Wi-Fi Smart Lock

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In the name of ALLAH, the Most Benevolent, the most Courteous

Abstract

A Smartphone has variety of uses and becomes one of the most important devices nowadays. This proposal presents the prototype implementation of door locking system using smart phone through Wireless Fidelity (Wi-Fi) technology. Programmed using Android, the smart phone can lock and unlock the door using Wi-Fi. Since less awareness concerns on door locking system, the device proposed in this project will help to solve the problem. The user does not have to worry whether the door is locked or not, because users can control it by using their Smartphone through an app. The project will be consisting of hardware and software development. Currently, a lot of work is being done in the Home Automation Domain.

CERTIFICATE

It is hereby certified that the contents and the form of the project entitled **Wi-Fi SMART LOCK** submitted by the syndicate of

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has been observed satisfactory as per the demand of the B.E. Degree in Electrical (Telecom) Engineering from Military College of Signals (MCS), National University of Science and Technology (NUST).

Approved by

Asst. Prof. Dr. Mir Yasir Umair

EE DEPARTMENT
MCS

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DECLARATION

No percentage of the work presented in this proposal has been proffered in assist of another award or qualification either at this university or elsewhere.

DEDICATION

Allah the Omnipotent,

Faculty, Supervisor for their help,

And our parents for their blessings and support

ACKNOWLEDGEMENTS

There is no success without the will of ALLAH Almighty. We thank our FYP Syndicate Supervisor Asst. Prof Dr Mir Yasir Umair from the depth of our hearts. He has been extremely supportive to us from the very beginning. He has provided his technical expertise experience on even the most minor problems regarding our project. He has been a great guide to take us through the whole process of FYP comprehensively. None of this would've been possible without he support and encouragement of our parents. They have supported us in every possible way and owe our success to their untiring efforts and countless prayers. May Allah bless all of them.

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Chapter 1: Introduction

The Concept of locks and keys is not new. We are using it since last century however, the shape and working of locks and keys have evolved many times. As we know that today world is a global village and this is because of internet and other communication facilities that were not present if we go 100 years back. Every device in this world is now becoming smart whether it is a fridge or a air conditioner. In this project we will apply new concepts to door locks to make then smart and innovative.

The number of smart phone users is rapidly increasing worldwide day by day and large number of various and convenient applications are being developed to make life easier. It was a time when phones were used only to send messages or to make phone calls but now every gadget has become smart. Smart phones now can do a lot more and they are also being used to control other devices.

[1]Control of the lock for a door remains unsatisfactory for many people. If we examine world today we can notice that now almost everyone has a smart phone. Here by smart phone we meant a phone that is operated by android operating system. Today there are millions of android applications that are available in play store and many of them can be downloaded from other platforms. Everyday a new android application is being launched making the world of applications more diverse. Today smart phones can do a lot more than making calls and sending

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[1] Hussain F. Alsaif, Mohammed A. Almaghrabi and Douglas E. Dow Program in Electromechanical Engineering, College of Engineering Wentworth Institute of Technology

messages. We in this project will introduce a very simple but useful application to control the operation of locking and unlocking of doors.

The android application will provide live steaming from the door which will help user to identify the person standing behind the door. Because of this application, user also not needs to worry about losing his door keys. The android application will save his data using his Facebook profile and user can login himself from any device he wants.

1.1 Problem Statement

Apart from losing the door keys, most people also sometimes forget to lock their home main gate's lock in a hurry. There is also a less security on conventional door locks. Stealer can simply break the door. These door locks have fewer options and additionally in previous technologies they has restricted tech and options.

1.2 Proposed Solution

As described earlier that we converting these conventional lock system to Smart door locks that work on IOS bases is our main objective. Next we want to develop an android application that works smarting in accordance to current needs of people. The application will also be easy to use and will be used to control the locking and unlocking of doors from everywhere we want. This project aims to form an alternate technique for people who want a more secure and smart way to control the entry and exit of people in their houses. Smart door locks will also eliminates the problem of losing of door keys because concept of door keys will become useless.

1.3 Project Specifications

Following are the specification of Smart Door Lock:

1 Un limited Range
2 Security
3 Ease of Use
4 Live Streaming
5 User friendly android application

1.4 Approach

Following steps describes our approach that will be followed:

1 In depth Research on earlier developments about the very topic
2 Selection of appropriate Controller that is Raspberry Pi
3 Search on Android Application
4 Study on IOT and other hardware components
5 Installing the required libraries
6 Testing of required components
7 Integration of camera with raspberry pi for live streaming

Next step is to develop android application having features like lock, unlock, live streaming. We will develop android application in such a way that it should be easy to use. The last step is implementation of door lock.
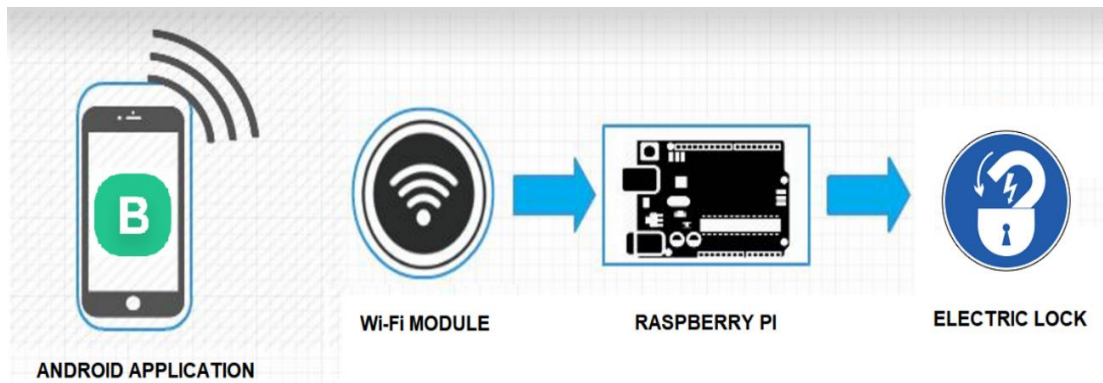
Figure 1: Approach used in smart Door Lock project

1.5 Purpose

To review and value an appropriate set to develop a smart door lock that is meant to supply high security, easy accessibility, and management is the purpose of this project. A key challenge that is faced during this project is the security and privacy of the IOT systems. Therefore, the paper will give an intensive and in depth investigation for the protection and privacy of IoT systems seeking to boost and enhance the lock mechanism by connecting it to the web, creating it a lot more strong, productive and innovative.

1.6 Goals

To make an IoT system that includes the smart door lock Android application is the main objective of this project. Android application should be user friendly and Smart door lock system should be secure and smart at the same time. following are our other objectives regarding smart door lock:

1. To make a cheap door lock and at the same time more secure and smart.

2. To make an android application which will be easy to use and understand. This android application will work as user endpoint.

3. To provide live streaming of person behind the door.

4. To make this project on IOT basis so that user can operate his smart door lock from everywhere in the world.

5. To make solenoid electric lock connected to the Wi-Fi as it is easily available in offices and houses all the day.

6. To make the operation of smart door lock more robust and productive.

1.7 Research Methodology

Our research methodology is split into two major parts. A practical and a theoretical part. The theoretical one was supported a pilot study where we have a tendency to went through the most important security considerations concerning IoT devices further as finding acceptable project scope supporting the goal of the project. the sensible half was to acquaint ourselves with the development tools and environments, for example android and node.js library, that are required to fulfill a fully functional useful system that considers the protection issues mentioned within the theoretical study.

1.8 Delimitation

The model (prototype) being developed in this documentation is meant to offer high security and straightforward access management that is also called easy access control. The development part will specially focus on delivering a model that's well-protected against malicious

attacks than in depth user practicality. This may result in a product that has high security. However, it would require some further development and optimization to fit the aim of easy and user friendly product.

1.9 Project Deliverables

Final Deliverable consists of Hardware/Software Integrated Smart door lock which will be used for security of houses and building.

1.10 Structure of Thesis

Chapter 2 contains the background and analysis study this thesis is predicated upon.

Chapter 3 contains the literature review and dealing progress utilized in the project and thesis.

Chapter 4 introduces the design and development of the project.

Chapter 5 introduces the test environment used throughout the project.

Chapter 6 is about references.

Chapter 2 : Background

A background study was carried out for the previous developments about this this project. There are many products available in the market but none of them fulfill our requirements. Some of them are just more complex will less features and some are expensive.Some of them are just fancy but less secure and some of them are for private use only. Following are some of the projects which were carried out for the same purpose.

2.1 Bluetooth based smart door lock:

This system was developed so as to extend the safety level of crucial spaces. This system used mobile devices to operates the locks. [2]Door lock is connected with mobile phones through Bluetooth device and using this project user can allow only desired personnel to enter the building. It has following important parts:

- Bluetooth based radio communication
- Graphical user interface observation system
- Serial communication
- Embedded system.

In this project, there were used 2 HC-06 Bluetooth-to-UART modules. These modules act as receiver and transmitter. One is connected to user side and other one is connected door lock's embedded system. They are connected in this way to receive information and to send important

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[2]https://www.researchgate.net/publication/292624568_Door-automation_system_using_bluetooth-based_android_for_mobile_phone

data about person using that door lock. This project makes use of Atmega32 microcontroller.

2.2 NFC Based Smart door lock:

In this project, the main requirement is NFC equipped smart phone which is a limitation. Using this product user can manage and send digital keys to desired persons and individuals.

NFC reader is going to be placed outside the door and microcontroller is going to be placed within the building where it cannot be changed or access by somebody outside the door. The microcontroller was connected to server through local area network capable switch. This network affiliation provides power to the microcontroller, NFC reader and electrical strike plate. The system was managed through the web site where the administrator of the smart NFC lock will manage the lock and produce electronic keys.

2.3 Wi-Fi Based Smart door lock:

The locking and unlocking system of door activates automatically in this system or project. Using Wi-Fi technology transmission of data will be done. Signal can be located through Wi-Fi anywhere. In this project users need not to worry about their doors whether they are locked or not because unlocked door will be detected by the sensors and imitated to users through their smart phones. Also user needs not to worry regarding losing of their door key.

Wi-Fi is provided in several smart phones. This has permits every device to exchange data or information with the web wirelessly. With the passage of time, Internet is playing a vital and crucial role in

everyday life. Many devices can be connected to the internet such as Smartphone's technology develops, Smartphone is becoming one of the devices that can help us to monitor things in every aspects. This project can contribute safer and advance technology compatible to the newest invention and technology.

2.4 Android based Smart door Lock

The working of system depends on password which is pre-defined by the user in this project. It provides security by letting only authorized persons to enter in the building and it also prevents unwanted unlocking which is done by an attacker. Sometimes it happens when a user forgets the password or other credentials but this system provides a facility or flexibility to the user to reset or change the password. So this project gives a more better and secure way of locking and unlocking of door of any building.

2.5 DIP Based smart door lock system:

This project is also to secure crucial spaces. The working of this project is based on digital image processing. This project uses the GSM technology and face recognition system. In this project one time password will be generated by GSM.

A database of photos of people is maintained with different angles using the camera which is mounted on the door. The door open automatically when there is a match and remained closed on mismatch. This project also includes alarm for forgetting to lock the door. The alarm also starts to ring when there is 3 wrong tries. One basic drawback in this project is that anyone with a similar face will also able to unlock the door because the face recognition system used in this project is not very

efficient. The door can also be unlocked by showing picture of desired person to camera.

Chapter 3 : Literature Review

This chapter describes the result of literature study. It also contains the background motivating the thesis.

3.1 Internet Of Things

Today, internet has become the most important part of people's lives and plays an integral part in the daily activities of people. Different smart phones with different amazing facilities are available in market. The use of internet in accordance with smart phone is increasing day by day. Thus the main objective is to connect everything owned by human being with internet to monitor and control it through smart phone. IOT helps to perform actions through internet and sending and receive data via internet. In IOT things are connected in such a way so that there is no need of human intervention for automatic identification of required activities. IOT also helps to share information from sensors via wireless network, to achieve the exchange of information in open computing network and thus achieving transparent management of system. Today things that are generally use in our daily life are becoming more smart by using current technologies but this is not enough until we get them connected to the variable environment conditions and by making their own common network, which is, machine-machine communication. In dynamically changing city areas, maintenance of public transport system, smart provision of electric energy, gas and water distribution systems and waste management system are some of the challenging activities to be taken care of. We believe that these complex systems can become better with IOT technology.

3.2 Blynk

Blynk is an android app that is used to control different controllers like Arduino and raspberry pi through Internet. It has a dashboard where we can build a GUI(Graphic User Interface) for our project by simply dragging and dropping widgets. It is very easy to set up everything on it and make it in working condition in very less time. Blynk is not specified for one fixed type of controller but it can support multiple controllers depending on your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi or through Ethernet, Blynk will get you online so that you can use IOT to run your project.

Figure 2: Blynk Application[3]

3.2.1 Blynk app overview

The Blynk application was developed for IOT. It can be used to remotely control the hardware. Its other features include sensor data display, data storage and visualization. Following are the three major components of this application.

3.2.2 Blynk App

By using the built in widgets of the application we can create interfaces for the projects.

3.2.3 Blynk Server

Communication between the integrated hardware and the application is done by Blynk server, by using cloud service of Blynk or by using one's personal Blynk server. Its code is open source and is capable of controlling hundreds of thousands of hardware devices.

3.2.4 Blynk Libraries

Blynk libraries are used to control communication between the hardware devices and server. It processes all the outgoing and incoming commands.

Whenever one press some button in the application, it works by sending the message to the Blynk cloud and then its algorithms enables it to connect to the hardware and vice versa. All the processes happens in just a blink of an eye.
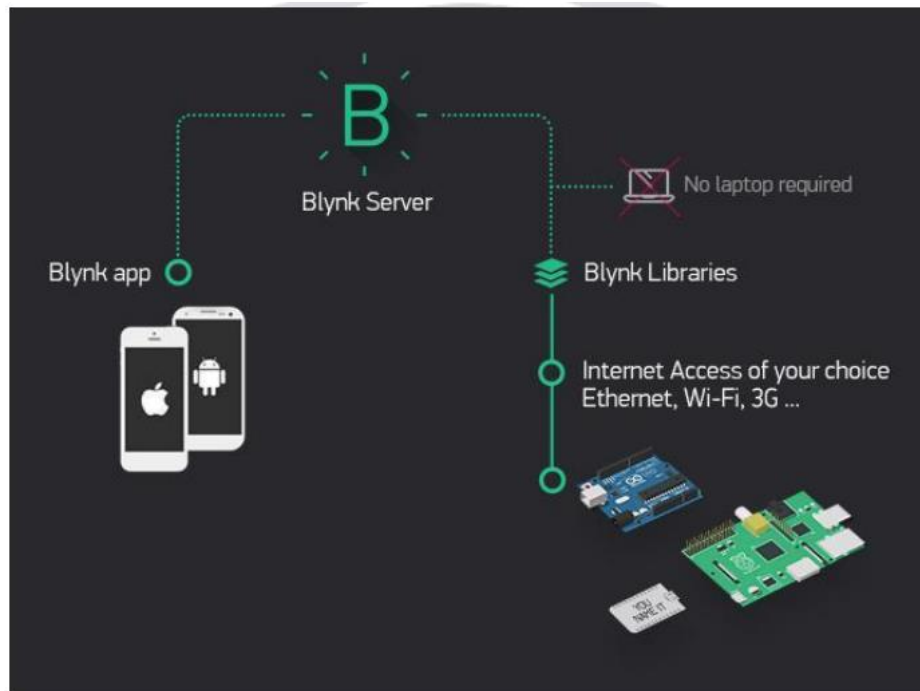
Characteristics

- It use same UI and API for all supported hardware devices.

- It can be connected to cloud by using either Wi-Fi, USB, Ethernet or Bluetooth.

- Very easy to set the widgets.

- Pin can be manipulate directly without code writing.

- New functionalities can easily be added by using virtual pins.

- History of data can be monitored using History Graph widget.

- Bridge widget is used for device-device communication.

- Others characteristics are tweets, sending emails, notifications, etc.

3.3 Raspberry Pi

This is basically a small computing device. Raspberry Pi foundation Initially designed and developed this device. The main purpose of the

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[4] https://docs.blynk.cc

foundation was to made people educated in the field of computing and to made the access to computing education easy.

[5]In 2012 Raspberry pi's very first model was launched. After that there have been many improvements and updated released versions. In the very first model there was 700 Mega Hz CPU, 256 MB of RAM and it was single core system. The latest model of raspberry pi has 1.4GigaHz CPU, 1GB of RAM and is quad core.

Raspberry pi very much popular in all around the world and is being widely used. One can polish one's programming skills and can learn to develop hardware based projects like home automation or some other industrial applications.

Raspberry pi is not a very much expensive device, infact it's a low cost computing device that runs on Linux. It contains GPIO (general purpose input and output) pins to control the electronic components.

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[5] https://www.raspberrypi.org/magpi/raspberry-pi-3-specs-benchmarks

Chapter 4 : Design and Development

Design and development of Smart Door Lock project is described in this chapter.

4.1 Technical specifications

Following are the technical specifications:

4.1.1 Hardware components:

Following are the main hardware components:

1   Raspberry Pi 3 Model B
2   Pi Camera
3   Wi-Fi Module (In Built)
4   Solenoid Electric lock
5   5V Relay

4.1.1.1 Raspberry Pi 3

This is basically a small computing device. Raspberry Pi foundation Initially designed and developed this device. The main purpose of the foundation was to made people educated in the field of computing and to made the access to computing education easy.

In 2012 Raspberry pi's very first model was launched. After that there have been many improvements and updated released versions. In the very first model there was 700 Mega Hz CPU, 256 MB of RAM and it was single core system. The latest model of raspberry pi has 1.4GigaHz CPU, 1GB of RAM and is quad core.

Raspberry pi very much popular in all around the world and is being widely used. One can polish one's programming skills and can learn to develop hardware based projects like home automation or some other industrial applications.

Figure 4: Raspberry Pi[6]

Technical Specifications

[7]Technical specifications are given below as follow:

1. A Quad core 1.2 Giga Hz processor with sixty four bit ARM v8
2. One HDMI, four USB ports and a one Ethernet port
3. 802. 11n Wi-Fi
4. Forty general purpose I/O pins
5. Mix composite video and 3.5 millimeter audio jack

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[6] https://www.amazon.in/Raspberry-Pi-Model-RASP-PI-3-Motherboard/dp/B01CD5VC92
[7] https://www.raspberrypi.org/magpi/raspberry-pi-3-specs-benchmarks

6. RAM of one GB

7. Interface for camera

8. Push pull small Mount Rushmore State card slot

9. Interface for show

Pin configuration of Raspberry pi:

The row of GPIO (general-purpose input/output) pins on the highest fringe of the board is that the powerful feature of the Raspberry Pi. GPIO pins are the physical interface between outside world and Raspberry Pi. They're thought of as switches at the best level that may be activate or off. GPIO Pins are 26 out of 40 and different are ground pins or power pins with extra 2 ID EEPROM pins. Any of the GPIO pins is selected (in software) as AN input or output pin and used for a good vary of functions. On the board, 2 5V pins and two 3V3 pins are there. The bottom pins (0V) also are there, that are unconfigurable. The remaining pins are all general purpose 3V3 pins. A GPIO pin selected as AN output pin is set to high (3V3) or low (0V). These pins is programmed to act with real world. It's not necessary that input comes from switches. The input is a symbol from different device or laptop or can be a device. Turning on AN LED, causation signals to different devices is the input. Devices hooked up to Raspberry pi are controlled by Raspberry pi from anyplace. If the devices are within the network, the information is remand by those devices. For the management of physical devices on web, the Raspberry pi is taken into account as ideal.
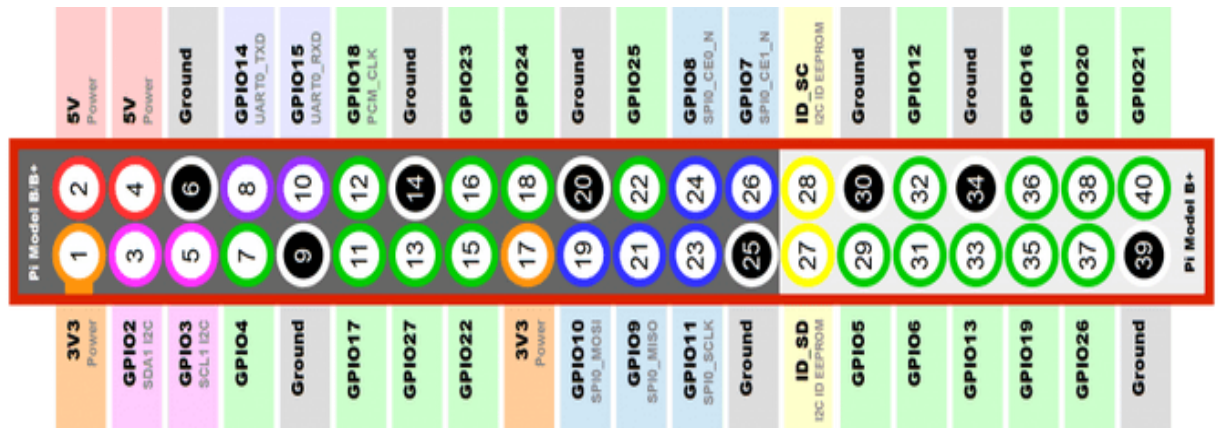
Figure 5: Raspberry Pi Pin Configuration[8]

As well as easy input and output devices, the GPIO pins is used with a range of different functions. Some are obtainable on all pins. Others are obtainable on specific pins.

- PWM (pulse-width modulation)

  ➢ Software package PWM obtainable on all pins
  ➢ Hardware PWM obtainable on GPIO12, GPIO13, GPIO18, GPIO19

- SPI

  ➢ SPI0: MOSI (GPIO10); MISO (GPIO9); spacecraft clock time (GPIO11); CE0 (GPIO8), CE1 (GPIO7)
  ➢ SPI1: MOSI (GPIO20); MISO (GPIO19); spacecraft clock time (GPIO21); CE0 (GPIO18); CE1 (GPIO17); CE2 (GPIO16)

- I2C

  ➢ Data: (GPIO2); Clock (GPIO3)

- ➢ EEPROM Data: (GPIO0); EEPROM Clock (GPIO1)

- Serial

  - ➢ TX (GPIO14); RX (GPIO15)

Working of GPIO:

The general purpose input output pins are called GPIO pins. There is no assigned function to GPIO pins by default, user can configured these general purpose input output pins according to his needs and requirements. The user can also control the function of GPIO pins during runtime which is the basic feature. General purpose input output pins can be used in a number of ways, they may be use for primary functions as well as for some other supporting functions.

Raspberry Pi is one of the popular chips available in the market and one of the remarkable feature of raspberry is forty general purpose input output pins. Out of the forty general purpose input output pins, some pins are set to give fix or constant voltage for example, general purpose input output pin number two and four give a constant voltage of 5 volts. [9]Similarly, general purpose input output pin number one and seventeen give a fix voltage of 3.3 volts. Some general purpose input output pins are also fixed for ground purpose for example general purpose input output pin number 6, 9, 14, 20, 25, 30, 34 and 39 are only available for the purpose of ground.

When the output of general purpose input output pin is high (3.3 Volts), it is considered as On otherwise when it is low, it is considered as Off.

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[9] https://www.raspberrypi.org/documentation/usage/gpio

4.1.1.2 Pi Camera :

A‘5’ megapixel camera is use for the aim of Live Steaming. It is simply interfaced to Module that's Raspberry pi.
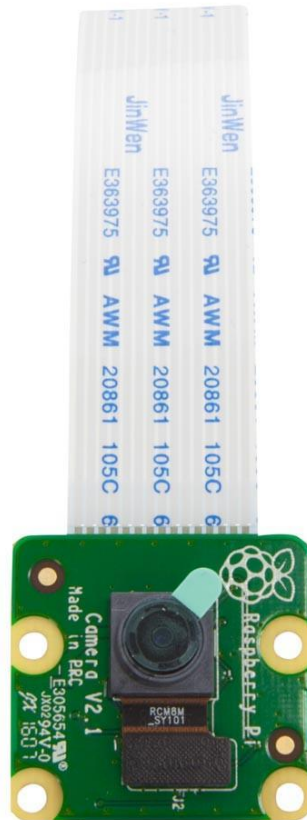
There is a versatile cable within the camera that may be inserted into CS1 connection that is present between the HD0MI ports and LAN. To use camera in Raspbian is straightforward by choosing the camera possibility and running the raspe-config.

We have used a five MP pi camera during this project that is capable to deliver a crystal clear 5MP resolution image, or 1080p HD recording at 30fps. during a mounted focus module, this camera has Omnivision 5647 device. The module is hooked up to Raspberry Pi, by means of a 15 Pin Ribbon Cable, to the dedicated 15-pin MIPI Camera Serial

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[10] https://thepihut.com/products/raspberry-pi-camera-module

Interface (CSI), that was designed particularly for interfacing to cameras. The CSI bus is capable of extraordinarily high information rates. It completely carries picture element information to the BCM2835 processor. The board itself is small at around 25mm x 20mm x 9mm, and weighs simply over 3g, creating it good for mobile or different applications wherever size and weight are vital. On board the device itself encompasses a native resolution of 5 megapixel, and encompasses a mounted focus lens. In terms of still pictures, the camera is capable of 2592 x 1944 picture element static pictures. It conjointly supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 recording. The camera is supported within the latest version of Raspbian, the Raspberry Pi's most preferable.

Features of Pi Camera:

The Raspberry Pi Camera Board Features:

1. Totally Compatible with each the Model A and Model B Raspberry Pi
2. 5MP Omnivision 5647 Camera Module
3. Still image Resolution: 2592 x 1944
4. Video: Supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 Recording
5. 15-pin MIPI Camera Serial Interface - Plugs Directly into the Raspberry Pi Board
6. Size: twenty x twenty five x 9mm
7. Weight 3g
8. Totally Compatible with several Raspberry Pi cases

4.1.1.3 Wi-Fi

Raspberry Pi model 3B encompasses in-built Wi-Fi module which can be used to connect this microcontroller to Wi-Fi to create it accessible

over web. As Wi-Fi is well obtainable in homes and offices thus no downside are going to be visage in connected good to Wi-Fi throughout the day.

4.1.1.4 Solenoid Electric Lock

Solenoids are essentially electromagnets. They're created from an enormous coil of copper wire. Coil (a slug of metal) is gift within the middle. The slug is force into the middle of the coil once this is energized. This makes the magnet able to pull from one finish.

Figure 7: Solenoid Electric Lock[11]

This magnet particularly is powerful. it's a slug with a slanted cut and an well mounting bracket. It's essentially an electronic lock. It's designed for a basic cupboard or safe or door. The lock is active unremarkably thus we have a tendency to can't open the door as because of the magnet slug is within the means. During this state, it

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[11] https://www.hobbyist.co.nz/?q=solenoid-lock

doesn't use any power. Once 9-12VDC is applied, the slug pulls in. It doesn't stick out any longer and therefore the door is opened.

The solenoids include the slanted slug as shown in figure, however we are able to open it with the 2 Phillips-head screws and switch it around thus its revolved 90, 180 or 270 degrees in order that it matches the door we wish to use it with. We have used external power provide of 12V as a lot of current is required to charge the magnet thus wo cant power it with 9V battery to drive the magnet electrical lock.

Technical details:

1. 12VDC (we will use 9-12 DC volts, however lower voltage leads to weaker/slower operation)
2. Attracts 650mA at 12V, five hundred mA at 9V once activated
3. Designed for 1-10 seconds long activation time
4. Georgia home boy Dimensions: forty one.85mm / 1.64" x fifty three.57mm / 2.1" x twenty seven.59mm / 1.08"
5. Dimensions: twenty three.57mm / 0.92" x sixty seven.47mm / 2.65" x twenty seven.59mm / 1.08"
6. Wire length: 222.25mm / 8.75"
7. Weight: 147.71g

4.1.1.5 5V Relay:

Relay is the specific electronic component which is used for switching purpose. It provides very fast switching. There are number of relays available in the market. They are characterized by the number of channels they have. Some of the available relays are one channel and some have multiple channels. There are also relays of different voltage

which are for different applications. But according to our need, we have used a 5 Volt Relay Module of one channel.

In Relay Module, there are six pins available, one pin is for operating voltage that is 5 Volts in our case and one pin is for driving voltage that is 3.3 volts in our case. When this pin is set to high, connected circuit closes and vice versa. One pin is for ground purpose. There are also three pins available on other side of Relay Module that is NC, NO and COM, middle pin is COM and here we provide high voltage of required circuit. Ground pin of required circuit is connected to NO.
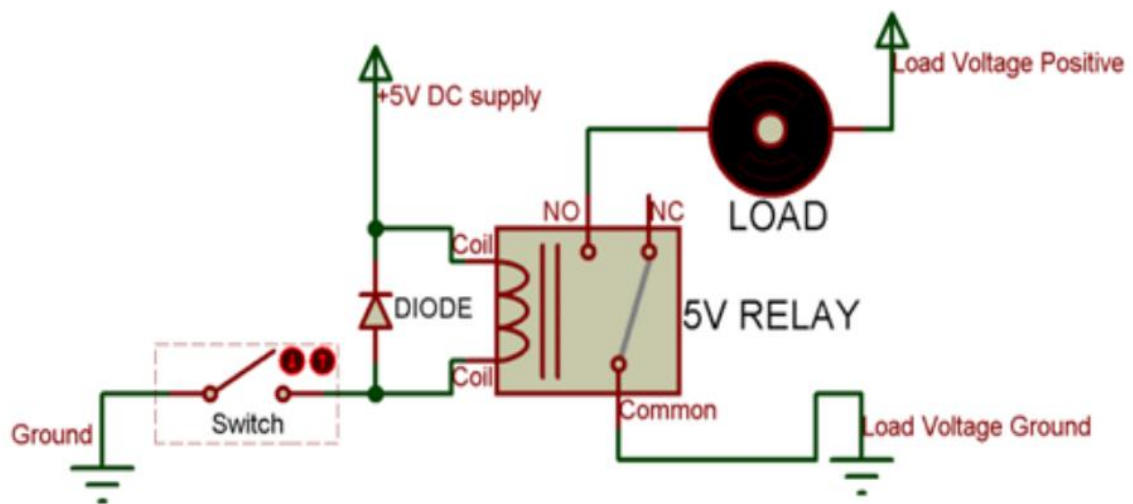

Figure 8: Circuitry of Solenoid Electric Lock[12]

Uses of Relay

1. Normally employed in change circuits.
2. Used for switching purpose like in home automation etc.
3. To manage (On/Off) significant masses at a pre-determined time/condition

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[12] https://megaeshop.pk/solenoid-cabinet-door-lock-electric-lock-assembly.html

4. they are used in crucial spaces to protect expensive components from failure. It breaks the circuit in case of failure.
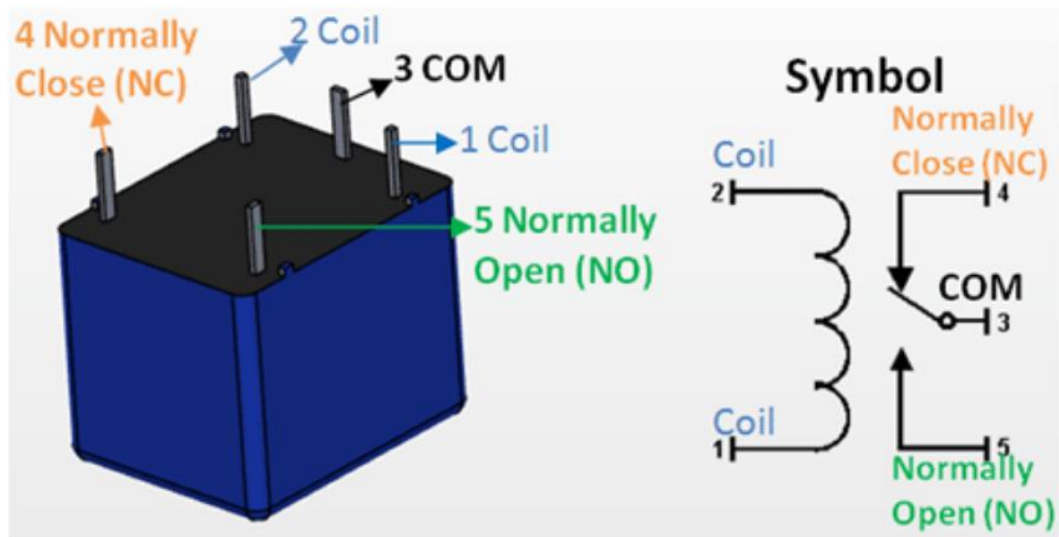
5. Employed in cars physics.

Figure 9: 5V Relay[13]

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[13] https://components101.com/5v-relay-pinout-working-datasheet

Pin Configuration of Relay

Pin Number	Pin Name	Description
1	Coil End 1	It is used for operating voltage that is 5 volts.
2	Coil End 2	It is used for ground purpose as well as for triggering switch.
3	Common (COM)	This pin is common to the circuit which is to be controlled.
4	Normally Close (NC)	Other end of required circuit is connected to NC.
5	Normally Open (NO)	Other end of required circuit can also be connected to NC according to requirement.

Features of 5-Pin 5V Relay

1. 5 Volts DC for triggering switching
2. seventy milli Amps for triggering Current
3. 10 Ampere load current @ 250/125V AC
4. 10 Ampere load current @ 30/28V DC
5. It has total 5 pins
6. Fast operation time of 10 milli sec

4.1.2 uv4l Streaming Server:

The uv4l-server module may be a plug-in specific for UV4L that allows a per-camera Streaming Server that may be at the same time accessed by any browser over hypertext transfer protocol or HTTPS protocols.

[14]It offers an internet interface from that it's attainable to work out the video stream in varied ways in which and an effect Page permitting to completely control the camera settings whereas streaming with any Video4Linux application. Apart from secure HTTPS protocol, basic authentication for each the traditional and admin users is additionally supported. The installation of uv4l server on Raspberry pi is extremely easy and may be a obtainable on their websites. To look at the live streaming on android, we've got Blynk video widget

4.1.3 Software used:

Software used in this project are:

4.1.3.1 Raspbian:

Raspbian is a free software package. it's supported Debian optimized for the Raspberry Pi hardware. An software package is that the set of basic programs and utilities that build your Raspberry Pi run. However,

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[14] https://www.linux-projects.org/uv4l/tutorials/streaming-server

Raspbian provides more than a pure OS. It comes with over thirty 35000 packages, pre-compiled software package bundled during a nice format for straightforward installation on your Raspberry Pi.

The initial build of over 35000 Raspbian packages, optimized for best performance on the Raspberry Pi, was completed in Gregorian calendar month of 2012. However, Raspbian remains beneath active development with a stress on rising the steadiness and performance of as several Debian packages as attainable.

4.1.3.2 Android Application

To control lockup and unlocking of door we've got used Blynk Application that is obtainable on Google Play Store. Blynk may be a new platform that permits us to quickly build interfaces for dominant and observation our hardware comes from our iOS and android device. Blynk supports hardware platforms like Arduino, Raspberry Pi, and similar microcontroller boards to make hardware based mostly comes. Blynk supports several affiliation varieties like LAN, Wi-Fi and Bluetooth etc.

We have interfaced the Blynk application to incorporate buttons for lockup and unlocking of door. We've got conjointly enclosed a video player for live streaming and a notification system to urge notified whenever an individual outside the door ironed the push button. Live streaming can help us to spot the person outside of door thus anybody at main gate is allowed or denied from anyplace with the assistance of this app.

4.2 Design Outline :

Nowadays, the potential of smartphones is astonishing. A Smartphone is capable to handle applications that may perform a good kind of functions. We have a tendency to all are involved concerning the safety of our premises. World is turning into smarter and smarter on a daily basis and that we need a controlled and a secured surroundings. This good Lock is that the secure, simple, and straightforward to manage your home's lock. In brief the aim of this project is to modify the tasks of lockup and unlocking the door and to extend the safety of the door locking system victimization Wi-Fi and therefore the connected App.

Camera can facilitate us to spot the person and that we will lock or unlock from anyplace we wish.

4.3 Testing:

We have tested our project and checked for any attainable error or inaccuracies in system followed by the refinement method.

4.4 Final product:

Upon in completion, the device are going to be build as compact as attainable and lean it a final form, that may be simple to put in and prepared to use.

Chapter 5 : Analysis and Testing

5.1 Introduction

Complete evaluation of Smart door lock project is implemented and the results are described in this chapter. Conclusion and Future enhancements are also discussed here.

5.2 Testing

To test the hardware and software assembly, we connected the raspberry pi with electric lock and pi camera. Through Wi-Fi, Android application was connected to Raspberry pi. Using 12V power adaptor, Electric lock was tested separately.

Smartphone activated door locking has been designed, implemented and tested successfully.

5.3 Real Time Implementation

Using android application, smart Door lock can be locked and unlocked. The user will get notification when someone is at the door. User can see the live view outside his door. After recognizing the person though live streaming, the user can now unlock door using Android application.

We have created a prototype to illustrate our project. Live Streaming is done using Pi camera behind the hole.

Figure 10: Prototype Implementation Demonstration-I

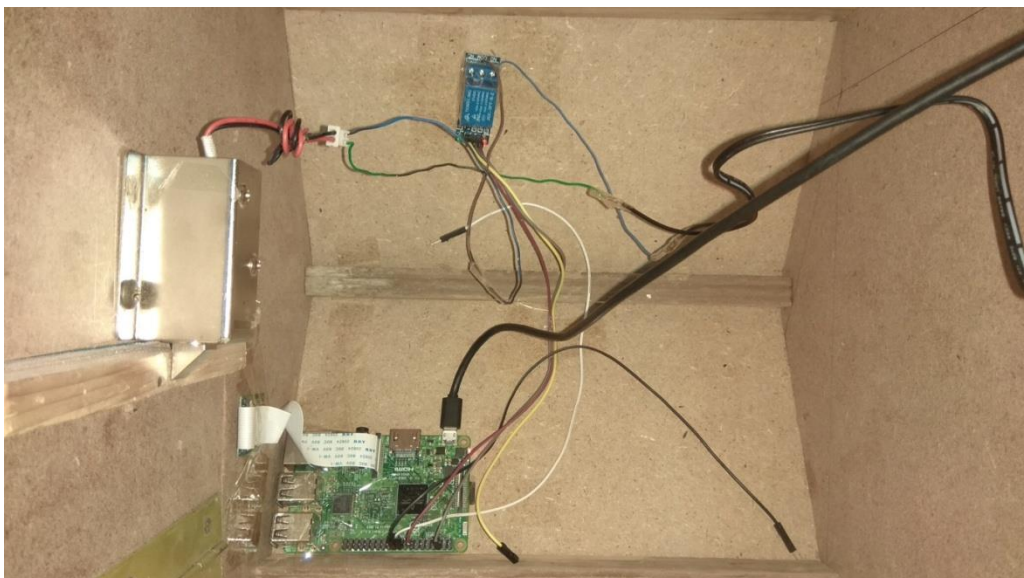*Figure 11: Prototype Implementation Demonstration-II*

Figure 12: Internal Circuitry of Smart Door Lock
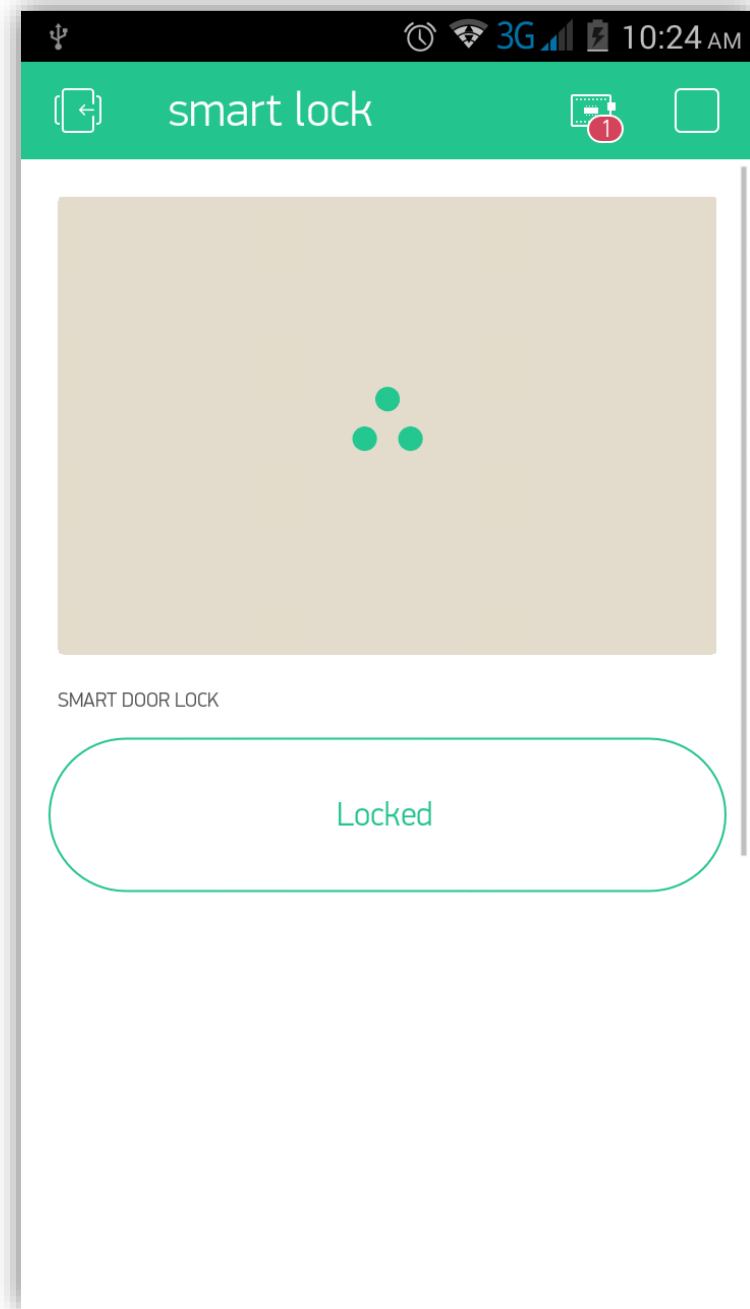
5.3.1 Android Application:

Figure 13: Android Application

When a person outside the rings the bell, there will be an intimation sent to user smartphone.
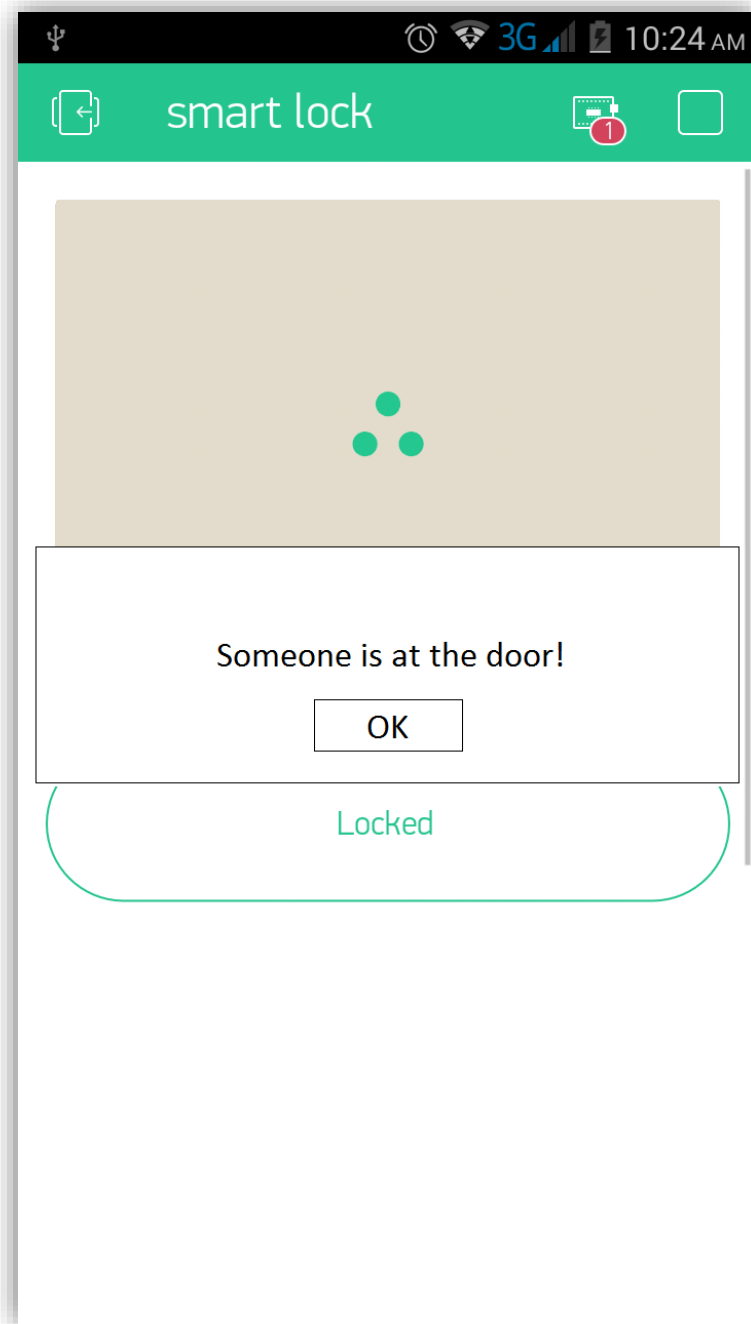

Figure 14: Intimation when someone is at the door

After receiving the notification, user now have an option to live stream as well as to unlock the door.
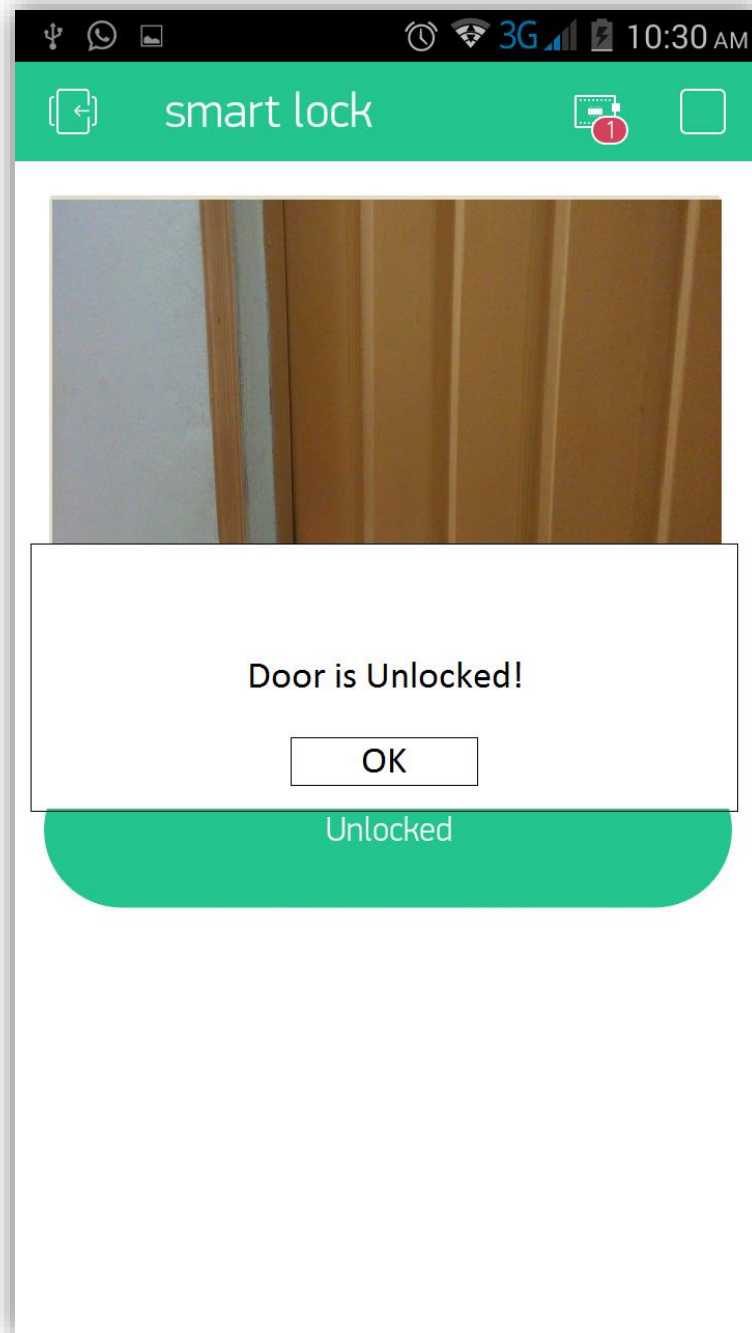

Figure 15: Unlocking of door using Android Application

After allowing the outsider, user can also lock the door back.
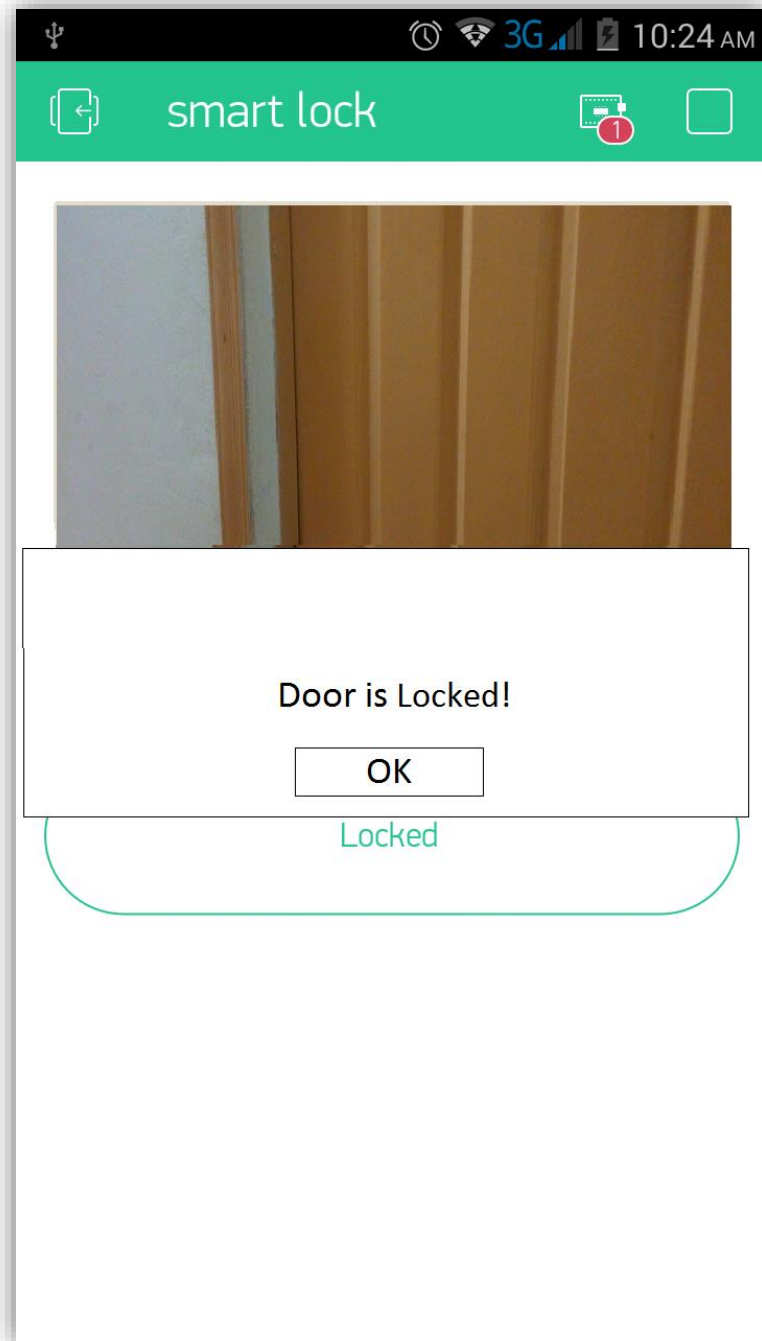
Figure 16: Locking of door using Android Application

5.4 Conclusion and Future Enhancements:

We conclude that Smart door lock provides the user more security in smarter way.

The existing relay can be replaced with solid state relay (SSR) to reduce the power consumption and increase the stability of the design in future. Furthermore, security features can be added to increase the efficiency of the design. This could be done by introducing application protocol encryption. Last but not least, the Android application interface can be further enhanced to ease the user in case they could not remember the IP address and port number.

Chapter 6 : References

- Ibshar Ishrat, Wajiha Muzaffar Ali, Sana Ghani, Sadia Sami, Maria Waqas , Fakhra Aftab, "Smart Door Dock System with Automation and Security" Dept. of Computer and Information Systems Engineering, NEDUET, Karachi, Pakistan, 2017.

- Rahul Satoskar , Akarsh Mishra, "Smart Door Lock and Lighting System using Internet of Things" Dept of Electronics and Telecommunication Rajarshi Shahu college of engineering Pune, India, 2018.

- Potts J. and Sukittanon, "Exploiting Bluetooth on Android Mobile Devices for Home Security Application" in Proceedings of IEEE Southeastcon, 2012.

- Raspberrypi.org, 'What is Raspberry Pi?' [Online]. Available: https://www.raspberrypi.org/help/what-%20is-a-raspberry-pi. [Accessed: 2-Feb-2019]

- Raspberrypi.org, 'GPIO' [Online]. Available: https://www.raspberrypi.org/documentation/usage/gpio. [Accessed: 3-Feb-2019]

- Raspberrypi.org 'Getting started with Raspberry Pi Camera' [Online]. Available: https://projects.raspberrypi.org/en/projects/getting-started-with-picamera. [Accessed: 15-Feb-2019]

- Instructables.com '5V Relay Module' [Online]. Available: http://www.instructables.com/id/5V-Relay-Module-Mod-to-Work-With-Raspberry-Pi. [Accessed: 15-Feb-2019]

- Blynk.cc 'Blynk' [Online]. Available: http://docs.blynk.cc. [Accessed: 15-Feb-2019]

- Linux-projects.org 'uv4L Installation' [Online]. Available: https://www.linux-projects.org/uv4l/installation. [Accessed: 21-Feb-2019]

- Hobbyist.co 'Solenoid Electric Lock' [Online]. Available: http://www.hobbyist.co.nz/?q=solenoid-lock. [Accessed: 21-Feb-2019]

Appendix A

```
var Blynk = require('blynk-library');
var Gpio = require('onoff').Gpio;
var led = new Gpio(23, 'out');
var led2 = new Gpio(25, 'out');


var AUTH = '185563377b49483697df7ed3d9205da2';

var blynk = new Blynk.Blynk(AUTH,options={port:443});
var os=require('os');

var networkInterfaces=os.networkInterfaces();

var v0 = new blynk.VirtualPin(0);

v0.on('write', function(param) {

        if (param[0] == '1') {
        blynk.notify("Door is Locked!");
        led.writeSync(1);
        } else {
        blynk.notify("Door is Unlocked!");
        led.writeSync(0);
        }
  console.log('V0:', param[0]);

});

var v1 = new blynk.VirtualPin(1);
  button = new Gpio(25, 'in', 'both');
button.watch(function (err, value) {
  if (err) {
    throw err;
  }
if (value == 1) {
        blynk.notify("Someone is at the Door");
  console.log('PI Buttom:', value);
    }});
```

Installation of Node.js and Blynk library on Raspberry Pi:

First of all, you need to install Node.js.

Before updating Node.js, please be sure to remove old versions:

```
sudo apt-get purge node nodejs node.js -y
sudo apt-get autoremove
```

Automatic Node.js installation

Add repositories:

```
curl -sL https://deb.nodesource.com/setup_6.x | sudo -E bash -
```

Install Node.js:

```
sudo apt-get update && sudo apt-get upgrade
sudo apt-get install build-essential nodejs -y
```

Manual Node.js installation

Automatic install might not work for you, in this case you can perform manual installation.

If uname -m gives you armv6l (on Raspberry Pi, usually), try this:

```
sudo su
```

```
cd /opt


wget https://nodejs.org/dist/v6.9.5/node-v6.9.5-linux-armv6l.tar.gz
-O - | tar -xz
mv node-v6.9.5-linux-armv6l nodejs


apt-get update && apt-get upgrade
apt-get install build-essential


ln -s /opt/nodejs/bin/node /usr/bin/node
ln -s /opt/nodejs/bin/node /usr/bin/nodejs
ln -s /opt/nodejs/bin/npm /usr/bin/npm


exit


export PATH=$PATH:/opt/nodejs/bin/
```

Check your Node.js and npm installation

```
pi@raspberrypi:/ $ node --version
v6.9.5


pi@raspberrypi:/ $ npm -v
3.10.10
```

Install Blynk globally

```
sudo npm install blynk-library -g
sudo npm install onoff -g
```

Run default Blynk client (replace YourAuthToken):

```
export PATH=$PATH:/opt/nodejs/bin/
unset NODE_PATH
blynk-client YourAuthToken
```

Creating a new Node.js project with Blynk

Installing Blynk globally may not work or can be undesired.
In this case, you need to create a new Node.js module with local Blynk
library dependency.

```
mkdir my-awesome-project
cd my-awesome-project
npm init
```

It will prompt you for general information about your project and
create a `package.json` file (project description). Next, add Blynk to
your project:

```
npm install blynk-library --save
```

You can also install onoff, if you want (allows direct pin operations):

```
npm install onoff --save
```

Now create your main script file index.js (just replace YourAuthToken):

```
var Blynk = require('blynk-library');


var AUTH = 'YourAuthToken';


var blynk = new Blynk.Blynk(AUTH);
```

```
var v1 = new blynk.VirtualPin(1);
var v9 = new blynk.VirtualPin(9);


v1.on('write', function(param) {
  console.log('V1:', param[0]);
});


v9.on('read', function() {
  v9.write(new Date().getSeconds());
});
```

 This is it. Run your project:

```
node index.js
```

You should see something like:

```
OnOff mode
Connecting to: blynk-cloud.com 8441
SSL authorization...
Connected
Authorized
```

<div align="right">

Appendix C

</div>

Installation of uv4L server on Raspberry Pi:

If OS is *Raspbian Wheezy* or *Raspbian Jessie,* following command will be used in terminal:

```
$ curl
http://www.linuxprojects.org/listing/uv4l_repo/lrkey.asc |
sudo apt-key add -
```

On *Raspbian Wheezy* add the following line to the file */etc/apt/sources.list*:

```
deb http://www.linux-projects.org/listing/uv4l_repo/raspbian/
wheezy main
```

while on *Raspbian Jessie* add this line:

```
deb http://www.linux-projects.org/listing/uv4l_repo/raspbian/
jessie main
```

If you are running *Raspbian Stretch* instead, type:

```
$ curl http://www.linux-
projects.org/listing/uv4l_repo/lpkey.asc | sudo apt-key add -
```

and add the following line to the file */etc/apt/sources.list*:

```
deb http://www.linux-
projects.org/listing/uv4l_repo/raspbian/stretch stretch main
```

Finally, we are ready to update the system and to fetch and install the packages:

```
$ sudo apt-get update
```

```
$ sudo apt-get install uv4l uv4l-raspicam
```

The above two commands will upgrade UV4L to the most recent version, if it's already installed.

If you want the driver to be loaded at boot, also install this optional package:

```
$ sudo apt-get install uv4l-raspicam-extras
```

As a convenience, the above package will install a service script for starting, stopping or restarting the driver at any time, for example:

```
$ sudo service uv4l_raspicam restart
```

When (re)starting the service, *uv4l* will be instructed to parse the configuration file */etc/uv4l/uv4l-raspicam.conf* to get the default values for the driver and the server options. You can edit that file to add, remove or change the default values. This same service is started at boot.

If you are using the TC358743, the *uv4l-tc358743-extras* package has to be installed for it to work:

```
$ sudo apt-get install uv4l-tc358743-extras
```

The above package will automatically install the *uv4l-raspicam-extras* package and some other helper programs. Before using the TC358743

make sure that both the *Camera* interface and the *I2C* bus are enabled in the *raspi-config* system tool and that the line *tc358743=yes* is present or uncommented in the configuration file */etc/uv4l/uv4l-raspicam.conf*.

Now the UV4L core module and the Video4Linux2 driver for the CSI Camera Board are installed. If you occasionally get unexpected errors from the driver, make sure the camera is enabled and enough memory is reserved for the *GPU* (256MB or more is suggested) from this menu:

```
$ sudo raspi-config
```

Also consider updating the firmware with the following command:

```
$ sudo rpi-update
```

For detailed informations, options, etc... about the modules installed type accordingly:

```
$ man uv4l
```

```
$ man uv4l-raspicam
```

To get the list of all available options:

```
$ uv4l --help --driver raspicam --driver-help
```

If you have not installed the optional *uv4l-raspicam-extras* package (which provides a convenient script for starting uv4l with the settings taken from a configuration file) and want to quickly test uv4l with the camera module, first load the driver manually:

```
$ uv4l --driver raspicam --auto-video_nr --width 640 --height
480 --encoding jpeg
```

(you might need to also set the *–tc358743-i2c-dev* option properly in case you have the TC358743 instead). Now you can take a JPEG snapshot from the device:

```
$ dd if=/dev/video0 of=snapshot.jpeg bs=11M count=1
```

For a list of other use cases click here.

To manually terminate a running driver, close all the applications accessing the device and kill the corresponding *uv4l* process:

```
$ pkill uv4l
```

Apart from the driver for the Raspberry Pi Camera Board, the following Streaming Server front-end and drivers can be optionally installed:

```
$ sudo apt-get install uv4l-server uv4l-uvc uv4l-xscreen uv4l-
mjpegstream uv4l-dummy uv4l-raspidisp
```

for which the manual pages are available:

```
$ man uv4l-server
```

```
$ man uv4l-uvc
```

```
$ man uv4l-xscreen
```

```
$ man uv4l-mjpegstream
```

```
$ man uv4l-dummy
```

```
$ man uv4l-raspidisp
```

The *WebRTC* extension for the Streaming Server is also available with two alternative packages depending on the Raspberry Pi model in use. If you have a *Raspberry Pi 1*, *Compute Module 1*, *Zero* or *Zero W* (Wireless), type:

```
$ sudo apt-get install uv4l-webrtc-armv6
```

Otherwise, if you have any other model (e.g. Raspberry Pi 2 or 3), type:

```
$ sudo apt-get install uv4l-webrtc
```

As the Streaming Server is able to serve and run any custom web applications, an optional package containing the source code of some of the demos mentioned in the examples (e.g. this one) is available. The files will be installed in */usr/share/uv4l/demos/*:

```
$ sudo apt-get install uv4l-demos
```

Note that some browsers may no longer exploit many of the WebRTC functionalities over HTTP for security reasons. You will need to configure secure *HTTPS* in the Streaming Server instead. To do this, you must provide a password-less private key and a valid certificate via the *–ssl-private-key-file* and the *–ssl-certificate-file* server options. A private key and a self-signed certificate can be generated as follows:

```
$ openssl genrsa -out selfsign.key 2048 && openssl req -new -
x509 -key selfsign.key -out selfsign.crt -sha256
```

Once you have installed and eventually configured the HTTP(S) Streaming Server module as shown above, make sure to reload *uv4l* for it to notice and start the server. Afterwards you can access the server with the browser at the default address and port *https://raspberry:8080/* (where *raspberry* has to be replaced with the actual hostname or IP address of your RaspberryPi and the protocol can be either *http* or *https*).

Many of the Streaming Server and WebRTC settings can be changed *on-the-fly* thanks to the RESTful API without restarting UV4L.

it's also possible to broadcast both live audio and video contents from the Raspberry Pi 2 to all the participants or viewers joining a room of a *Jitsi Meet* conference on the Web. Furthermore, no browser and no GUI will have to be used on the Raspberry Pi. For this to be possible, it's necessary to install the additional *xmpp-bridge* service, which will be automatically started once the installation has finished or when the system boots:

```
$ sudo apt-get install uv4l-xmpp-bridge
```