CSE 3009: Internet of Things (IoT) Project Report

On

HOME INTRUSION SYSTEM
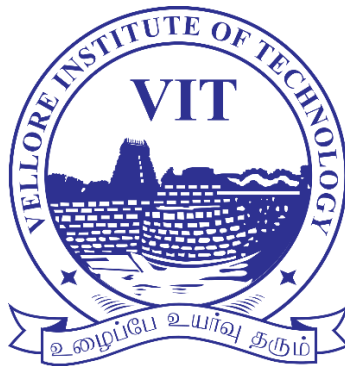
By

RAJAT RATHI 17BCE0900
ANURAJ SRIVASTAVA 17BCE2006
SHASHWAT SAHAI 17BCE2275
SAUMYE AGARWAL 17BCB0067

F2 SLOT

Under the Guidance of
Dr. Vishnu Srinivasa Murthy Y

School of Computer Science and Engineering

Vellore Institute of Technology (VIT), Vellore

Tamil Nadu – 632 014

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CERTIFICATE

This is to certify that **RAJAT RATHI (17BCE0900) ANURAJ SRIVASATAVA (17BCE2006) SHASHWAT SAHAI (17BCE2275) AND SAUMYE AGARWAL (17BCB0067)** year B.Tech, Computer Science & Engineering) from Vellore Institute of Technology (VIT) has successfully completed his/her project work in the field of Internet of Things (IoT) on the topic HOME INTRUSION SYSTEM This is a record of his/her own work carried out during the Fall Semester of the Academic Year 2019-20 under the guidance of Dr. Vishnu Srinivasa Murthy Yarlagadda. He/She has presented his project in the presence of faculty.

Dr. Vishnu Srinivasa Murthy Y,

Assistant Professor / Guide

ABSTRACT

The project involves the use of machine learning to build a smart home intrusion detection system. The System will be capable of recognizing faces and sending live video feed and SMS alerts to the house owner if any suspicious activity is detected. The entire project is developed on a raspberry pi, along with a camera module. The interface is totally wireless as the user can turn the system on and off with the VNC android app. The system is capable of recognizing multiple users, it captures a video feed of the house using it's camera module and then processes the image frames using OpenCV to find out any strangers. Once it has detected any stranger in the house it will send an SMS alert to house owner and will also store an image of the stranger which could then be viewed by the user on the mobile app.

Acknowledgements

I would like to express my deepest appreciation to all those who provided me the possibility to complete this report. A special gratitude I give to our Internet of Things faculty, Prof. Y.S Vishnu Murthy, whose contribution in stimulating suggestions and encouragement from the starting till the end of this project, helped me to coordinate my project especially in writing this report.

Furthermore, I would also like to acknowledge with much appreciation the crucial role of the staff members of sensors and instrumentation labs, who gave the permission to use all required equipment and the necessary materials to complete the task of development of security system using face detection on raspberry pi. A special thanks goes to my team mates, who help me to assemble the parts and gave suggestion about the tasks required to do in order to complete the project. Last but not least, many thanks go to the head of the department and dean of SCOPE school who gave us this wonderful opportunity to develop this project and simultaneously learn a lot about the programming in raspberry pi and python and also using packages like OpenCV and face detection. have invested his full effort in guiding the team in achieving the goal. I have to appreciate the guidance given by other supervisor as well as the panels especially in our project presentation that has improved our presentation skills thanks to their comment and advices.

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Rajat Rathi

Anuraj Srivastava

Shashwat sahai

Saumye Agarwal

November 2019

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MOTIVATION

In recent years, biometric-based techniques have emerged as the most promising option for recognizing individuals. These techniques examine an individual's physiological and behavioral characteristics in order to determine and ascertain their identity instead of authenticating people and granting them access to physical domains by using passwords, PINs, smart cards, plastic cards, tokens or keys. Passwords and PINs are hard to remember and can be stolen or guessed easily; cards, tokens, keys and the like can be misplaced, forgotten, purloined or duplicated; magnetic cards can become corrupted and unreadable. However, an individual's biological traits cannot be misplaced, forgotten, stolen or forged [1]. Face recognition is one of the least intrusive and fastest biometrics compared with other techniques such as fingerprint and iris recognition. For example, in surveillance systems, instead of requiring people to place their hands on a reader (fingerprinting) or precisely position their eyes in front of scanner (iris recognition), face recognition systems unobtrusively take pictures of people's faces as they enter a defined area. There is no intrusion or capture delay, and in most cases, the subjects are entirely unaware of the process. People do not necessarily feel under surveillance or their privacy being invaded

We have chosen this project because it provides the user with total wireless control of the Monitoring System. Most of the security systems implemented require much hardware to be installed and also are complex to operate and use. The best part of our project is that it uses minimal hardware because it can implemented with minimal cost. The basic Hardware consists of only a raspberry pi and a camera module. The installation will require minimum cost and also the user needs no additional monitors for watching the live feed of the security system. The user can simply log into our App and then watch a live video feed of his house from anywhere in the world thanks to the VNC cloud connection.

PROBLEM STATEMENT AND APPLICATIONS

- The project involves the use of machine learning to build a smart home intrusion detection system. The System will be capable of recognizing faces and sending live video feed and SMS alerts to the house owner if any suspicious activity is detected. The entire project is developed on a raspberry pi, along with a camera module.

- The interface is totally wireless as the user can turn the system on and off with the VNC android app. The system is capable of recognizing multiple users, it captures a video feed of the house using it's camera module and then processes the image frames using opencv to find out any strangers

- Once it has detected any stranger in the house it will send an SMS alert to house owner and will also store an image of the stranger which could then be viewed by the user on the mobile app.

- After complete development, this project is applicable for all security systems to which work with a camera to monitor visitors

- This home intrusion system can be installed in homes, offices etc wherever there is a need to keep a track of who is coming to the building and block entry of unknown and suspicious intruders.

This system will also recognise familiar and regular visitors so there won't be any discrepancy

In this project we simply took a raspberry pi and a camera module attached to it and developed a simple machine learning model to distinguish strangers from the people of the Household. The camera module captures a video feed of the house which is then analyzed by the raspberry pi using OpenCV library.As soon as any stranger has been detected in any of the video frames then the system sounds a buzzer to alert the neighbors as well as startle the thief. Then a text message is sent to the house owner indicating suspicious activity in the house. The owner can then open the VNC Viewer App to see a live video of the house. Also it stores an image of the stranger on the local system as well as on the cloud helping in investigations later. To control the system we used the VNC Server and Viewer to enable total wireless control of the system, to interface with the system and also to control execution of the system. The best application of the system is as Security system which continuously monitors the house and the spaces around it ,the total wireless control helps the user to easily monitor his house and any suspicious found within the house will be immediately reported to the user along with a buzzer alarm going off at the same time to inform the user if he is in close vicinity of the house. As security system it will require minimum hardware and along with the features implemented will give a better user experience to the users

PROPOSED APPROACH AND CONNECTION SPECIFICATIONS

The proposed security solution hinges on our novel integration of cameras and motion detectors into web application. Raspberry Pi operates and controls motion detectors and video cameras for remote sensing and surveillance, streams live video and records it for future playback. This research is focused on developing a surveillance system that detects strangers and to response speedily by capturing and relaying images to owner based wireless module.

- The interaction between the different modules is done using the VNC app itself. The Rpi needs to be setup first like installing the Raspbian OS and providing it with SSH details to connect to a WIFI network

- Once the initial setup is complete, as soon the pi boots up it automatically connects to the WIFI network and we can get the IP address allotted to it. Since the latest version of raspbian OS comes with the VNC server pre-installed, the VNC server starts up as soon as wifi is connected.

- Now we find the IP allocated to the PI board by simply reading the client info connected to our wifi. Then we enter this IP address into the VNC Viewer, installed on our computer and it asks for the username and password, after entering those, the raspbian Desktop is shown and we can interact with it.

Software Requirements

The software Components needed to build this project wereVNC Server- installed on the raspberry pi, it sends pixel by pixel data of the pi desktop to the VNC Viewer app.

Viewer- installed on the user's mobile device and also for interfacing with the software. The VNC Viewer appreceives the pixel data from the VNC server and gives the user a medium to interface with the Raspberry pi wirelessly.

Fast2Sms API- Installed on the raspberry pi, the API enables us to send text messages to a specified number using python functions.

OpenCV Library- Installed on the Raspberry pi, it is used for processing of the video frames and it has some inbuilt machine learning functions which are used for facial recognition.

Python Compiler- installed on the raspberry pi, all the scripts are written in python3 and need a python compiler to start it's execution.

Interface Used:

VNC Cloud Server – To interact/interface with the raspberry pi, we used the VNC server application which was installed on the raspberry pi. The desktop pixel information was transferred from the VNC server to the VNC Viewer and any interactions on the VNC Viewer were transferred back to the Raspberry pi all using cloud servers

Camera Module – the camera module acts an interface between the user and the system. The camera module monitors the house and the video feed from it is used by the system to detect suspicious activity. The user can view the video feed of his house via the camera module only. Although the information is transmitted by the VNC server but still it is captured by the camera and then passed on the user.
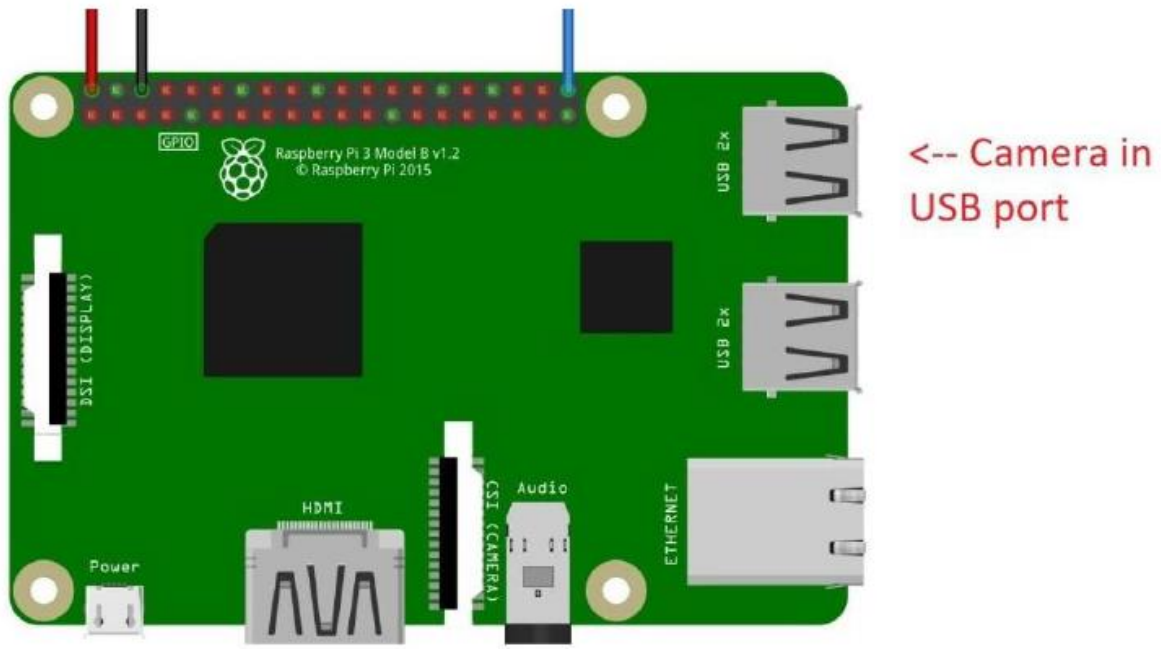
FIGURE 1 – INTERNAL DIAGRAM OF RASPBERRY PI
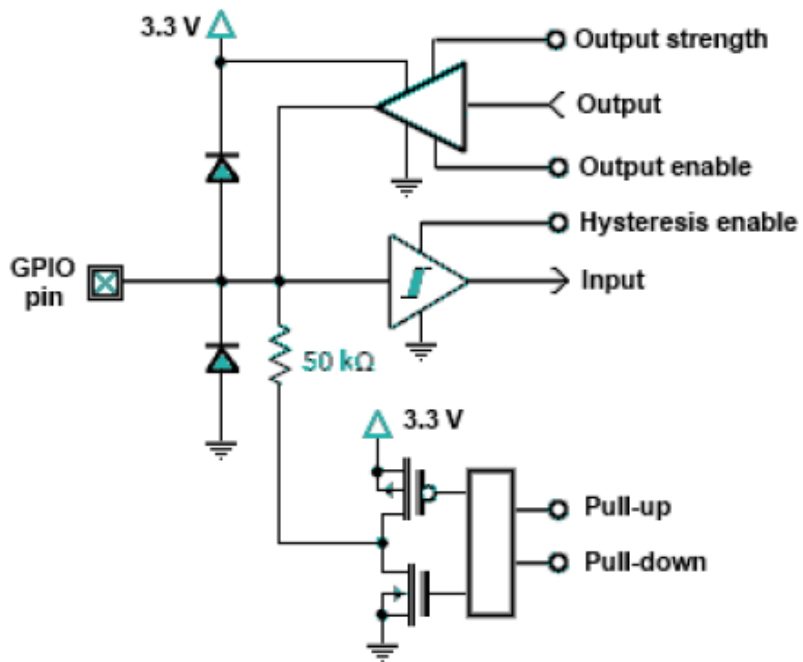
Equivalent Circuit for Raspberry Pi GPIO pins

FIGURE 2 PIN DIAGRAM OF RASBERRY PI

425 × 272

RESULTS OBTAINED

The project designed and implemented a security system based on the Raspberry Pi. The aspects of the system are: motion detection using a PIR sensor, video capturing using a Pi Camera and sending out an alert through buzzer. It did not however achieve the option of image processing in the Raspberry Pi because of system constraints i.e. processor speed.
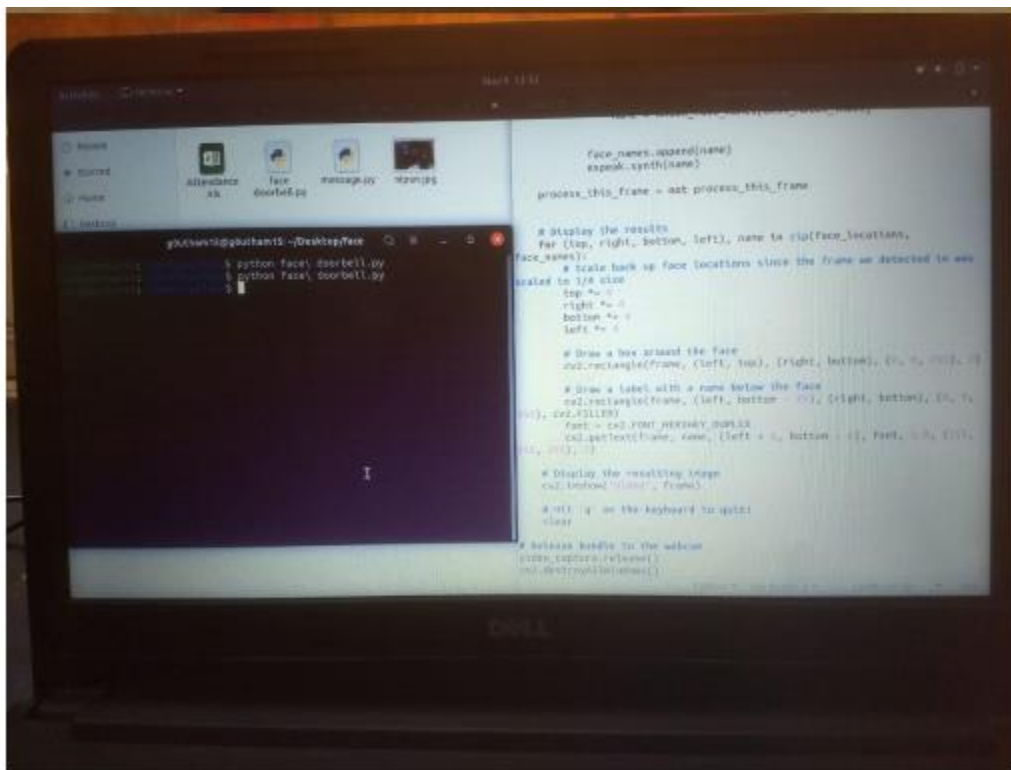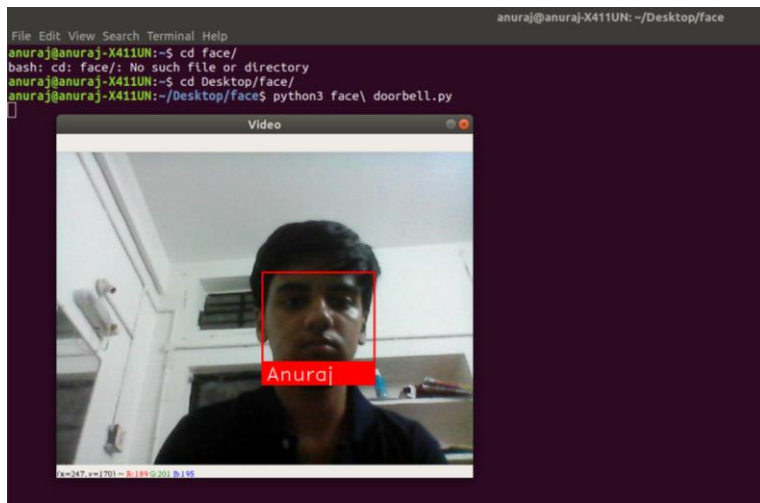
Data Image Used:

CONCLUSIONS

Home of the future is a space for the digital natives. With the invention of lots of automation technologies featuring IOT and AI, home automation has become a reality. One can implement several of their tasks with just a single command of verbal instructions. These technologies can used to build fully functional home automation system and control smart home devices including smart lights, connected thermostats, and appliances. There are several new technologies which can become a part of home in the near future: Increased efficiency, control, and customization: Artificial intelligence is set to make you lazy in the near future. Technology will become much more efficient and one will be able to control everything from volume to security from one central place. The devices will work automatically and you don't need to waste your energy it will act upon user's preferences. AI would revolutionize home by automatic threat detection and proactive alertness. Integration of Smart home devices: One can command it to control small things of home through voice and Smartphones. All the tech giants are working in the field of IoT to bring advancements in the home automation devices. In near future, homes will be equipped with such IoT devices which will make your daily lives work faster smoother and more accurate. Mark Zuckerberg came up with a goofy proof-of-concept video showing off an idealized version of how his Jarvis system actually works. Google Home, which is Google's smart speaker loaded with Google Assistant, was updated at last year's Google I/O with a bunch of new features, including "proactive assistance", also known as push notifications, hands-free free calling, Spotify, SoundCloud, and Deezer integrations, and more. Also, more recently, Google launched two more Google Home speakers, Home Max and Home Mini. Smart spaces outside homes: Smart parking through sensors will help to recognize whether the parking is available or not. Camera monitoring can be done and with the help of artificial intelligence and computer vision, both parking facilities and security can be provided. It would be a faster and smoother process and act as a reference for other smart systems to be built accordingly. Streetlights can also be automated through sensors and build for effective use for the people nearby. Development of smart appliances: The devices which we use to use like television, refrigerator and even the mirror is getting smarter today with evolution of technology. The smart mirror should not

only act as a face video but also help to other tasks like listening to music and stuff. Televisions have become part of a centralized entertainment and can also be used for social media. The refrigerator has been upgraded to sense the temperature outside and operate accordingly. The washing machine will wash the clothes according to the clothes material and switch off after drying. They will keep on advancing as the technology evolves. Personal home delivery: Drones will be used to deliver the packages at the right time. They will replace the normal salesman job. They might also be used for several other tasks like monitoring the weather outside the home, returning something back to a relative's home nearby and so on. They can also be used for monitoring the traffic in our locality. One can build several amazing projects using the concepts of home automation. There are several projects already done by developers and available on the Internet. They might help you to start the work with IoT. You can add new skills to own smart device. You can make your smart home device work according to your life works and habits. Even we can build many projects around it by discovering new areas of the internet of things and make the world a smarter place to live in

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