Face and Voice Assistant Based Smart Home Security and Home Automation System

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Abstract: *Home security framework and home automation frameworks have been expanding preposterous ubiquity as a result of the change within the field of science and accompanying dangers of breaking within the system. This work envisions a brilliant locally built up on the two independent and rising progresses by implies of confront acknowledgment for security purposes, and Google voice collaborator for home automation purposes. Too, the foremost later work done is inspected rapidly and gives the significant of a home security framework and home automation framework could be a basic ought to fill the hole within the progressing developments displayed within the related field. The most objective of this work is to supply a voice, command-based home automation framework and live video spilling based domestic security framework. The security system ensures the working of the brilliant domestic by taking the picture of the person who rings the entryway bell differentiating it with the put away database of proprietor dependably and heartily through Raspberry Pi. This work also provides live video streaming. Voice control utilizing Blynk gives the entire house makes this framework powerful and effective which could end up being an incredible cause to crippled, senior, and paralyzed individuals in the remote regions.*

Keywords: Blynk, Home security system, Home Automation System, Raspberry Pi, Voice Assistant Google

1. Introduction

Security is crucial to everyone, all over the globe, and hazards have been increased owing to evolving technology, and improvement in safety measures for home has become important part of our life. Home security system is quite a hot discussion and has a strong demand for handicapped, paralyzed and elderly individuals owing to the helpful nature of the technology. Many nations embrace sophisticated systems of safety. Identification accuracy is the primary problem, and many distinct topologies such as biometric fingerprinting, important passwords, sensors and facial recognition methods can achieve this. Face recognition technology is useful for a broad variety of apps. Many of the researchers developed this technology in order to provide home security by using the motion of a person and door ring bell [1]. Face is identified in the suggested offline scheme and there after acknowledged through coordinating picture taken continuously with the saved database as likewise done, with no correspondence with the owner, for a snappier, simpler to utilize or introduce and reasonable framework to help mechanically uneducated people in far off locales. Raspberry Pi is altered with Python language to work with OpenCV computations for detached face acknowledgment of successful and intelligent home. Researchers have been developed automatic control of home appliances using smart phone applications such as MIT app [2] and Blynk app [3]. Home appliances can be easily controlled using these android applications which reduce energy. This also provides comfort and safe to the aged persons or physically disabled peoples.

Voice is one of the most significant information sources utilized for man machine cooperation. In this way, to make the brilliant home more easy to use, Google help alongside online application can be utilized to control the home framework. The subject of brilliant home computerization goes back to quite a few years prior when researchers and specialists around the globe created inventive arrangements, for example, programmed light switches and voice controlled apparatuses. At present, results are accomplished utilizing a variety of IR sensors to control smart switches that identify human nearness. These sensors have insignificant force prerequisites however are just possible after specific interval of time when they are conveyed in numbers. What's more, IR blasters chip away at the discovery standard by obstructing an anticipated beam. It doesn't separate individuals from some other antique. Furthermore, if any lifeless thing impedes the beam, such acts would likewise be actuated.

The major contribution of the work is primary focus of this article is the development of both using internet and without internet, intelligent home is developed by making both face acknowledgment and Google voice assistant for use in distant fields of the Internet connection.

The remaining part of the paper is sorted out as follows: Section II provides the details regarding recent home security and home automation system. Section III presents the proposed work of the system which contain block diagram. Section IV and V contains hardware and software requirement. Section VI and VII provides the working principle and results and discussions of the work. VIII illustrates the conclusion of the work.

2. Literature Review

Kumbhar et al. designed home security system using Raspberry Pi 3[1]. Here they used two modes of operations: person's motion and doorbell rings. If the person is in motion and he pressed the door bell, the raspberry pi will captures his image. The captured picture is compared with the database which is stored. In case the captured picture is found recognizable with the put away database at that point the entryway open else the notice is sent to the user's mail. Bhavna and Neetu Sharma developed wi-fi based smart home security system using Arduino Uno and ESP8266 [2].

This method is used to control home appliances using smart phone application and also to provide home security from intruders. Singh et al outlined domestic automation framework utilizing Node MCU and Firebase to control domestic apparatuses through smart phone applications [3]. Here they have utilized MIT app in arrange to control domestic apparatuses. Davidson and Mohammad implemented Internet of Things (IoT) based smart home security system [4]. Here they presented RF based smart door opening system by using Elegoo Mega 2560 microcontroller board, Raspberry Pi 2. Wankhade et al. developed IoT based home automation framework utilizing ESP8266 module to control home appliances [5]. Prasanna at all implemented home control using Node MCU [6]. Here home appliances are controlled using Blynk android app. In paper [7], the authors have been implemented home security system and home automation system using Node MCU. Blynk app is used to control home appliances and if there is presence of person in front of the door, ultrasonic sensor sends the notification to the user. Sandeep Mishra and Jagruti developed a home automation system using Node MCU and Blynk app [8]. Here the home appliances are controlled using mobile application. Rao and Uma implemented smart home automation using Raspberry Pi [9]. Ahsan at all developed IoT based home automation and home security system [10]. Smartphone application is used in their work to provide home automation.

Hence from all the above review, in many of the security aspects we have seen that the captured image contains unwanted things in the background and live streaming are much important in the home security. In home automation system many of the authors used ThingSpeak account to monitor and control the home appliances. The novelty of this paper is to provide home security system of live video streaming and to detect and recognize only the face of the individual who enters the home entryway. In this work we used Haar cascade algorithm to detect and capture only the face part such as eye, nose and mouth. This algorithm removes the extra things in the background and captures only the face. On the other hand home automation can be controlled using both commands and voice. Here we used Google voice assistance which is currently available in every Smart phones and Blynk mobile application to monitor and control the home appliances. Instead of ThingSpeak, If This Then That (IFTTT) account is used to control home appliances.

3. Proposed Work

The proposed work contains the block diagram of smart home automation framework and home security framework.

3.1 Block Diagram

Block diagram of the proposed work has been presented in the figure 1. It contains Raspberry pi 3 model B, Web camera module, Node MCU IoT device, Relay, and external power supply. Here Raspberry Pi is the main part of the work which can provide excellent interfaces and connects to the internet in various languages like C, C++, JAVA, and python. As we are using Node MCU for home automation

and Raspberry pi for home security system there is a need for C programming language and Python language.

Raspberry pi is the main heart of the work because we can use many languages in a single board. A web camera recognizes, detects, and authenticates the image of the person. Relay is used as a switch for electric appliances. In the block diagram relay is connected to both light and fan.
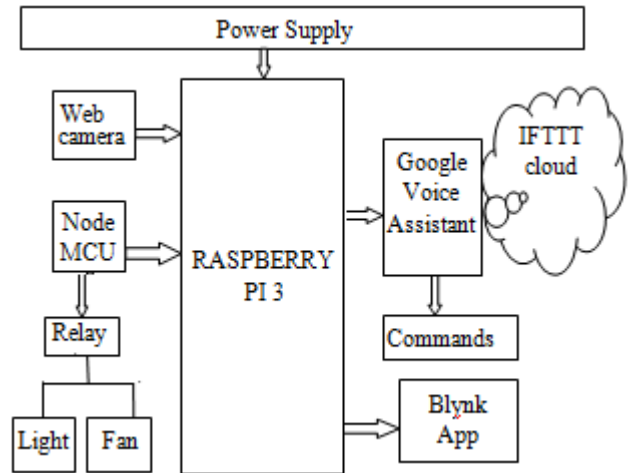

Figure 1: Block diagram of proposed model

4. Hardware Requirements

4.1 Raspberry Pi 3

Raspberry Pi is a small sized minicomputer. It can operate numerous of applications. Figure 2 represents Raspberry Pi 3 which contains 40 GPIO pins, four USB sockets, camera module, audio jack etc. It also provides the connectivity of LAN or Ethernet cable. The entire work is done using Raspberry Pi. Since the availability of Wi-Fi and Bluetooth in it, we have been developed offline smart home system. Raspberry Pi acts as web server, SQL server and control unit [11]. Raspberry Pi is modified with python and Open CV (Open Source Computer Vision) computer dialects. The programs which are required to perform domestic security and domestic robotization framework are put away in miniaturized scale SD card.

Figure 2: Raspberry Pi 3

4.2 Web Camera

Web camera is used to capture the image of the person. Web camera is as shown in the figure 3.Web camera is connected to Raspberry Pi 3 to provide information about the home security. When the Internet camera captures the image of the individual, it'll send to the Raspberry Pi to compare with the database. After comparing the image with dataset opening or closing of door will takes place.

Figure 3: Web Camera

4.3 Node MCU

Node MCU is a used as both hardware and firmware in our project. ESP8266 model is used in this project on which Wi-Fi SoC is integrated. Node MCU is shown in the figure 4 which is used as circuit board which is functioning as Dual in line Package (DIP).

Figure 4: Node MCU

4.4 Relay

Two channel relay is used in our work. Figure 5 represents two channel relay board. It contains Normally Closed (NC), Normally Open (NO) and COM ports. Switching on and switching off of the electric appliances can be controlled automatically and electronically. It is also provided with VCC, GND and two input pins. One COM port is connected to light and another is connected to the fan.

Figure 5: Two channel Relay

4.5 Light and Fan

In this project light and fan is used as home appliances. Light and fan are connected to the two channel relay. Relay module is given as connection to Node MCU. Light and fan are connected to Node MCU. Node MCU is connected to Raspberry Pi 3. When the commands are given through Blynk or Google Voice Assistance these home appliances are controlled.

5. Software Requirements

5.1 Python OpenCV

Python is an easy programming language to learn. It is perfect for IoT since it gives you with numerous in built and downloadable libraries which you'll utilize to interface with any sensor. Open CV (Open Source Computer Vision) may be a library of programming capacities. It in addition utilized for composing application level programs. In basic language, it is utilized for picture dealing with. It is basically utilized to do all the operation related to pictures. In this extend, PuTTY and VNC Watcher is utilized as program. This computer program is utilized for basically for picture preparing.

5.2 Arduino IDE

Arduino is an open-source PC equipment and programming organization. The Arduino Community is implied to the undertaking and client arrange that structures and livelihoods microcontroller-based progression sheets. These alter sheets are known as Arduino Modules, which are open-source prototyping stages. The streamlined microcontroller board arrives in a collection of progress board bundles. The preeminent broadly recognized programming approach is to utilize the Arduino IDE, which businesses the C programming dialect. This gives you get to an Arduino Library that's persistently creating appreciation to open-source network.

5.3 Blynk App

Blynk application is expecting for the Web of Things. It can control hardware remotely, it can appear sensor data, and it can store data, imagine it and do various other cool things. Blynk App permits making astonishing interfaces for our activities utilizing different gadgets gave in this application. Blynk Server is liable for all the interchanges between the Smartphone and equipment. We can run our private Blynk server locally, simple handle a great many gadgets and furthermore enable correspondence with the server and method all the drawing nearer and outcoming orders [6]. In our project this app controls home appliances like fan and light remotely by just clicking on and off in this app.

6. Working

The prototype model of smart home security system and home automation system is as shown in the below figure 6. It consists of Raspberry pi 3, web camera, Node MCU, LED to display date, time and some commands like light is on, light is off, fan is on, fan is off and door is open or door is closed. LED is used to display date, time and other commands like turning on light, turning off light. The model also consists of external supply to provide power to the entire model. Relay is used as switch in our project. Light and fan is used as electronic appliances. Web camera is used to capture the image of the person which also enables live video streaming.
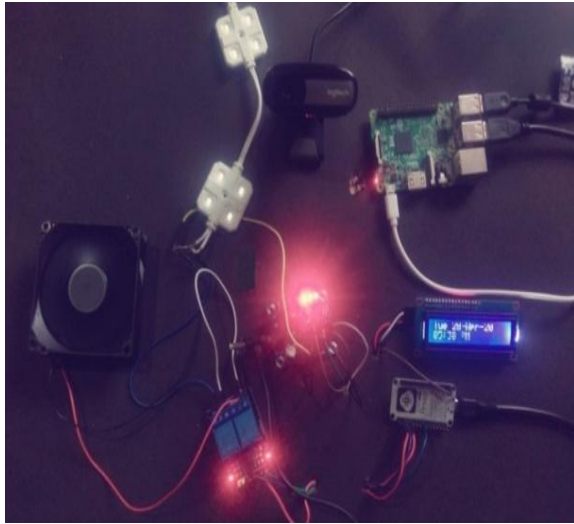
Figure 6: Prototype model of home security and home automation system

6.1 Home Security System

Home security system is done using web camera which is connected to Raspberry pi 3. Web camera captures the image of the person who enters the door. Initially Raspberry Pi is trained and stored with the captured database. The trained database contains the information about the family members such as name, age etc. In home security system, face is recognized to perform opening and closing of door. Authentication is very important factor in opening and closing of door. We have given a real time image in order to undergo image processing such as pre-processing, segmentation, feature extraction and classifier. Pre-processing of image will play the entire operation of face recognition. Pre-processing removes unwanted noise and enhances the quality of the image. Pre-processing is additionally called as sifting of the picture. The pre-processed picture is at that point portioned. Feature extraction includes the extraction of the features of the face like shape, color and texture. The extracted image is then classified using Haar cascade classifier which helps in proficient recognition of the image. In our work Python and Open CV programming is used for face recognition. PuTTY and VNC Viewer software is used. Here face acknowledgment innovation is introduced at the entrance of the home entryway. We have already stored a database with minimum of 50 images. When the person enters the door and if he rings the bell, the raspberry pi captures the image of the person, comparing it with the stored database. Raspberry Pi checks the image of person whether known or alien. If the image threshold of the person is higher than the given threshold, the door will automatically open. Otherwise, the unknown person's image will be captured and send it to the owner's E-Mail and SMS. The door will be kept closed until owner himself open the door. Here we are providing with free and fast SMS service.

6.2 Home Automation System

In home automation phase, home appliances like light and fan are controlled by the Google Assistant process through the controller module for speech to content and content to discourse change and exchanging the bundles by utilizing serial communication whereas getting to IP addresses of the Wi-Fi module without web. The main idea of this proposed work is to control home appliances automatically using smart phone applications. In this work, the Blynk app is used to control home appliances by just clicking switch off and on options which are given manually. Another method of controlling home appliances is by using Google Voice Assistance which is currently available in every smart phone. Firstly connections are made as shown in Figure 1. Raspberry Pi is connected to Node MCU Relay, external power supply, Light, and fan. In this work, we have used two methods of controlling home appliances i.e., Google Voice Assistance and Blynk App. In Google Voice Assistant, just telling switch on the light will switch on and if we tell switch off the light will switch off. The same process follows to the fan. On the other hand, the Blynk app is able to control domestic machines. By fair tapping or clicking 'ON' and 'OFF' in the app we can control our home appliances like light and fan. The fundamental objective of this work is to enable physically disabled and aged persons to do their work independently and to save wasting of energy along with resources.

7. Results and Discussions

The entire system is designed and implemented using Raspberry pi 3. The home security is provided capturing the image and comparing it with data stored in the database. In case the captured picture is coordinating with the database at that point the entryway would open. Else the door will remain closed until user opens it. The home automation system is provided by just clicking on and off in Blynk app, the home appliances is controlled and also through Google assistant using voice home appliances is controlled in this project. This system evidences that automatic control of home appliances is possible through voice using Google Assistant.

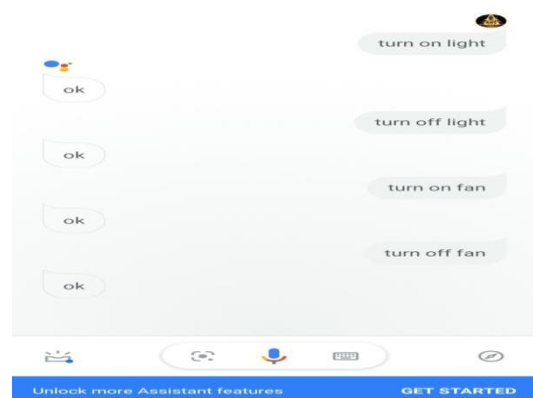**Figure 7:** Home Automation system using Blynk App

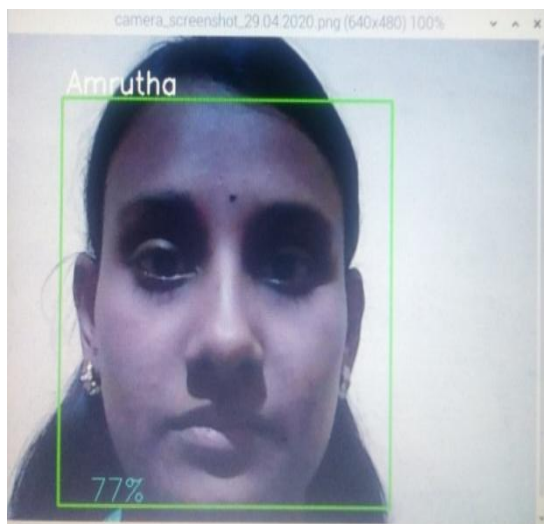**Figure 8:** Home Automation System using Google voice Assistant

Figure 9: Face recognition for home security system

and which is used as trusted face database in securing our home.

Figure 7 gives the home automation system using Blynk Android app. Blynk app is connected to the internet or Wi-Fi. By clicking on "ON" and "OFF" light and fan can be controlled.

Figure 8 shows the home automation framework utilizing Google voice Assistant. The home appliances such as light and fan can be controlled using voice through Google assistant.

Figure 9 provides the home security system where the threshold level is more. In this figure, firstly the image is detected, trained and recognized using python programming language. If the threshold level is more than 40%, the person is detected as known. Thus the door is opened automatically. If the threshold level is less than 40%, it is detected as unknown. The image of the intruder is captured and sent through the mail to the user. The notification is also sent to the user's mobile number. Here we are providing with free and fast SMS service to the user.

Advantages:
1) Flexibility.
2) Better scalability and security.
3) Improved comfort and safe.
4) Energy Saving.
5) Live video streaming.
6) Free and fast SMS service.

8. Conclusion

The goal of our work is to supply home security framework conjointly domestic mechanization framework utilizing smart phone application and using Google assistant through voice is fulfilled in our project. This work provides safety and energy saving measures to our home. In home security system, accuracy of the image is increased. This work also provides aged and physically disabled persons in doing their daily work independently. Our future work is to provide home security system using iris scanning for automatic opening and closing of door. From this system our home is secured as we are all having uniqueness in everyone's body

References

[1] Deepak. S. Kumbhar, H.C. Chaudhari, Shubhangi M.Taur, and Shubhangi S. Bhatambrekar, "IoT Based Home Security System Using Raspberry Pi-3", International Journal of Research and Analytical Reviews (IJRAR), Vol.6, Issue.1, pp. 305-309, Jan 2019.

[2] Bhavna and Dr. Neetu Sharma, "Smart Home Security Solutions based on Internet of Things (IOT) using WIFI Interface", International Journal of Engineering Sciences & Research Technology (IJESRT), pp. 389-397, May 2018.

[3] Shweta Singh, Shikha Verma, Surendra Kumar, Satish Kumar Singh, and PermendraVerma, "Home Automation Using Node MCU, Firebase & IOT", International Journal of Scientific Research and Review (IJSRR), Vol. 7, Issue. 3, pp.1289-1294, March 2019.

[4] Mohammad Asadul Hoque and Chad Davidson, "Design and Implementation of an IoT-Based Smart Home Security System", International Journal of Networked and Distributed Computing (IJNDC), Vol.7, Issue.3, pp. 85 – 92, April 2019.

[5] Ravi Wankhade, Shashank Karhade, Pratik Mohite, Kanchan Dhole, Akash Ganvir, Bharti Khedkar, and Sharayu Sangekar, "Home Automation System Based on IOT using Cellular Devices", International Journal of Scientific Research in Science and Technology (IJSRST), Vol.6, Issue.1, pp. 480-484, Feb 2019.

[6] Lakshmi Prasanna Polana , Sireesha Potla , Venkata Triveni Vudata, Naga Lakshmi Vuyyala, and Shalini Tadi, "Home Control Using Node MCU", International Journal of Advance Research and Development (IJARnD), Vol. 3, Issue.2, pp. 87-92, 2018.

[7] K. Lova Raju, V.Chandrani, SK. Shahina Begum and M. Pravallika Devi, " Home Automation and Security System with Node MCU using Internet of Things", International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECON), 2019.

[8] Prof. Sandeep Mishra and Miss. Jagruti J. Mishra, "Home Automation Using Node MCU-32S and Blynk App", International Journal for Research Trends and Innovation (IJRTI), Vol.4, Issue.7, 2019.

[9] P Bhaskar Rao and S.K. Uma, "Raspberry Pi Home Automation with Wireless Sensors using Smart Phone", International Journal of Computer Science and Mobile Computing (IJCSMC), Vol. 4, Issue. 5, pp. 797-803, May 2015.

[10] Md. Rakib Ahsan, Sheikh Zarif Ahmad, Mohammad Shamsul Arefin, and Md.Aminul Bari, "Implementation of IOT based Smart Security and Home Automation System", International Journal of Engineering Research & Technology (IJERT), Vol. 8, Issue. 6, July 2019.

[11] Chinmay Bepery, Sudipto Baral, Animesh Khashkel and Farhad Hossain, "Advanced Home Automation System using Raspberry-Pi and Arduino", International Journal of Computer Science and Engineering (IJCSE), Vol. 8, Issue. 2, March 2019.