

Home Security Automation Using Internet of Things

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Declaration

We, Sudipta Sharma, Borhan Uddin, Md. Azizul Islam declare that this thesis titled, “**Home Security Automation using Internet of Things**” and the works presented in it are our own. We confirm that:

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- Where any part of this thesis has previously been submitted for a degree or any other qualification at United International University or any other institution, this has been clearly stated.
- Where we have consulted the published work of others, this is always clearly attributed.
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Certificate

I do hereby declare that the research works embodied in this thesis/project entitled “**Home Security Automation Using Internet of Things**” is the outcome of an original work carried out by Sudipta Sharma, BorhanUddin, Md. Azizul Islam under my supervision.

I further certify that the dissertation meets the requirements and the standard for the degree of BSc in Computer Science and Engineering.

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Abstract

This project is about Smart Home Automation based on Internet of things. Basically this project is built to focus our smart life style. It is a smart way to lead our life easily and swiftly. It will save our time and from outside we can monitor our home and important work place. It will be secured and it does not need any extra man power.

In this project, we mainly focus on the usage of internet to provide secured home automation. We can control all our electronic devices through the Internet. We don't need to switch off or on the electrical things physically. We can control every electronic things through the process. We don't need to help a person for open or close the door. We can also open or close the door from remote distance on our smart phone or computer.

It's a digital process through which we can control every switch from distance place. So we can avoid the analogue way of controlling or monitoring our work place or house. We also have safe, secure, comfortable and smart way by internet of things. To provide security, we have used Amazon face recognition tool with door camera and provided a cloud-based security.

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Chapter 1

Introduction

1.1 INTRODUCTION

The Internet of Things (IoT) is an example where objects can be decorated with sensing, determining, technology and networking abilities that permit them to connect several devices and services over the Internet. Finally, IoT devices will be formula-aware, global and it will enable circumambient esprit. It's a concept where each device are assign to an IP address and through that IP address anyone makes that device identifiable on internet.

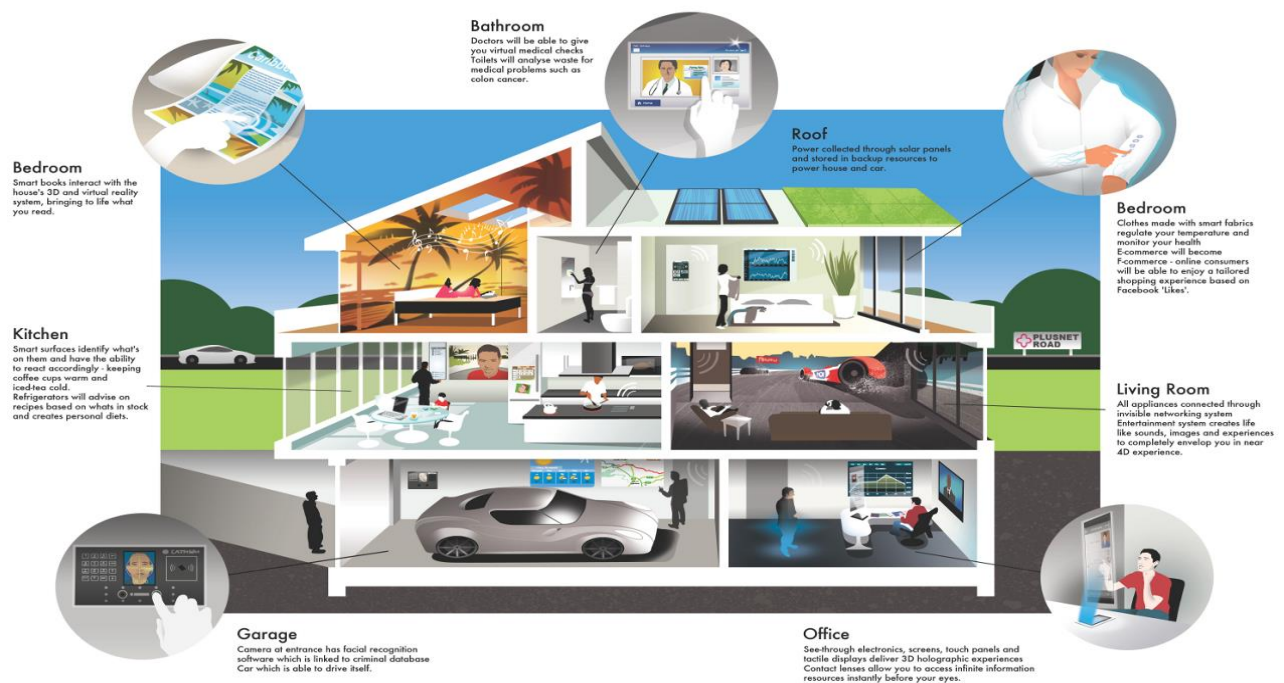


Fig 1.1: Smart Home Automation

1.2 PROBLEM STATEMENT

Sometimes we forget to turn off our electric devices at home and sometimes we wish to run our electric devices automatically when they needed. In a single sentence we can say that “we just need smart devices who can understand our need in time”. This is the era of information. We always want to get information of everything. We can’t get information of our home devices all the time when we are not in touch with them.

Surveillance is another major issue of our daily life. The world is getting smarter day by day that’s why we also feel need of a smart surveillance system. How it would be if any such devices keep an eye all the time to keep our home scrutinized. Another salient need is security, i mean smart security system. We feel need of a smart secured authentication system to keep our home secured.

1.3 Motive of this Project

- Simplify management system.
- Data model for information gather and manage communication
- Stability of the platform
- Make tasks more convenient
- Save money on utilities
- Home security
- Good for the environment
- Peace of mind
- Wireless Technology
- Appliance controlled through **mobile or Laptop from outside.**
- **Notification** via Email.

1.4 Goal of this Project

There are lots of scope where we can deploy this project. We can mention few of them.

- Blindly we can deploy this project in our home to make it smarter.
- Corporate offices are another scope to deploy this project.
- To keep track of industrial production this project is very suitable.
- Educational institute can use this project for several purposes.
- Any kind of surveillance.
- To reduce the waste of power.
- In any movement to prevent any outsider's entry.
- For research purpose.
- To collect different types from people.

1.5 Prospect of this project

- We want to connect all the devices of a home through internet.
- They will operate automatically when it is need.
- We will train all the devices using "Machine learning" to operate by itself.
- Simulated in the model in a real house, developing a more advanced motion detection algorithm.
- Car parking autonomously avoiding obstacles.
- Create a system that accommodates my proposition, if possible.
- Power by Solar System.
- Automatic cut off between Solar and Main Power
- Data Analytics – appliance usage

Chapter 2

Theoretical Background

2.1 Internet of Things (IoT)

IoT (Internet of things) refers of physical device that connected to the internet for collecting and sharing data. It has also known as complementary of physical device.

Use of IoT:

- >For Home security
- >Measuring distance from home to any destination
- >Review the weather
- >Set any direction for transport system
- >Use for digital telemedicine

2.2 Artificial Intelligence

The interest of human intelligence processes by machines, especially computer systems is called artificial intelligence (AI). These techniques join learning, self-correction and contention. Particular function of AI includes speech recognition, expert systems and machine vision.

2.3 Internet of Things (IoT) with Artificial Intelligence

The Internet of Things (IoT) word declared in recent years to identify objects that are connected through the Internet. Things' means to devices that is connected to the Internet and transfers data to another devices. The cloud-based IoT is used to connect a wide range of things

such as sensors, mobile devices, vehicles, industrial materials to develop different smart systems in smart city or smart home, smart grid, smart industry. In the IoT, cloud computing handling the large volume of data generated by connecting devices easy and provides the IoT devices with resources on-demand.

Artificial Intelligence (AI) The Internet of Things (IoT) will play an important role in affluent resource in the future. There are multiple forces which are driving the growing need for both technologies and more and more industries, governments, engineers, scientists and technologists have started to implement it in manifold circumstances. The dynamic benefits and advantages of both IoT and AI will smeared when they are attached.

Moreover, AI can be used with machine learning in smart-homes to make an actually eminent smart home. Likewise, AI and IoT can be used to explore the human attitude via Bluetooth signals, motion sensors or facial-recognition technology and to make the similar changes nature.

2.4 IoT Won't Work Without Artificial Intelligence

IOT(Internet Of Things): It is a technology, through which devices can interact with each other. The “things” in the Internet of Things means it is more than wearable technology pervaded to our cities, our homes and far.

AI(Artificial Intelligence): It is sub-domain of computer science, which aims to develop the computer system capable of performing intelligent task, which only human can perform like language understanding, speech recognition, pattern recognition, decision-making, language translation, etc.

2.5 Focus on Home Automation

Home automation is like building automation for home. it is also known as smart home. it can control lighting, climate, entertainment system, and security also. by using home automation it makes our life so easier.

Benefits of Home Automation:

- > Cheaper
- > Its secure
- > Its automated, not need to work manually
- > For security purpose no need to keep any guard
- > Reminds for schedule
- > Check & measure the weather.
- > Auto notifying system
- > **Control electrical device, Door by smartphone or tab or laptop from outside.**

2.6 Home Security in IoT

IoT (Internet of thing) is infrastructure of connected physical device. Home security is a very useful application of IoT and we are using it as it is very cheaper than any other system and it works well. System can notify the admin for unauthorized entry by using face recognition and matching the pattern. After take the notification admin can take action against the unauthorized person. The main benefits of home security through IoT are it is cheaper, maintenance cost is low users. By using this manufacturers and users both will be benefited.

Chapter 3

Basic Introduction to the Main Products

3.1 Raspberry pi

Raspberry pi is cheap Microprocessor that tampon's into a monitor or TV. It is an efficient small computer which can be used in electronics projects, and for many of the things that computer works. we can also learn how to program languages like python. Raspberry pi 3 has 64 bit cpu, Wi-Fi, Bluetooth also many others facilities.

Use of raspberry pi:

- > Make Home networks through Wi-Fi signal.
- > If raspberry pi is connected to home network and some print server software we can make wireless print server.
- > It can build networking monitoring tool.
- > Home automation system with arduino.
- > can be build smart speaker.

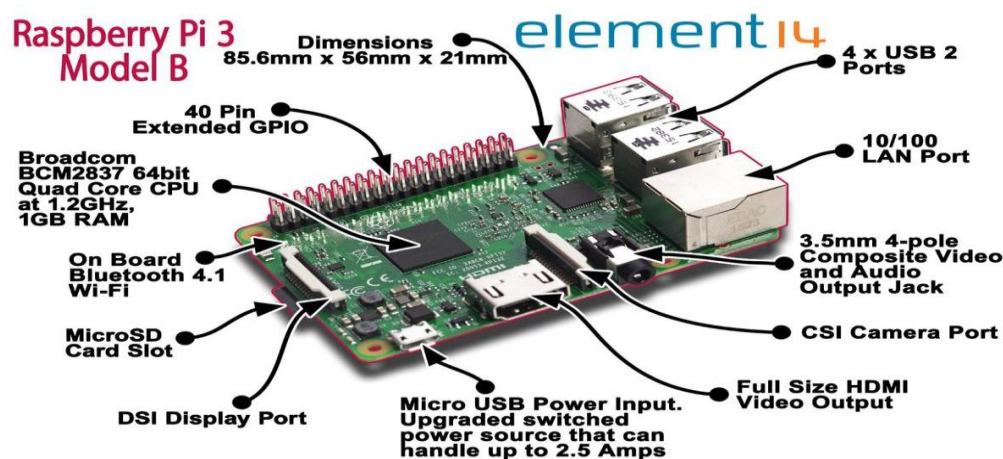


Fig 2: Raspberry pi

3.2 SERVO MOTOR

Servo motors are self-controlled electric device. It has maximum pulse, minimum pulse and repetition rate. It can be turned 90 degrees in any direction. There are different types of servo motors like position and rotation servo, continuous rotation servo and linear servo. by selecting and controlling we can use any types of servo motor.

Use of Servo motor:

- > used in robotics for actual movement
- > Automated door opener
- > Control the wheel of robotic vehicle
- > Control weaving machine in textiles
- > Used for solar panel angle adjust



Figure 3: Servo motor

3.3 PIR sensor

The PIR (Passive Infrared) Sensor detects motion by standardized changes in the infrared (heat) levels throw by contiguous things. It is a pyro electric device. When motion is detected the PIR Sensor outputs a upper signal on its output pin.



Figure 4: PIR sensor

3.4 Temperature Sensor

LM35 is a temperature sensor. It used to detect the temperature in a centigrade scale. it's low output resistivity and analog output. LM35 is less prone to oxidation and can measure high voltage range than that of thermocouples.

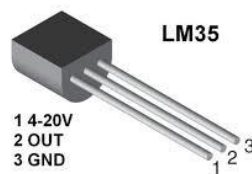


Figure 5: LM35 Temperature sensor

3.5 Relay

Relay closes and open the circuit's electro mechanically. it monitoring one electric circuit by closing and opening contacts in other circuit. This type of switches is extremely necessary for a diversity of Raspberry Pi projects.

Take two jumper wires and connect one of them to the GPIO port on the Pi and the other one to the GND Pin. The other ends of the wire to the relay board. Connect the GND to the GND on the relay and GPIO Output wire to the relay channel pin number, which depends on the relay that are using. Remember the GND goes to GND on the relay and GPIO Output goes to the relay input pin.



Figure 6: Relay

All the switches like light, fan, ac, TV and others electronics devices are connected to this relay and its off/on are controlled via Raspberry Pi.

3.6 Other Components

- Must be Internet connection.
- A monitor,
- A USB keyboard that connects to Pi.
- A mouse that connects to Pi.
- A Mac or a PC that is running Windows or Linux.
- A USB-SD adapter or micro SD card to burn the operating system image onto the micro SD card.
- A 16 GB or above micro SD card.
- A breadboard.
- 6 F/M jumper wires.
- A diffused 10mm LED.
- A adapter
- Power supply

Chapter 4

Procedure & Description

4.1 Why security in Home Automation

This project makes human life tasks easier. This is wireless technology, so it is good for our environment. It also save our money like security guide or monitoring person, and also save utilities. After all family members or a single person can enjoy this project so that's the Peace of mind.

4.2 Procedure

Step 1: Install python 3.5 in raspberry pi. Sudo apt-get installs python3.5.

Step 2: Create an account an Amazon web server.

Step 3: Create a Gmail account

Step 4: set A press button with raspberry pi GPIO port.

Step 5: set a camera with raspberry pi in USB port.

Step 6: write a python code to capture photo when press button.

Step 6: also write python code for connect to AWS and Gmail server with raspberry pi.

Step 7: set a servo motor with raspberry pi GPIO port.

Step 8: install Node Red dashboard for controlling servo motor switch. (UI)

[N.B: need a REAL IP for controlling all process from outside]

4.3 Description

4.3.1 Raspberry pi setup:

First off all, raspbian OS install in raspberry pi. Then need to install python, node Red dashboard and some of configuration. After that, there need to update and upgrade. Then reboot the raspberry pi.

Sudo apt-get install 3.5

Sudo apt-get install npm

Sudo apt-get update

Sudo apt-get upgrade

Sudo reboot

4.3.2 AWS account:

Create a AWS account in amazon web server. with a valid master debit card A/C number.

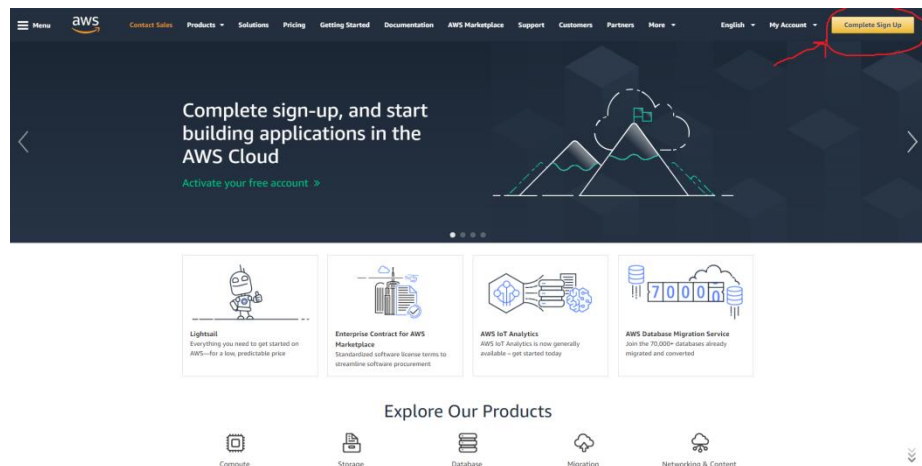


Figure 7: AWS website

Boto3API is used for face recognition.

AWS give an authentication secret key for connecting raspberry pi. To see details, apply

ls ~/.aws

if you use one or the SDKs in addition to the AWS CLI, you may notice additional warnings if credentials are not stored in their own file.

The files generated by the CLI for the profile configured in the previous section look like this:

~/ .aws/credentials

```
[default]
aws_access_key_id=AKIAIOSFODNN7EXAMPLE
aws_secret_access_key=wJalrXUtnFEMI/K7MDENG/bPxrFcYEXAMPLEKEY
```

~/ .aws/config

```
[default]
region=us-west-2
output=json
```

The following settings are supported.

aws_access_key_id – AWS access key.

aws secret access key – AWS secret key.

There is a graph to see how many API are successfully called from AWS.

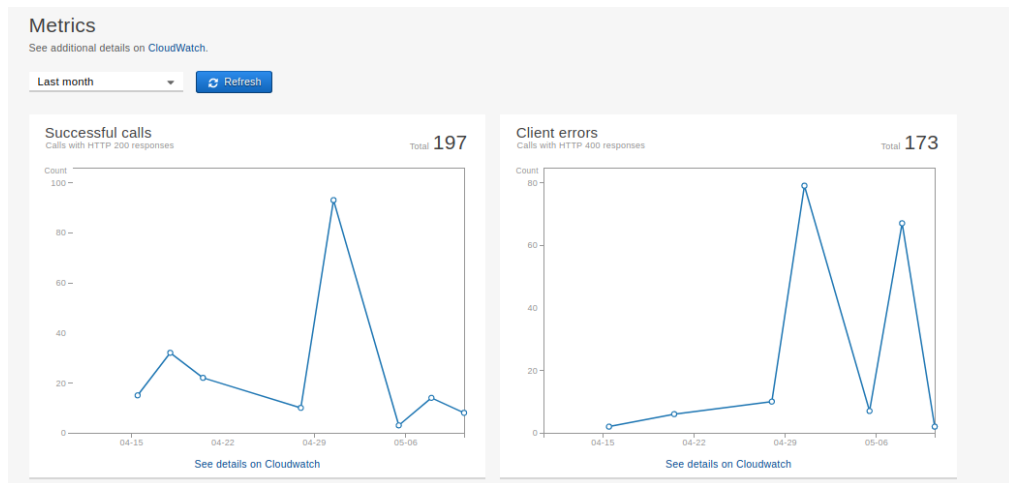


Figure 8: Graph of Successfully API call

4.3.3 Press button and Auto Capture for Recognition:

There need to be a signal or data in raspberry pi for take action. It can generate randomly or manually. Random or auto data scanning take huge space and make slow the processor. So we use manual data with a button press that's set in GPIO ports with wire. It generate the signal in raspberry pi to capture photos.

4.3.4 Servo motor setup:

Add a servo motor with the door. All the mechanisms are controlled by a Microcontroller through power supply.

Codes are given in page 27 [5.4].

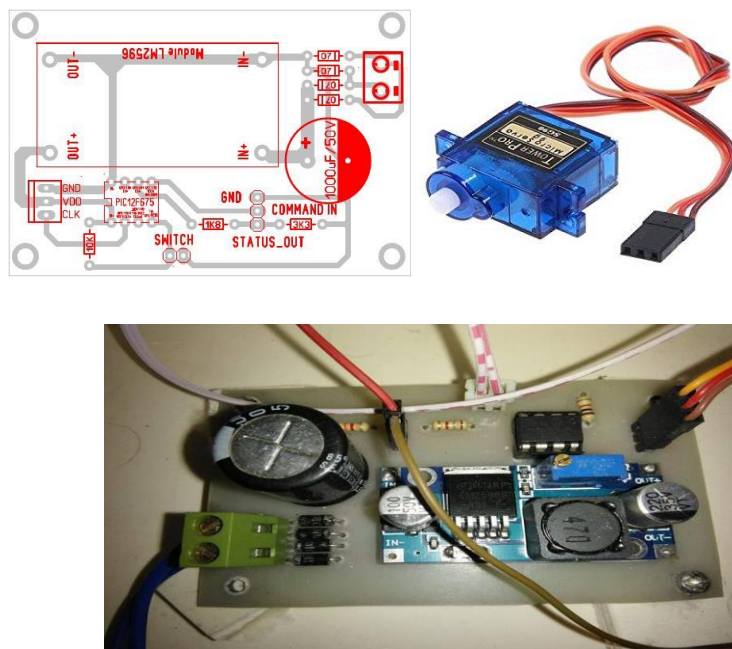


Figure9: Servo motor with Microcontroller

4.4 Full Description of this project:

At first a number of photos folder are store in raspberry pi for matching the instant captured photo.



Figure10: Authorized user photos

When `sudo python3.5 camera_work.py` this command is run in raspberry pi terminal, The camera is ready to take photo and it will be waiting for a signal from press button. [*camera_work.py is a file where camera configuration codes are written.*]

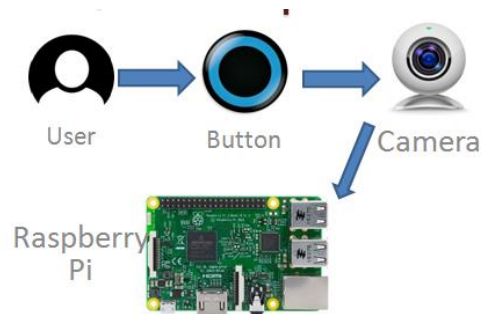


Figure11: Press button and capture image

After press the button it automatically capture the photo and tries to match the photo from storage folder. It tries to match the photos one by one, if it match a photo more than 80% (threshold value=80), the green LED blink for once and open the gate automatically.

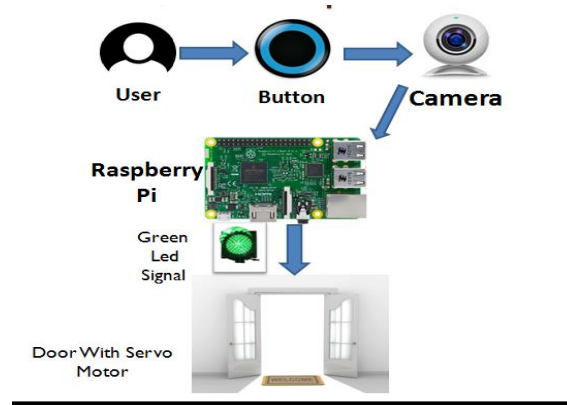


Figure 12: Photo matches and opens the door

If the recent taken photo does not match with any of the saved photo from the storage folder then it send an **Email** to the authenticate users and the door remain closed and he can't get permission to enter.

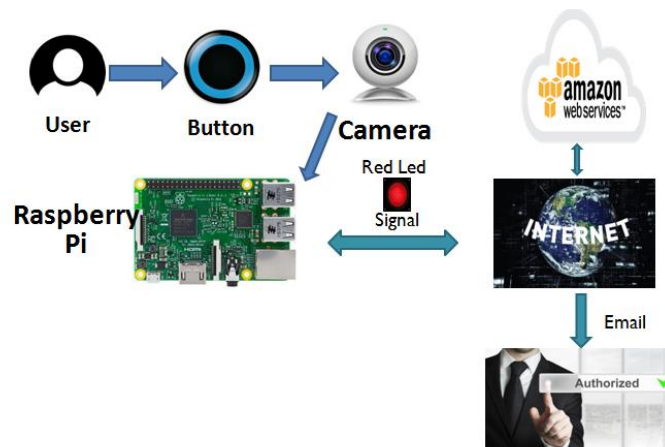


Figure13: Notify Email

There could be another scenario. If there comes a person who is familiar with the authenticate user but there is no saved photo in the storage folder of that person, the homeowner want to give him access. Then any of the authenticate user can open the gate from remote distance over internet just pressing a button.

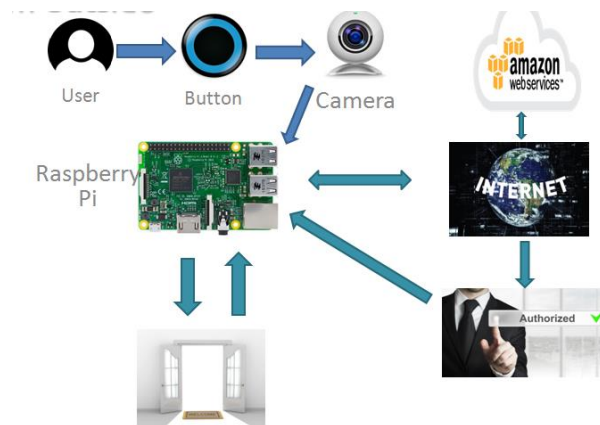


Figure 14: open door from outside

4.5 Node red dashboard

It needs to enter UI interface (“Node red” building interface on raspberry pi) to control from outside for opening or closing the door. Light, Fan, AC and all electronics devices can be controlled through this UI interface.

For install updated node-red dashboard try this command in terminal.

```
npm i node-red/node-red-dashboard
```

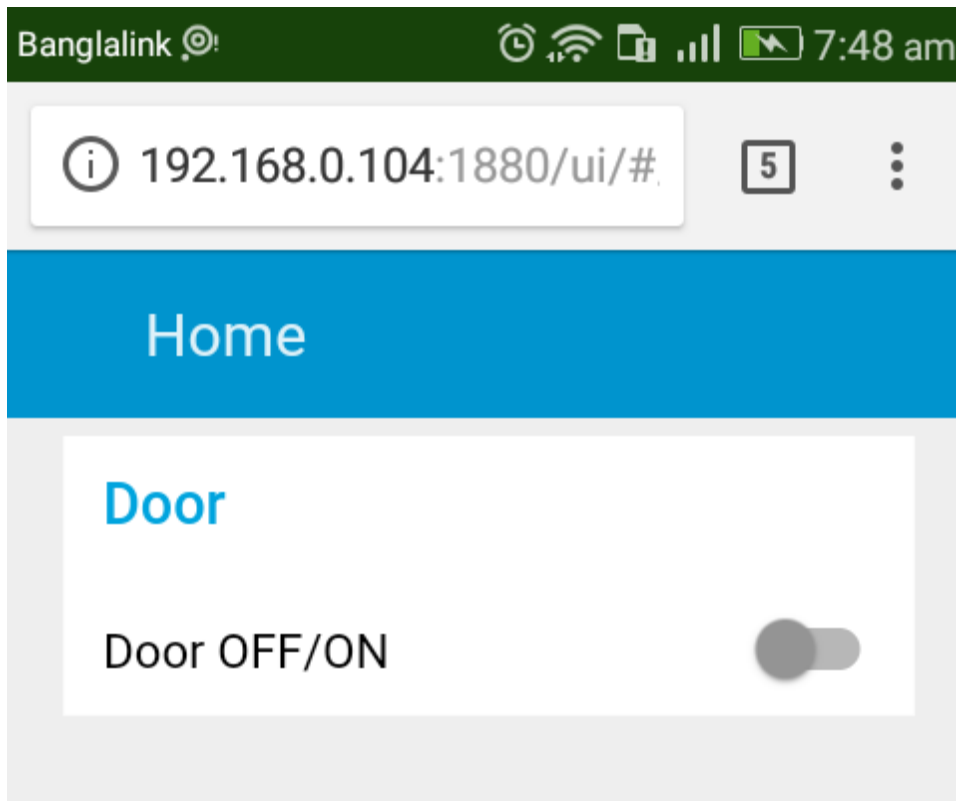


Figure 15: Node-red interface

For enter the interface, there need to type “*local host ip:1880/ui*” in browser URL.

Chapter 5

Algorithms

5.1 Flow Chart:

We can see the flowchart of every step of our methods. Figure 16 shows how face recognition working and what will do if photos match or does not match.

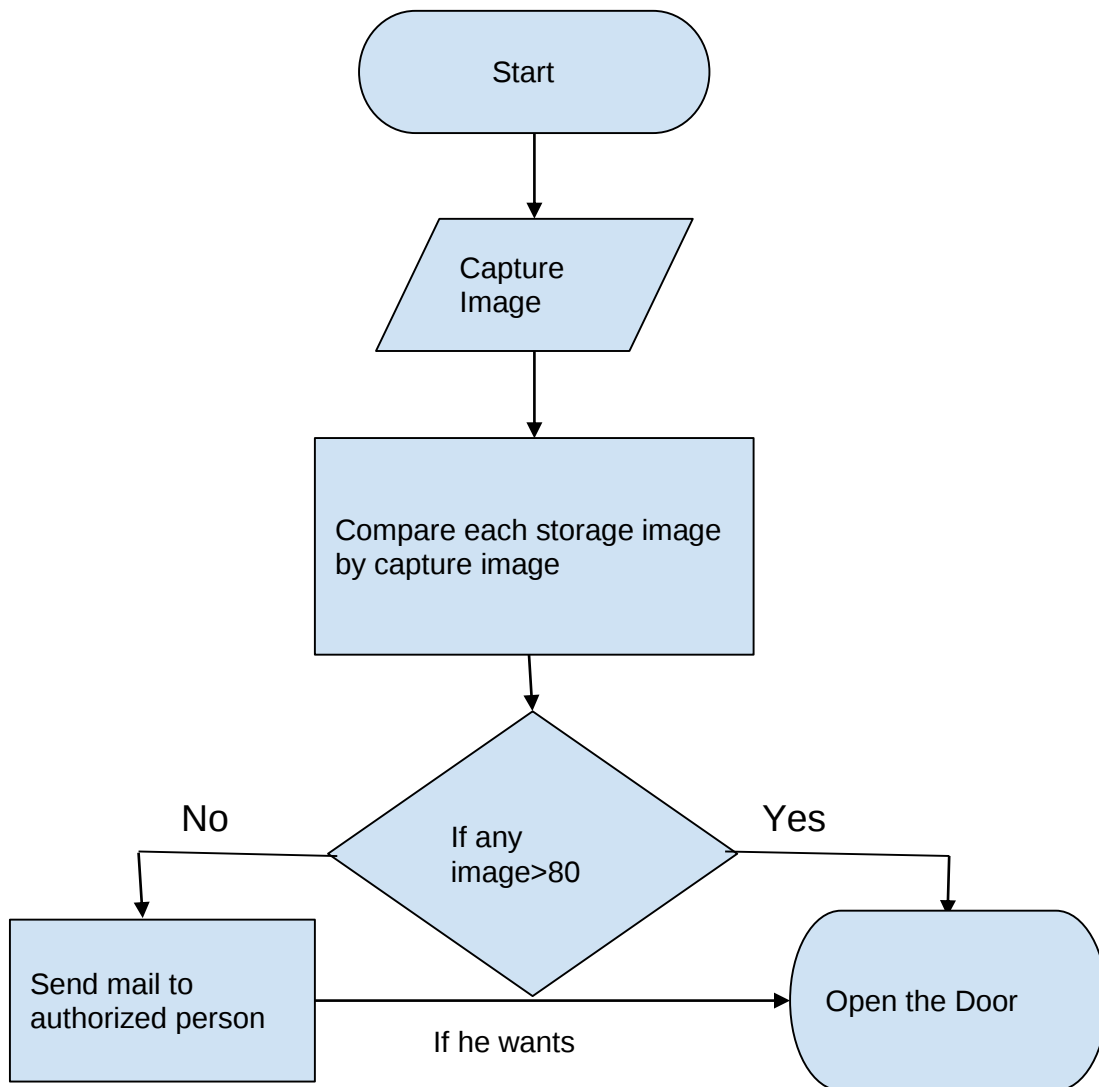


Figure 16: flowchart

5.2 Algorithm 1: Algorithm to capture image and face recognition

Deep learning (DL) is a subfield of machine learning based on learning multiple levels of delegations by making a chain of command of features where the upper levels are defined from the lower levels and the same lower level features can help in defining many upper level features. Here is use Constructive algorithm based on Deep learning classification (level detection).

```
read_photos()
    Store image list;
    For each photo in the family photo directory
        Open file name as source image;
        Image list = read image;

Return image list;

Process_image()
    Read family photos;
    client ←- call recognition api;
    Values ←-;

    Capture an image and store it source bytes
    For each image in family photos
        Response = compare photos with the recent captured photos;
        Values = response values;

    Values append (response values);
    Return max (matched values);

Capture_image()
    Call webcam;
```

```

While true
    Input_state = GPIO.input from 18 no pin of raspberry pi;
    If input_state false
        capture_image();
        Value = process_image();
        If value < 80
            Send mail to the homeowner;
        Else
            open the gate;

```

5.3 Algorithm 2: Algorithm to notify homeowner

```

send_email()
    Take sender's email and password;
    Take list of email recipients;
    Attachments = captured image/ unrecognized image;
    For file in attachments
        Open file;
        Message = MIMEBase('application', "octet-stream");
        Encode the message;

    Message composed;
    Call SMTP gmail server
        Login
        sendmail(sender, recipients, composed);
    Print email sent;

```

5.4 Code for Door open & close in Microcontroller

```

void InitTimer1()
{
    T1CON      = 0x11;
    TMR1IF_bit  = 0;
    TMR1H      = 0x3C;
    TMR1L      = 0xB0;
    TMR1IE_bit  = 1;
    INTCON      = 0xC0;
}

#define Servo GP5_bit
intclk=0;
intservo_clk=0,ddd=0;
void Interrupt() iv 0x0004 ics ICS_AUTO
{
    if (TMR1IF_bit)
    {
        TMR1IF_bit = 0;
        TMR1H = 0x3C;
        TMR1L = 0xB0;
        //Enter your code here
        clk = servo_clk;
        Servo = 0;
        for(ddd=0;ddd<clk;ddd++)
        {
            Delay_us(2);
            Servo = 1;
        }
        Servo = 0;
    }
}

void main()

```

```

{
    TRISIO1_bit = 0;//output
    TRISIO2_bit = 1;//input
    TRISIO3_bit = 1;
    TRISIO5_bit = 0;
    CMCON = 0x07;//comparator off
    ANSEL = 0x00;//all digital
    ADCON0 = 0x00;
    InitTimer1();
    servo_clk=78;//close
    while(1)
    {

        if(GP2_bit)
        {
            servo_clk=30; //open
        }
        else
        {
            servo_clk=78;//close
        }

        if(GP3_bit)GP1_bit = 1; //open status
        else GP1_bit = 0; //close status
    }//while(1)
}

```

Chapter 6

Summary

6.1 Conclusion

We can learn many things by completing the project. It's made our life easy and comfortable. By this interface we don't need extra security because it only allows the person to open and close who are actually involved. So in that case it is safe. We do not need cc camera and others because it has its own security. It also saves our electricity. The designed system not only monitors unauthorized persons, but also monitors the sensor data, like temperature, motion also electronics devices like light, fan, ac, TV. We control home appliances from anywhere in the world and its response quickly. It is a simple and user friendly.

6.2 Where this project can be used?

1. Any house or work place.
2. For any surveillance.
3. Monitoring business or offices from remote distance.
4. School/college/university can use this project to count attendance automatically and notify guardian.
5. To make the city smarter this project can be highly demanding.

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