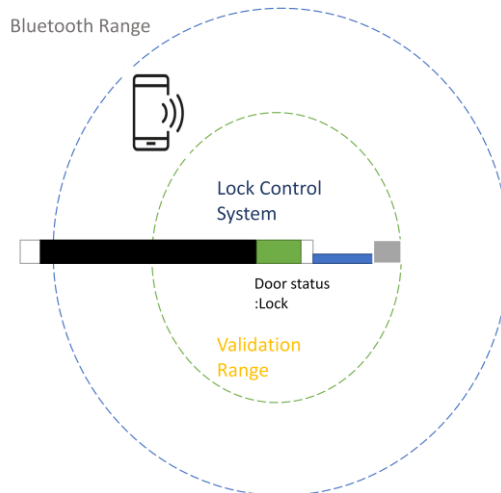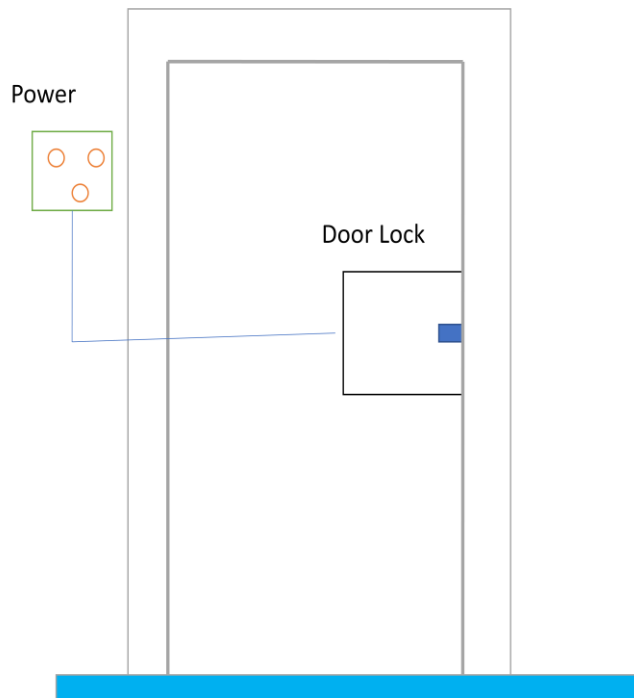


**Fig1. Working model of Door lock**

**Fig2. Schematic diagram of door lock**

ii) **Bluetooth Adapter:** The Bluetooth Adapter is needed to establish a connection between the lock and the Mobile Gadget. It also ensures that the user must be close to the Lock which then also acts as a protective barrier.

iii) **Base Lock:** The whole system will be built upon an already existing classical style lock so that it still has the element of familiarity with it. So, it will be easier for the user to adapt to this new locking system.

iv) **Micro-servo Motor:** A servomotor act as a actuator  or linear actuator that permits for precise control of linear actuator or angular , velocity and acceleration. It consists of an appropriate motor joint to a sensor for position feedback. It needs a  sophisticated controller, relatively a dedicated module  specifically designed for use with servomotors.

v) **PCA9685 Interface:** The PCA9685 consist of  16-channel I2C-bus controlled LED controller which is optimized for Red/Green/Blue/Amber (RGBA) color backlighting applications. Every LED output has individual 12-bit resolution (4096 steps) PWM controller with a permanent frequency. The controller works at a programmable frequency from a typical 24 Hz to 1526 Hz with a cycle that is adjustable from 0% to 100% so the LED can be  set to give output a particular brightness.

vi) **Jumper Wire:** A jump wire (also called as jumper wire, or jumper) is a group of wire cable having a connector or pin at every end , which is normally used to interconnect the components of other prototype or test circuit, internally or with different equipment or components, without soldering. Separate jump wires are attached  by inserting their "end connectors" into the slots given in a board, or a part of test equipment.

### 2) The Mobile Application

This mobile application will be provided to the user with a unique hash value assigned to it so as to ensure that only the intended user can operate a given lock. This application will not be UI heavy but some quality of life changes may be made if the users require any extra features or there is a need for extra layers of security. This application will communicate with the lock device with the help of Bluetooth. It will take the fingerprint information from the mobile system, thus reducing the hassle of going through the authentication over and over again.

### Password-Security system

Password security system can be uniquely used by not storing user's password but instead it stores the [3] derivative of the password. Even if unauthorized user has access to system using password then the bitmapped image cannot be modified.

### Face detector lock

Face detector lock can be implemented by using hierarchical network framework which follows a pre-trained architecture for face recognition. The[4] author has introduced door lock using face recognition using Rasberry pi.This system follows the concept of real time system.

### Speech  recognition

Speech recognition [5] is based on work tested through user's voice. Fixed word is used in the form of speech, here it has google speech text library, also known as speech recognizer.

### Face detection by Image processing

The working of this technique [6, 12] are often compared with the manual face detection as long as we integrate the eye detection System with the developed system. On the other hand the executed applications exhibited an exceptional result and returned exceptionally good on the PCA technique and distorted arrangement.

### Methodology

Initially App id is fetched for user registration then the user register his/her fingerprint on their device. This process is required because only the registered user is allowed to open the door of office or home [10, 11]. Once the registration is completed the system auto assigns ID for verification. The connection is established by enabling Bluetooth of device and user is suppose to put their finger on mobile sensor , if the finger print pattern matches with the valid finger print then the door lock gets opened as the kit receives the input. On the other hand if the user puts wrong finger on the sensor or any unwanted user tries to access it then the system won't respond.

According to the work mentioned in paper [1], it can be concluded that certain improvement can be made in modern locking system instead of a traditional one and its implementation is practically feasible [7, 8]. Some of the benefits of implementing such a lock would be
1)  Increased security.

2) Use of Biometrics and IOT to make the home smarter.
3) Similar in cost and size to that of a classical lock but much more secure.
4) Can be easily used with the help of a mobile device that everyone carries around with themselves.
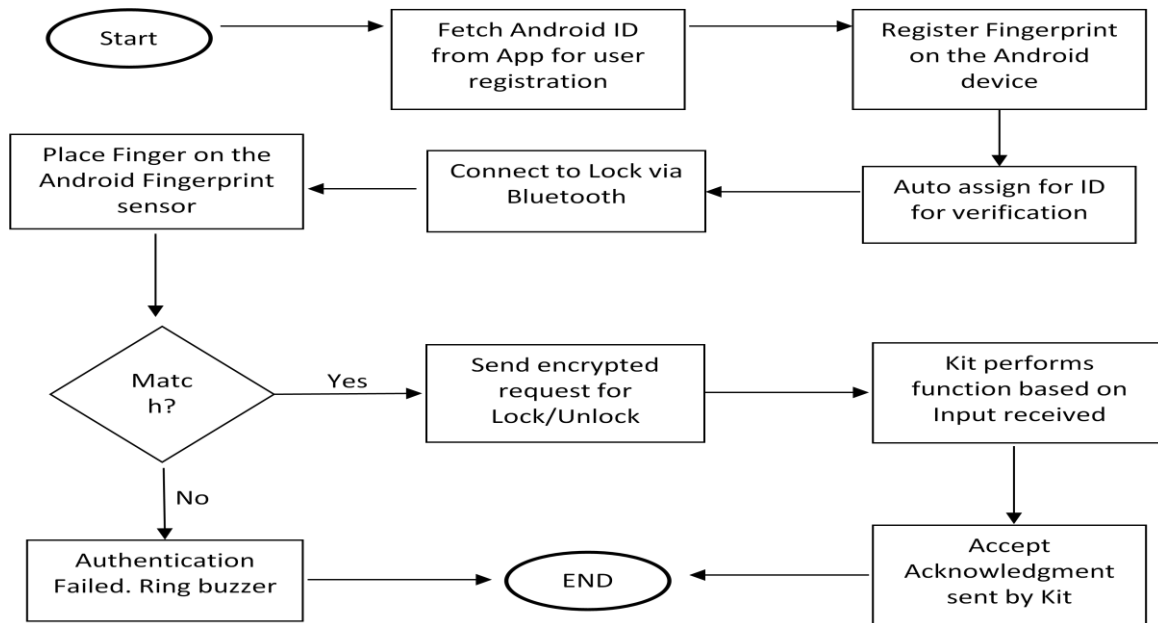5) Easier to use.



**Fig 3. Door Lock Algorithm**

1. Initially users android ID is extracted through App.

2. Users fingerprint is registered on the device(Android Device).

3. The required ID is auto-assigned.

4. For connection Bluetooth of both devices needs to be connected.

5. The user put his/his finger on the device.
    Sensor.

6. If the finger print pattern matches then request is sent to unlock.

7. Otherwise authentication Fails.

8. After successful authentication the prototype system will perform function to open the lock.

**Fig 4.Flow chart**

**Fig 5. Door  lock kit**



**Fig 6.Connectivity Port**



**Fig 7.Door lock**

**Fig 8.Door lock App**

**Conclusion**

The proposed system is an easy to make and feasible upgrade to the classical locking system. This will allow for a much more sophisticated way for the future locks to be implemented. It increases the overall security of the home and allows for a much safer environment in  this world of ever increasing crimes. The system is hard to break into and the security measures ensure that the attacker will have huge obstacles if she/he wants to break into any house protected by this system. This work has immensely vivid directions it can advance in. Some of them are-

1) We can have the lock pre-fitted in the door, that is, the lock can be put in when the door is being manufactured.
2) We can add multiple layers of biometric and other security layers to increase the protection level.
3) Add a camera so as record any suspicious activity.

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