Kashi Institute of Technology

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Final Year Project SRS

By

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Title of the Project	IOT Based Door Unlocking System
Front End	XML
Back End	Python , JAVA
Name of Guide	Mr. Gyanendra Tiwary Mr. Yashwant Mohan(co-Guide)

Software Requirements Specification

for

“INTERNET OF THINGS” BASED DOOR UNLOCKING SYSTEM

Version 1.0 approved

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Table of Contents

1. Introduction

1.1 Purpose

This SRS document is stating the detailed explanation of the architecture, functionalities and specifications of the project. This document is going to serve as a guideline for the users as well as the development team .Target audiences of this project are guest who visit at home,warehouse or workplace or the relatives/friends of the Owner. The objective of the project is to develop a hardware device integrated with camera which will capture image of individual and send to the owner's mobile device .There is a possibility that multiple versions of this document can be released. Therefore,some modifications and improvements can be done in order to satisfy the meet of adapting the changing requirements and specifications.

1.2 Document Conventions

DB	**Database**
RPi	**Raspberry Pi**
GPIO	**General-Purpose Input/Output**
APP	**Application**

1.3 Intended Audience and Reading Suggestions

The target audience for the Door Unlocking System will be homeowners, and renters that would like to know in real time when a visitor is at their door. Business owners and secretaries can also use the Door Unlocking System to interact with visitors in a safe and convenient manner. Absentee owners can use the Door Unlocking System to monitor and interact with people at their remote property.This project is a prototype for the IOT based Door Unlocking system and it is restricted within the college premises. This has been implemented under the guidance of college professors. This project is useful for the

person who want to monitor his house from remote access control system which comprises of the internet to control the devices and appliances at home or office with the person controlling them from anywhere around the globe.

1.4 Product Scope

This document proposes a remote access controlled door entry system for homes and office buildings.

Methods/Statistical Analysis: In our proposed system, a RPi board is used as the platform for monitoring and controlling the door lock. The door entry system proposed here consists of a switch for guest monitoring, camera for guest authentication, solenoid actuator for opening of the door and a speaker set for making the system intimate the responses to the guest. Switch, speakers and camera for interaction with the guest are mounted at appropriate places at the door.

Findings: Status of the switch can be monitored by the RPi. As the guest presses the switch on arriving at the door, the door entry system enables the host to conveniently monitor and control the entry of people to the house through Internet.

Application/Improvements: The main advantage of our proposed system is that it can be easily used in home without requirement of any new software installation and configuration. In future, Instead of monitoring switch status, interrupt driven method can be used to monitor the person.

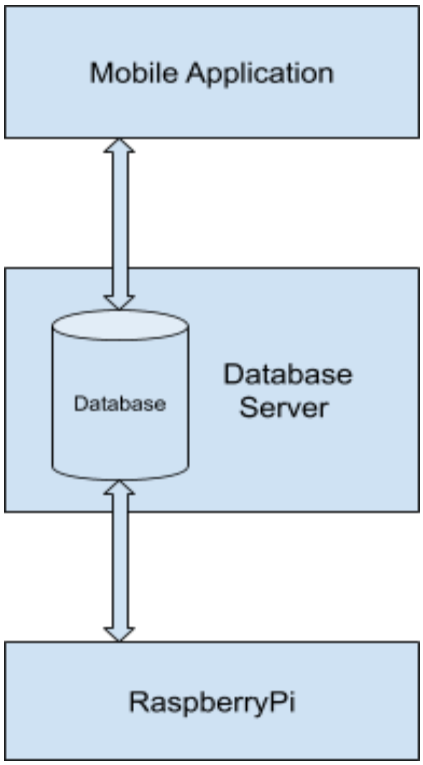
1.5 References

[1] https://www.raspberrypi.org/downloads/
[2] https://www.raspberrypi.org/documentation/hardware/
[3] https://www.raspberrypi.org/documentation/remote-access/
[4] https://github.com/rick4470/IEEE-SRS-Tempate

2. Overall Description

This section will give an overview of the whole system. The system will be explained in its context to show how the system interacts with other systems and introduce the basic functionality of it. It will also describe what type of stakeholders that will use the system and what functionality is available for each type. At last, the constraints and assumptions for the system will be presented .

2.1 Product Perspective



This system will consist of two parts: one Mobile App and RPi. The Mobile App will be used to Control the GPIO pins of RPi and view information gathered by it while the RPi is used to capture the images and control the lock system as a whole.

Since this is a data-centric product it will need somewhere to store the data For that, a DB will be used . Mobile App and RPi will communicate with the DB. The Mobile App will use the DB to get data as well as update data . All of the DB communication will go over the Internet.

2.2 Product Functions

With the Mobile App user can see the image captured by the piCamera module and user can take actions like Grant , Reject or notify them (Voice message) via Application. Mobile App also allow to check all the previous captured images with date associated at time of capture .Rpi process the captured images to the DB.

2.3 User Classes and Characteristics

There are two types of users that interact with the system: Owner and Guest . Each of these two types of users has different use of the system so each of them has their own requirements.

Guest interact with the Switch and he have to face towards the camera so that the captured images will be clearly visible to the owner of the house .

Owner uses the Mobile App to see the captured images from piCamera , grant or deny the access of the door and also he/she can notify them as voice message .

2.4 Operating Environment

The software being developed will be running under Raspbian OS and The hardware that will be running these programs is RPi and some other components attached with it .

The Mobile App being developed will be running under Android OS and we will follow the specifications that appear in this document in section 3.

2.5 Design and Implementation Constraints

- The Internet connection is a constraint for the application. Since the application fetches data from the DB over the Internet, it is crucial that there is an Internet connection for the application to function.

- Camera is very important constraint if it does not work no image will be captured from the environment and thus owner will not get the image of guest on the Mobile App .
- Both the RPi and the Mobile App will be constrained by the capacity of the DB. Since the DB is shared between both of them it may be forced to queue incoming requests and therefore increase the time it takes to fetch data. Due to free version of DB there is a limitation in the storage capacity .
- In case of the usage of product in some extreme conditions such as cold, hot or wet, some
- precautions should be taken to keep device working.
- Cost of the hardwares should be in a reasonable margin to be affordable.

2.6 User Documentation

For user documentation and information, please consult section 3: External Interface Requirements and attached user manual.

2.7 Assumptions and Dependencies

Raspbian OS is the default Linux OS which RPi organization provides to the users.On RPi this OS will be run. In case the OS is not operating, the software requirements specification should change accordingly.

Full working of the Project will depend on the proper working of the camera, Door lock, Switch, RPi and fullness of the power adapter. So the status of these components should be controlled regularly.

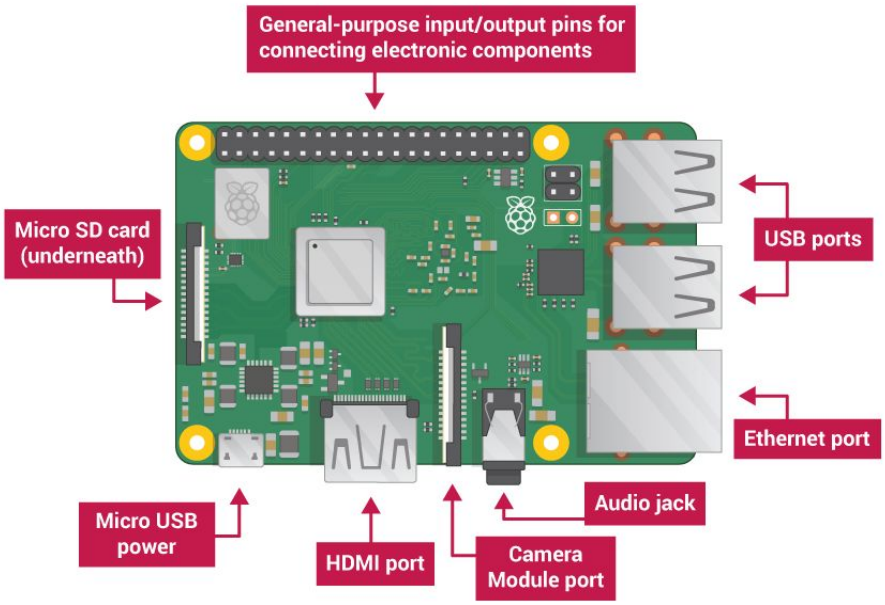
It is assumed that Mobile App will be compatible with android version 5.0 and above.

3. External Interface Requirements

3.1 User Interfaces

Visual part of computer application or operating system through which a user interacts with a computer or a software. It determines how commands are given to the computer or the program and how information is displayed on the screen.

3.2 Hardware Interfaces



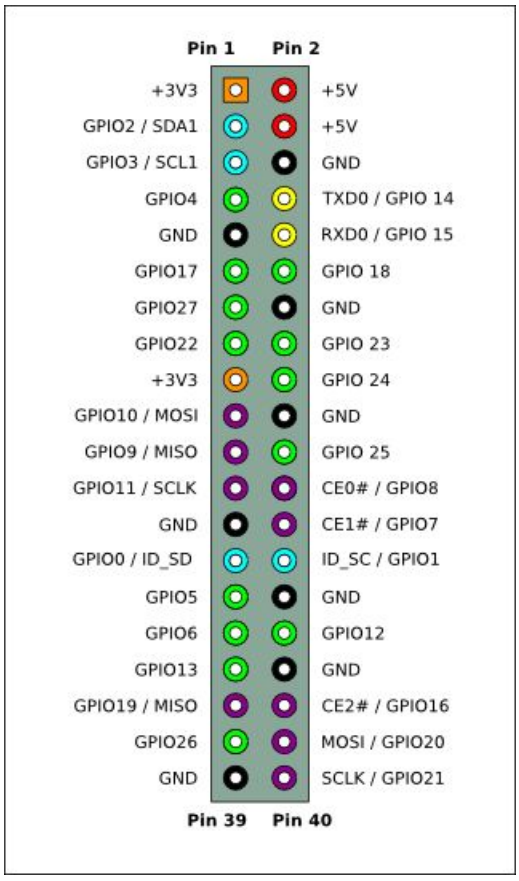
The RPi device looks like a motherboard, with the mounted chips and ports exposed (something you'd expect to see only if you opened up your computer and looked at its internal boards), but it has all the components you need to connect input, output, and storage devices and start computing. You'll encounter two models of the device: Model A and Model B. The only real differences are the addition of Ethernet and an extra USB port on the more expensive Model B.

Here are the various components on the RPi board:

ARM CPU -- This is a Broadcom BCM2835 System on a Chip (SoC) that's made up of an ARM central processing unit (CPU) and a Videocore 4 graphics processing unit

(GPU). The CPU handles all the computations that make a computer work (taking input, doing calculations and producing output), and the GPU handles graphics output.

GPIO -- These are exposed general-purpose input/output connection points that will allow the real hardware hobbyists the opportunity to tinker.



Audio out -- This is a standard 3.5-millimeter jack for connection of audio output devices such as headphones or speakers. There is no audio in.

LEDs -- Light-emitting diodes, for all of your indicator light needs**.**

USB -- This is a common connection port for peripheral devices of all types (including your mouse and keyboard). Model A has one, and Model B has two. You can use a USB hub to expand the number of ports or plug your mouse into your keyboard if it has its own USB port.

HDMI -- This connector allows you to hook up a high-definition television or other compatible device using an HDMI cable**.**

Power --The board takes fixed 5 V input, (with the 1.2 V core voltage generated directly from the input using the internal switch-mode supply on the BCM2835 die). This permits adoption of the micro USB form factor, which, in turn, prevents the user from inadvertently plugging in out-of-range power inputs; that would be dangerous, since the 5 V would go straight to HDMI and output USB ports, even though the problem should be mitigated by some protections applied to the input power: The board provides a polarity protection diode, a voltage clamp, and a self-resetting semiconductor fuse.

Premier Farnell recommend the following power supplies:

- Model A: 5 V DC, 500-1200 mA
- Model B: 5 V DC, 1000-2000 mA

SD card slot -- This is a full-sized SD card slot. An SD card with an OS installed is required for booting the device,you can download an OS and save it to the card yourself.

Ethernet -- This connector allows for wired network access and is only available on the Model B. We include RPi version 3 and the additional device is solenoid lock,camera, 2A Adapter(charger),jumper wire, and one bread board

PiCamera -- The Raspberry Pi camera module can be used to take high-definition video, as well as stills photographs. It's easy to use for beginners, but has plenty to offer advanced users if you're looking to expand your knowledge.If you're interested in the nitty-gritty, you'll want to know that the module has a five megapixel fixed-focus camera that supports 1080p30, 720p60 and VGA90 video modes, as well as stills capture.

Solenoid lock :-A solenoid is a coil wound into a tightly packed helix. In engineering, the term may also refer to a variety of transducer devices that convert energy into linear motion. The term is also often used to refer to a solenoid valve, which is an integrated

device containing an electromechanical solenoid which actuates either a pneumatic or hydraulic valve, or a solenoid switch, which is a specific type of relay that internally uses an electromechanical solenoid to operate an electrical switch; for example, an automobile starter solenoid, or a linear solenoid, which is an electromechanical solenoid. Electromechanical solenoids consist of an electromagnetically inductive coil, wound around a movable steel or iron slug (termed the armature). The coil is shaped such that the armature can be moved in and out of the center, altering the coil's inductance and thereby becoming an electromagnet. The armature is used to provide a mechanical force to some mechanism (such as controlling a pneumatic valve). Although typically weak over anything but very short distances, solenoids may be controlled directly by a controller circuit, and thus have very quick reaction times. The force applied to the armature is proportional to the change in inductance of the coil with respect to the change in position of the armature, and the current flowing through the coil. The force applied to the armature will always move the armature in a direction that increases the coil's inductance.

3.3 Software Interfaces

The connection between the RPi and their software use in the RPi is raspbian the main connection is that raspbian use in the RPi we describe the raspbian,here Raspbian is the main and basic software for RPI device officially supported by the RPi foundation. In Fact it is an Operational system based on debian and optimized for RPi hardware it comes with lots of pre installed hardware it comes with lots of pre installed pieces of software appropriate for most of ARM user and developer and in this i am going to look through almost all possible operating system as well as the RPi image,compare and review major type of other software you can use for your complicated RPi project.

3.4 Communications Interfaces

The communication between the different parts of the system is important since they depend on each other. However, in what way the communication is achieved is important

for the system and is therefore handled by the underlying operating systems for the Mobile App.

The IOT based 'Door Unlocking System' shall use the HTTP protocol for communication over the internet and for the intranet communication will be through FTP protocol suite.

4. System Features

4.1 Switch Monitoring :: REQ-1

4.1.1 Description --The pushbutton switch has been connected to the GPIO pin. The RPi. GPIO library module has been imported and named as GPIO. The GPIO pin has been configured as input. The value of this pin is checked to detect if there has been a key press.

4.1.2 Priority -- This requirement is high priority.

4.1.3 Source -- The source of this use case is the guest.

4.1.4 Stimulus/Response Sequences --

Preconditions: None

1.Guest press the Switch .

Postconditions: Enables the Picamera to take picture .

4.1.4 Functional Requirements --

Includes REQ-4
Specializes:REQ2,REQ3
Connects:REQ-2

4.2 Image Capture::REQ-2

4.2.1 Description -- The purpose is to use the device's optical hardware to produce the image Captured by the optical hardware. Camera library modules have been imported and a function picamera.PiCamera() has been defined. In the function definition image is captured with the name "date.jpg" where date defines the current system time and is saved in the "/home/pi" directory .

4.2.2 Priority -- This requirement is high priority.

4.2.3 Source – The source of this use case is the guest.

4.2.4 Stimulus/Response Sequences --

Preconditions: The Guest must stand in front of Camera .

1.PiCamera Capture the Image of Guest

2.The captured image must saved as named to the current system date and time

Postconditions: path of saved image is ../ home/pi .

4.2.5 Functional Requirements --

Specializes: REQ-3

Specialized by: REQ-1

4.3 Send Image::REQ-3

4.3.1 Description--The purpose of this feature is to send the captured images from the RPi local storage to the Online DB such that o maintain the records with the date when the image is been captured .

4.3.2 Priority -- This requirement is high priority.

4.3.3 Source -- The source of this use case is RPi

4.2.4 Stimulus/Response Sequences --

Preconditions: The internet connection must be there and images must be available in the directory .

1. RPi send the captured image to the online database .

Postconditions: System will wait for response after successful transmission of image .

4.3.4 Functional Requirements --

Specializes: REQ-6

Specialized by: REQ-2

4.4 Door Unlock::REQ-4

4.4.1 Description -- When the host grants permission to the guest to enter the door is unlocked. To unlock the door, a function called open_door() has been defined. In the prototype developed, a 12V solenoid actuator has been used to demonstrate the unlocking of the door. The GPIO pins 18 and 23 have been configured as output. When the open_door() is called, these pins are activated. When the two pins 18 and 23 are set as True and False respectively the solenoid actuator runs and pulls the shaft in.

4.4.2 Priority -- This requirement is medium priority.

4.4.3 Source -- The source of this use case is Mobile App

4.2.4 Stimulus/Response Sequences --

Preconditions: Owner should send allow command through Mobile App via accessing the GUI.

1. As soon as RPi get the information from mobile App it allow the GPIO pins to set value from 0 to 1 or True .
2. After that Solenoid will be unlock .

Postconditions: System will wait for response after successful transmission of image .

4.2.4 Functional Requirements --

Includes: REQ-6
Connected by: REQ-5

4.5 Audio Response::REQ-5

4.5.1 Description --The system interacts with the guest at every step of the process through the speakers. The pygame mixer library module has been imported for this purpose. The required audio has been saved in the form of wav files. These files have been generated using text to wav conversion software. A sound channel

named sound channel has been initialized. The respective wav file is played at every step of the process by using the sound Channel. Play () function.

4.5.2 Priority -- This requirement is low priority.

4.5.3 Source -- The source of this use case is Mobile App

4.6.4 Stimulus/Response Sequences --

Preconditions: After viewing the image .
1. Owner shall send the Audio Response .
Postconditions: The response will be given to the RPi.

4.5.4 Functional Requirements --

Specializes: REQ-4
Specialized by: REQ-6

4.6 Mobile App ::REQ-6

4.6.1 Description -- Mobile App is Developed by which Owner can get the notifications of the Visitors/Guests .It is based on Android OS.

4.6.2 Priority -- This requirement is medium priority.

4.6.3 Source -- The source of this use case is Owner

4.6.4 Stimulus/Response Sequences --

Preconditions: Owner must receive the notification .
1. Owner click on the notification to view the image .
2. Mobile App contains Buttons for Unlock , Voice message .
3. Owner shall click on the buttons to perform these operations .
Postconditions: The response will be given to the GPIO pins of Rpi

4.6.5 Functional Requirements --

Specializes: REQ-4
Specialized by: REQ-3

5. Other Nonfunctional Requirements

5.1 Performance Requirements

The performance requirements for the Smart Door system specify how fast and reliably the product is expected to perform. The performance requirements for the IOT based "Door Unlocking System" include characteristics such as the time it takes to start/stop activities and maximum time it must take to set up the system.

5.1.1 System Setup

5.1.1.1 Description: The system shall be able to be mounted and configured in less than ten minutes by the end user. The user will mount the hardware near the door, and the configuration shall be defined as pairing the user's mobile device with the hardware.

5.1.1.2 Constraints: The user may require tools to bore holes for the mounting hardware. The user must have a PC and an Android OS for system configuration.

5.1.2 Notification Time

5.1.2.1 Description: While the system is operational and connected to the internet, the system shall notify to the user (Owner) of guest activity in less than 10 seconds.

5.1.2.2 Constraints: Notification time is dependent upon network bandwidth and connectivity.

5.1.3 Latency

5.1.3.1 Description: The user shall have an overall user request latency of less than 200ms .Overall latency includes the transmission of the user request and system response time.

5.1.3.2 Constraints: Overall latency is dependent upon network bandwidth and connectivity.

5.1.4 Response Time

5.1.4.1 Description: While the system is operating within the Active state, the system shall respond to user requests in less than 3 seconds.

5.1.4.2 Constraints: Response time will rely on network bandwidth and connectivity.

5.1.5 Initialization Time

5.1.5.1 Description: Upon device power on, the system shall be initialized after a period no longer than 1 minutes.

5.1.5.2 Constraints: None

5.1.6 Recording Log - Log Availability

5.1.6.1 Description: The logs shall be updated after interaction has ended.

5.1.6.2 Constraints: Availability will rely on network bandwidth and Connectivity.

5.1.7 Power - Power Supply

5.1.7.1 Description: The system shall be equipped with a power supply that will take a power source as specified in requirement 5.1.9 and provide an operating voltage of 5-12V and a current 1-2A.

5.1.7.2 Constraints: The types of devices chosen to implement our system will drive the specific power requirements.

5.1.9 Power - Power Source

5.1.9.1 Description: The system shall source 120V AC power from a standard household electrical outlet.

5.1.9.2 Constraints: Location must have 120V AC electrical outlet.

5.1.10 I/O Ports

5.1.10.1 Description: The system shall provide the appropriate I/O ports for interacting with components, including, but not limited to: General Purpose I/O ports, USB ports, and TRS phone jacks.

5.1.10.2 Constraints: Microcontroller will determine the type and number of I/O ports.

5.1.11 System Availability

5.1.11.1 Description: After initial configuration, the system shall be available at least 95% of the time that it is connected to both working 120V AC electrical power and a working internet connection.

5.1.11.2 Constraints: The mobile device and system must both have internet access and electrical power.

5.2 Safety Requirements

- This product shall only be connected to an external power supply rated at 5V dc, and a minimum current of 600-1800mA for Rpi and 12V dc and 2A for Solenoidal lock. Any external power supply used with the RPi shall comply with relevant regulations and standards applicable in the country of intended use. This product should not be overclocked without using the governator as this may make certain components very hot.

- This product should be operated in a well ventilated environment and the case should not be covered.

- This product should be placed on a stable, flat, non-conductive surface in use and should not be contacted by conductive items.

- The connection of unapproved devices to the GPIO connector may affect compliance or result in damage to the unit and invalidate the warranty.

- All peripherals used with the RPi should comply with relevant standards for the country of use and be marked accordingly to ensure that safety and performance requirements are met. These articles include but are not limited to keyboards, monitors, and mice used in conjunction with the RPi.

- Where peripherals are connected that do not include the cable or connector, the cable or connector used must offer adequate insulation and operation in order that the requirements of the relevant performance and safety requirements are met.

5.3 Security Requirements

5.3.1 Changing the default password : Every RPi that is running the Raspbian OS has the default username pi and default password raspberry, which should be changed as soon as we boot up the Pi for the first time. If our Raspberry Pi is exposed to the internet and the default username and password has not been changed, then it becomes an easy target for hackers.

5.3.2 Changing the username: All RPi come with the default username pi, which should be changed to make it more secure. We create a new user and assign it all rights, and then delete the pi user.

5.3.3 Making sudo require a password: When a command is run with sudo as the prefix, then it'll execute it with superuser privileges. By default, running a command with sudo doesn't need a password, but this can cost dearly if a hacker gets access to Raspberry Pi and takes control of everything. To make sure that a

password is required every time a command is run with superuser privileges, edit the 010_pi-nopasswd file under /etc/sudoers.d/ by executing the command.

5.3.4 Improving SSH security:-SSH is one of the most common techniques to access Raspberry Pi over the network and it becomes necessary to use if you want to make it secure**.**

5.4 Business Rules

A business rule is anything that captures and implements business policies and practices. A rule can enforce business policy, make a decision, or infer new data from existing data.This includes the rules and regulations that the System users should abide by. This includes the cost of the project and the discount offers provided. The users should avoid illegal rules and protocols. Neither Admin nor member should cross the rules and regulations.

Appendix A: Glossary

The following are the list of conventions and acronyms used in this document and the project as well:

Owner : Intended user of the Software .

Database : Use to store the data in organized format .

Use Case: A broad level diagram of the project showing a basic overview.

Rpi: It is a Microprocessor.

GPIO: General Purpose Input/Output .

SSH: Also known as 'secure shell' is an encrypted networking technology that enables you to manage computers from the command line over a network.

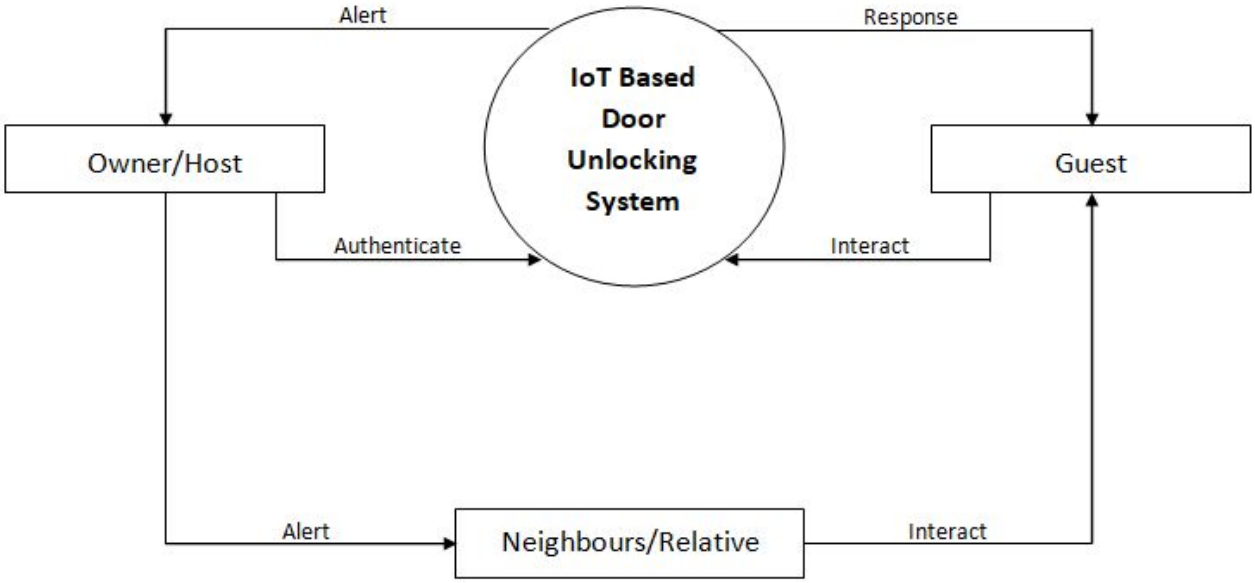
Connects: Links this requirement with another

Includes: Has the appropriate constraint in it .

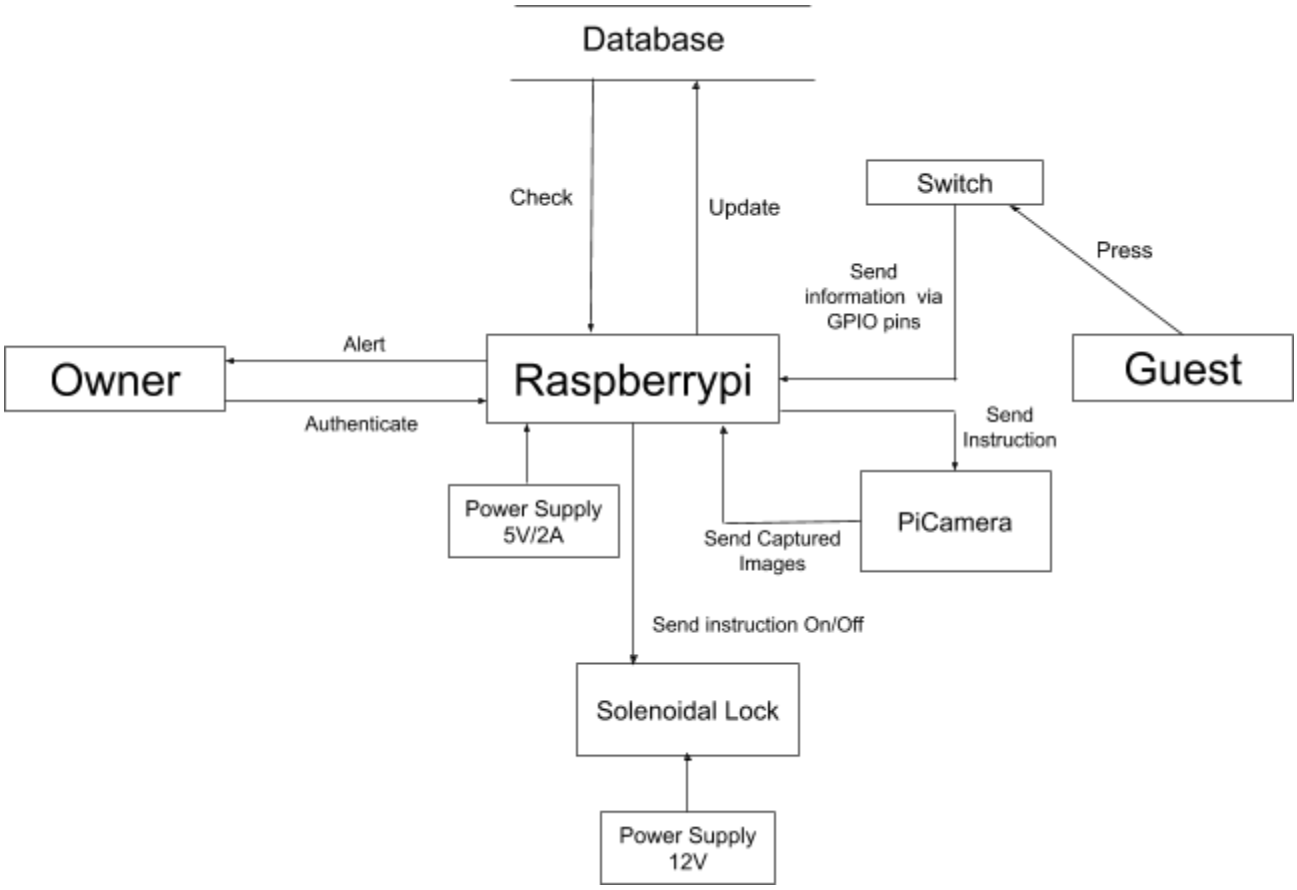
Extends: Shows or cancels a constraint effect if the conditions are met.

Appendix B: Analysis Models

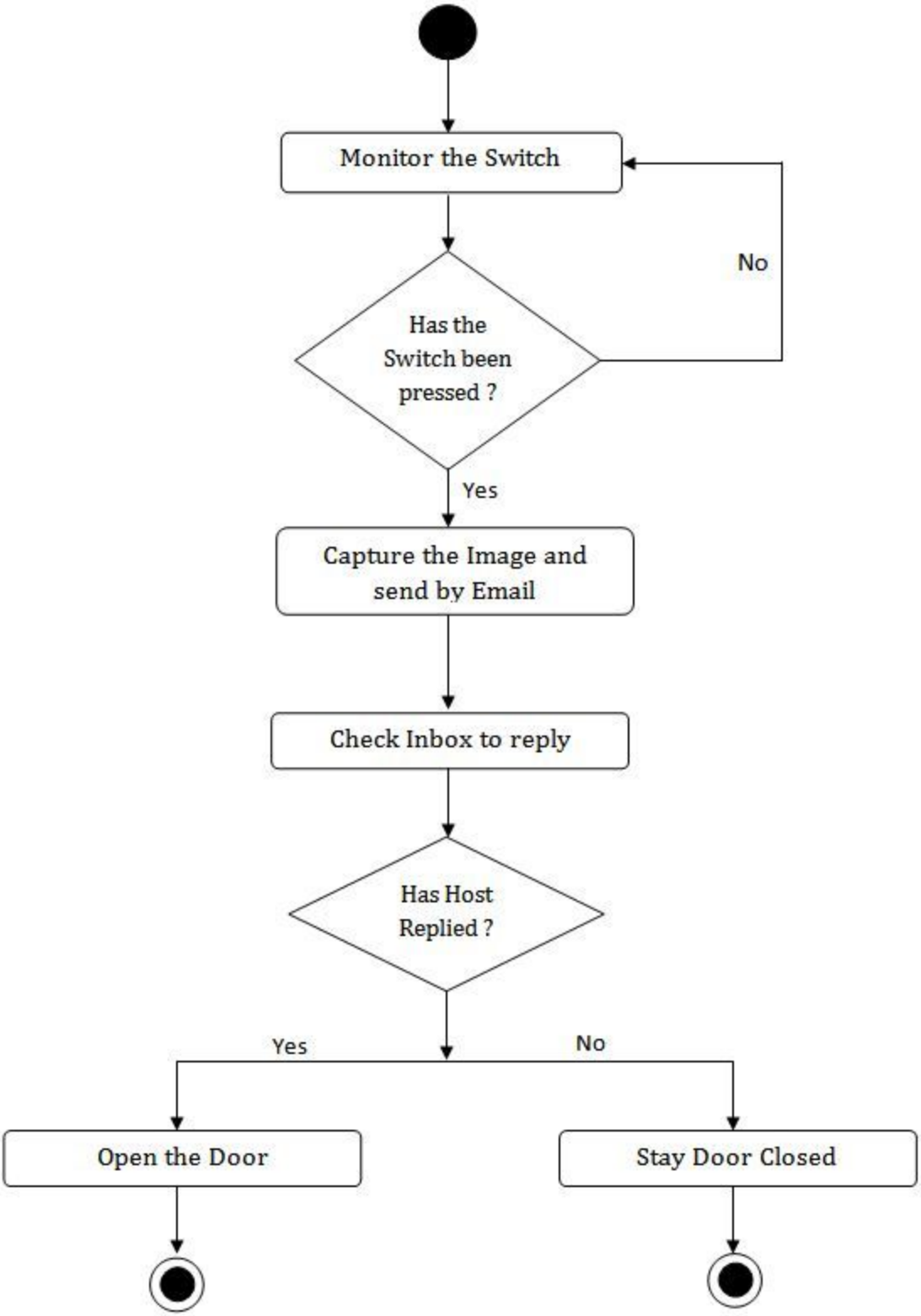
DFD LEVEL-0



DFD LEVEL-1


Database
Check
Update
Switch
Press
Send
information via
GPIO pins
Alert
Owner
Raspberrypi
Guest
Authenticate
Send
Instruction
Power Supply
5V/2A
PiCamera
Send Captured
Images
Send instruction On/Off
Solenoidal Lock
Power Supply
12V

ACTIVITY DIAGRAM



USE CASE DIAGRAM