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Smart Door Security System using Raspberry Pi with Telegram

Shivani Desai[1], Virendra D Pawar[2]

[1]*Shivani Desai, Dept. of Computer Engineering, Vishwakarma Institute of Technology, Pune, Maharashtra*
[2]*Virendra D Pawar, Asst. Professor, Dept. of computer Engineering, Vishwakarma Institute of Technology, Pune, Maharashtra*

Abstract - *In modern world, the IoT is at its peak. The world is becoming smarter, the home automation is emerging. Smart Door control system is a latest technology in home automation. The main purpose of smart Door technology is to provide a complete security to the door, ease and comfort for users. The aim of this paper is to enlarge the door automation technique using Raspberry pi and android phone. Raspberry pi controls PIR sensor, camera module, bell button, which is used in detecting the motion of a arrival of a person, capturing an image of a person as soon as the bell is being pressed and sends the still image to the android device through telegram app and alerts the owner about the person standing at the door. The entire systems programming has been established in python 3.5 domains for raspberry pi operations.*

Key Words: IoT, Telegram, Raspberry pi, python, Putty, Security

1. INTRODUCTION

In today's era every "thing" has its unique identity that is what IoT (Internet of Things) is. It enables the connectivity with physical devices and allows user to transfer the data across the world through the networks. The technology is playing a vital role in day-to-days life. Likewise the security. The main objective of this project is to build a system that will control the door using a smart phone. This system includes various components like a Raspberry Pi model B3 (Inbuilt-Wi-Fi), PIR Sensor, Bell, Camera Module and a Telegram App for getting the notification on an Android Device.

The Purpose of this system is that whenever the person arrives in front of the door , the person's motion is been detected by a PIR sensor and as soon as he/she presses the bell button, the camera captures the image and the still image is sent on a telegram app of an android device. The components are connected via raspberry pi which has an internet connection through Wi-Fi.

The user can unlock the door with the help of a mobile phone as soon as he/she gets notification. The user will unlock the door if the person is known and will give authentication to enter the house.

Now a day's security plays a foremost role as per as high-tech things are taken into the consideration "more the technology, higher the security". This paper procures the security to the raspberry pi, to secure it from getting hacked. SSH keys (asymmetric cryptography) network security is being used in this project. User can also use a FAIL2BAN method to secure your raspberry pi.

2. LITERATURE REVIEW

Nareshkumar R.[1]This paper is related to design a home based automation system using smart phone and RPI having biometric system. It captures the images when sensed through PIR sensor, and using GSM technology the communication has been done between the system and a computer.

Reeta R[2]This paper uses the Eigen face detection technique, where image is been captured using a snippet code detecting the features of a person, the captured images are stored into the database and. Access is given to the members particularly whose image is already in the database , alert is send if unauthorized face is detected using GSM.

Rishabh Kumar Gupta [3] This paper consist of remote access control system, switch and the speaker is used for interacting with the guest standing right outside at the door. Zigbee module is designed to support wireless sensor network. Image is captured to the primary host and if needed then to the secondary host, so locking and unlocking of door is done.

D.Kishore[4]This paper uses the Raspberry pi, PIR sensor which captures the images, saves it on the system and sends it through Email via TCP/IP. Entire system is built using ARM1176JZF-S microcontroller, implementation is done on smart phone using JavaScript.

3. SYSTEM OVERVIEW

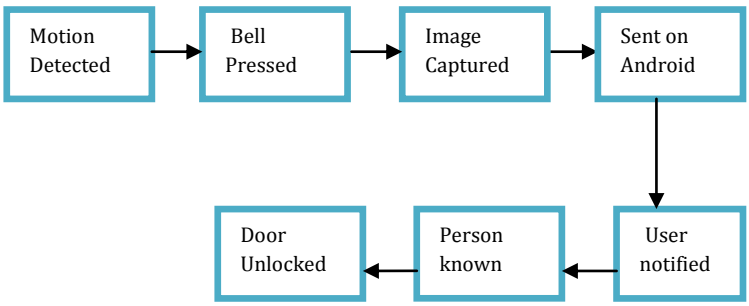


Fig-1 Functional Block Diagram

As shown in fig-1 The Motion is detected using PIR sensor, and when bell is pressed still image is captured and sent to a user on an android app ,user gets notified , and if the person is known then the door is unlocked by the owner. System requires following components:

1. Raspberry pi B3
2. PIR Sensor
3. Camera Module
4. Wi-Fi Module
5. Telegram App

1 Raspberry pi-3 Model B:

Fig-2 Raspberry pi-3 ModelB

Raspberry pi is a small credit card size computer, which acts as a heart of the whole system. Its a BCM2837 processor, System on chip (SoC) With an ARM having a CPU and GPU. The CPU consist of Quad core ARM-Cortex A53, 64 bit. Consisting of 1GB RAM. The RPI include a wireless connectivity with802.11 wireless LAN (Wi-Fi) and Bluetooth 4.1, 4*USB 2.0 ports, a set of GPIO (2*20 pins) header. It also has an audio jack, a camera interface, display interface, HDMI port. It requires a power supply of min 2.5 A for glowing up the repositioned Led's. It has a small SD card slot at its back, inserting the OS, other files import it in the card and then export all the files and get started .Changes can be made as per the requirements.

$sudo apt-get update && sudo apt-get update

$Sudo reboot

The above commands will help user to update the raspberry pi and can proceed further to configure the pi.

2 PIR sensor:

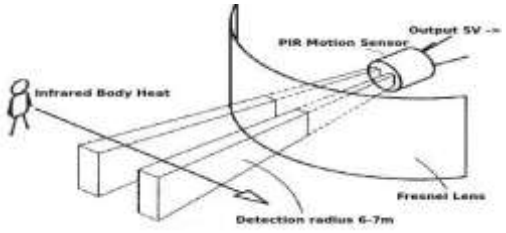


Fig-3 PIR Sensor

PIR (Passive Infrared sensor) is an electronic component that measures any kind of object (person / animal in the field. The window behind the lens is made up of IR-transmissive material. The Fresnel lens condenses light up to some 6-7 meters and its highly sensitive. It has a pins consisting of VCC, Ground and the Output. The output is given to GPIO pins of Raspberry pi through 5V of power supply to the VCC.

3 Camera Module

Fig-4 Camera Module

The camera module is a 5MP customized designed camera for a raspberry pi. It has a small socket at the board named as 'Camera Interface' situated between HDMI port and Ethernet. Insert the camera module into its slot, designed for interfacing a camera. This module allows the user to capture the still images and also to record a video in full HD. When the picture is taken its camera preview is opened for few seconds, using python coding adjust the resolution and send the image to an android app.

"Sudo raspi-config" is the command which allows you to enable the camera module on raspberry pi.

4 Wi-Fi Module:

Wi-Fi is a wireless technology that provides high speed connectivity. It is trademarked as IEEE 802.11x. it is supported by many applications such as video games , home networks , mobile phone etc. The Wi-Fi is the most favorable choice for IoT now days which will increase the speed of connecting the network worldwide. In this system the Raspberry pi has a in-built Wi-Fi, hence accessing it from anywhere, controlling the raspberry pi

5 Telegram App on Android Phone:

Fig-5 Telegram App

The telegram app is heavily encrypted app. It delivers the messages, images, documents, files faster than other apps. It is highly secured from attackers, as it has end – to end encryption and it is a cloud based app. It can be accessed from multiple devices as well. It also procures a "Secret Chat" facility which has self destructing feature.

4. METHODOLOGY

When the person arrives at a home and stands in the front on the door, he/she will get detected by PIR motion detector, Led glows as motion is detected, The PIR sensor is connected to raspberry pi, it has three pins. The GND pin is connected to GND of RPI, VCC is connected to 5V and the output is connected with any GPIO pin. As soon as the person will press the bell the image is captured with the help of a camera module. The push button is used as a switch, inserted in a breadboard, one wire is connected with GND and other is connected to some GPIO pin. The image of a person is captured and stored in a RPI and immediately send on an android phone, whenever the bell is pressed. The CLI-Telegram is used on an mobile phone, Linux commands are used for the installation process, since telegram is highly secured app, has various features like Secret chat, has end to end encryption and also can send data and files up to 1.5 GB.

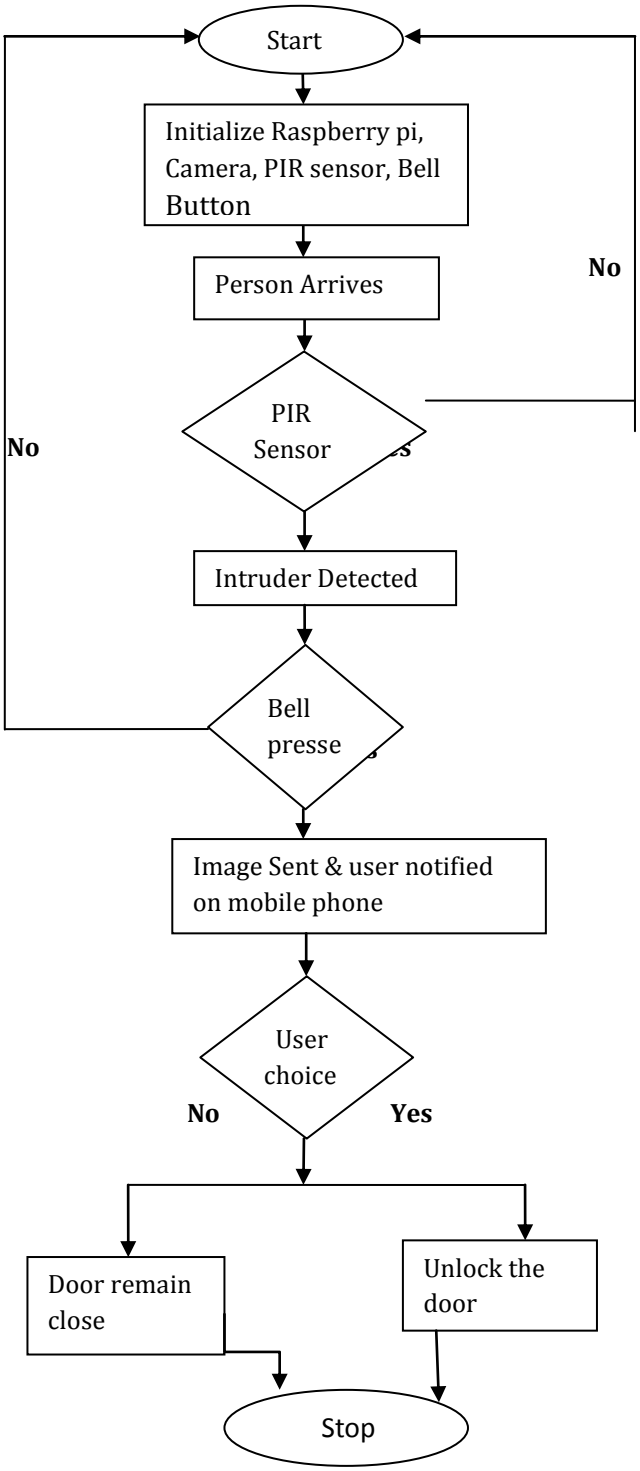
User need to add the contact details while installation process , the data will be save in the script call tg.sh and the photos will be saved in a script tg_photo.sh , these scripts are saved in home/pi/tg.

Then after the still image is been sent, the user will unlock the door if the person is known. The unlocking of door is done when a user presses "1" on a telegram it will unlock the door.

The requirement of this projects include a Raspberry pi model 3B having a SD card which has a Raspbian OS , a switch , a camera module of 5Mp , a PIR sensor and an android phone with installation of an telegram app in it. It also requires a power supply of 1.5A to even 2A, a USB cable. The coding is done in python having a python IDLE version 3.6. The necessary modules and libraries are also imported.

The Network security is playing a Vital role, the PUTTY and PUTTY GEN are used for SSH (secure shell) The SSH key is generated using a asymmetric cipher i.e. generation one public and private key. The public key can be shared among users, while a private key remains with the owner.

5. FLOWCHART AND ALGORITHM



1. Start
2. Initialize Raspberry pi, camera module, PIR sensor, Bell Button etc
3. If person arrives, he/she will get detected by PIR sensor
4. If the person presses the bell, then the image is captured by the camera and will send a notification and a snap on a smart phone.
5. The telegram app is been used to get the notification on a smart phone.
6. The snap is sent, it's a user choice to open a door or to keep it close.
7. Stop.

Fig-6 Complete Setup

6. NETWORK SECURITY

SSH (Secure Shell) is a cryptographic Network protocol which is used for securing a raspberry pi.

SSH uses an Asymmetric Cipher an algorithm that performs encryption and decryption.

As SSH key has a user name and password which can be stolen in the middle, but the SSH generates a pair of key: Public and Private Key.

The data can be encrypted by using a user's public key and can be only decrypted by the private key.

In this project Putty and putty Generator are used for generating the SSH for securing a raspberry pi

HOW TO SECURE RPI USING SSH:

1. Download Putty and key Generator.

2. Select key generator and click on "import- key".

3. Generate the passphrase.

4. Putty will generate the public and private key

5. Save the private key with .ppk file

6. Now open the Putty and enter the host name, select SSH-> authentication -> browse the private key and close it.

User must change the default "User name" and "Password"

$sudo raspi-config
Improve SSH security by using the following command -
$sudo nano /etc/ssh /sshd_config

User can make a use of FAIL2BAN, it is an intrusion prevention software framework that protects computer servers from malicious attacks, hence improves the security of the Raspberry pi

It scans log files and bans IPs which are showing the malicious signs, which make too many log in attempts or performs unwanted activity.

HOW TO SET UP FAIL2BAN IN RPI?

Step1:$sudo apt-get installs fail2ban
During installation create a file "jail.conf"

Step2:$sudo
cp/etc/fail2ban/jail.conf/etc/fail2ban/jail.local

Step3: open file in nano editor:
sudo nano /etc/fail2ban/jail.local

Step4: within that use CTRL + W and search sshd
Type: enable = true
Filter =sshd

This shall process and enable the fail2ban and configure it.

7. CONCLUSION

We have a designed a smart system which reduces the human efforts and provide the ease to operate the Smart door, can access it from any corner of the world, providing a good security. It is easy to upgrade, portable. The smart door lock system using telegram is very efficient technique, which allows the user to grant the access to the known person by sending a back message to RPI and unlock the door. The system uses various components like PIR sensor, camera module, switch and telegram app on an android phone. The networks security is also playing a vital role so that raspberry pi could not be hacked. The coding is done using python language and installation of a telegram is done using CLI Telegram and some concept of Linux The networks security is also playing a vital role so that raspberry pi could not be hacked. The SSH key is used, which provides a good network security. The Fail2ban software can also be used as an additional security to Raspberry pi.

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