ISSN: 2582 - 6379
Orange Publications
International Journal for Interdisciplinary Sciences and Engineering Applications
IJISEA - An International Peer- Reviewed Journal
2022,May, Volume 3 Issue 2
www.ijisea.org

Design and Development of Face Recognition and IoT Based Smart Home Security System

Bodigadda Chanti[1], B. Rama Rao[2]
PG Scholar[1], Associate Professor[2]
Department of Electronics and Communications Engineering Amrita Sai Institute of Science and Technology Paritala, Kanchikacherla , Krishna District , Andhra Pradesh , India

ABSTRACT

In this paper, a holistic solution for Smart Home Security is implemented which helps in improving privacy and security using two independent and emerging technologies of facial authentication and IoT technology With the help of the proposed application, the user will be able to monitor his home through his mobile phone/tablet/PC. This method involves facial recognition by taking a real-time feed of the person at the door and then analysis of the live feed is carried out where the face recognised is authenticated with the data of owners in the database which matches the face to a name. IoT Technology has been used to doubly check the output of facial authentication. The entire process is carried out with the help of neural networks. If there's an unauthorized person at the door, an alert will be triggered and the owner will get a notification of this unauthorized access and would get to choose whether they want to add the person to their database or not. The overall accuracy of the proposed model is 82.71% with an accuracy of 87.5 % for Facial Authentication and 84.62 % for Speaker Authentication. Along with this, the main novelty for the research is to identify faces through masks which will help to properly verify the identity of the person and would prove to be beneficial not only in the current COVID- 19 scenario but also in cases of thefts and burglaries by alerting the owner about the anomaly. Thus this smart security system can be extended to applications like banks, malls, offices, etc., and shall not be limited to only homes.

Keywords: Face Recognition, IoT, Neural Networks

I.INTRODUCTION

An embedded system is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general- purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today.

Embedded systems are controlled by one or more main processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task, which may require very powerful processors. Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

ISSN: 2582 - 6379
Orange Publications
International Journal for Interdisciplinary Sciences and Engineering Applications
IJISEA - An International Peer- Reviewed Journal
2022,May, Volume 3 Issue 2
www.ijisea.org

II. DEEP LEARNING SYSTEM

Deep learning is based on the branch of machine learning, which is a subset of artificial intelligence. Since neural networks imitate the human brain and so deep learning will do. In deep learning, nothing is programmed explicitly. Basically, it is a machine learning class that makes use of numerous nonlinear processing units so as to perform feature extraction as well as transformation.

The output from each preceding layer is taken as input by each one of the successive layers. Deep learning models are capable enough to focus on the accurate features themselves by requiring a little guidance from the programmer and are very helpful in solving out the problem of dimensionality. Deep learning algorithms are used, especially when we have a huge no of inputs and outputs. Since deep learning has been evolved by the machine learning, which itself is a subset of artificial intelligence and as the idea behind the artificial intelligence is to mimic the human behavior, so same is "the idea of deep learning to build such algorithm that can mimic the brain".

Deep learning is implemented with the help of Neural Networks, and the idea behind the motivation of Neural Network is the biological neurons, which is nothing but a brain cell.

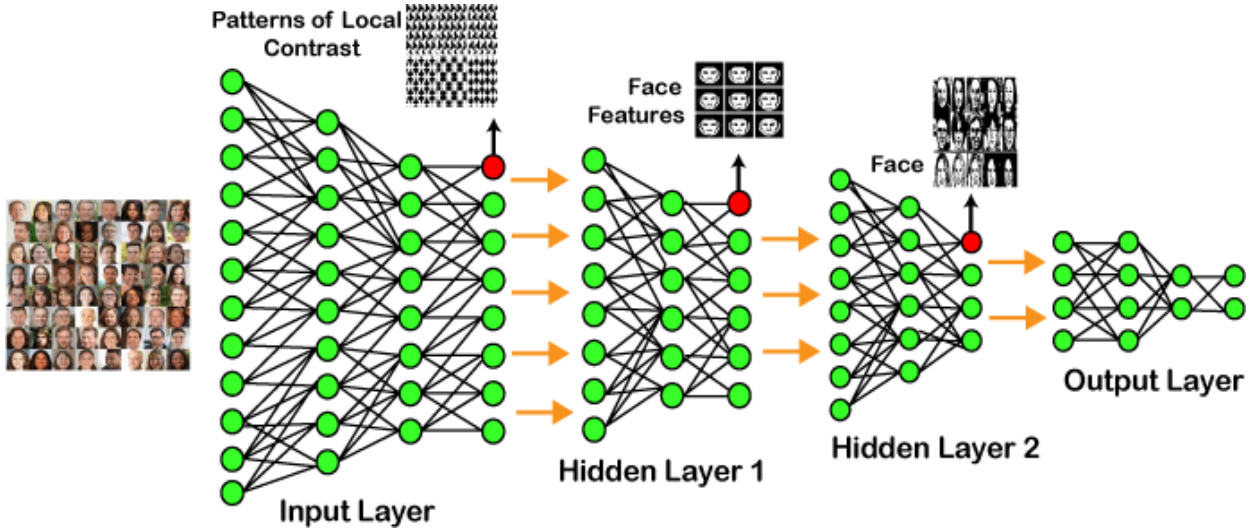


Figure 1: Shows example of deep learning System

ARCHITECTURES:

DEEP NEURAL NETWORK: It is a neural network that incorporates the complexity of a certain level, which means several numbers of hidden layers are encompassed in between the input and output layers. They are highly proficient on model and process non-linear associations.

DEEP BELIEF NETWORK: A deep belief network is a class of Deep Neural Network that comprises of multi-layer belief networks.

STEPS TO PERFORM DBN: With the help of the Contrastive Divergence algorithm, a layer of features is learned from perceptible units. Next, the formerly trained features are treated as visible units, which perform learning of features. Lastly, when the learning of the final hidden layer is accomplished, then the whole DBN is trained.

ISSN: 2582 - 6379
Orange Publications
International Journal for Interdisciplinary Sciences and Engineering Applications
IJISEA - An International Peer- Reviewed Journal
2022,May, Volume 3 Issue 2
www.ijisea.org

RECURRENT NEURAL NETWORKS: It permits parallel as well as sequential computation, and it is exactly similar to that of the human brain (large feedback network of connected neurons). Since they are capable enough to reminisce all of the imperative things related to the input they have received, so they are more précis

DEEP LEARNING APPLICATIONS

SELF-DRIVING CARS: In self-driven cars, it is able to capture the images around it by processing a huge amount of data, and then it will decide which actions should be incorporated to take a left or right or should it stop. So, accordingly, it will decide what actions it should take, which will further reduce the accidents that happen every year.

VOICE CONTROLLED ASSISTANCE: When we talk about voice control assistance, then Siri is the one thing that comes into our mind. So, you can tell Siri whatever you want it to do it for you, and it will search it for you and display it for you.

AUTOMATIC IMAGE CAPTION GENERATION: Whatever image that you upload, the algorithm will work in such a way that it will generate caption accordingly. If you say blue colored eye, it will display a bluecolored eye with a caption at the bottom of the image.

III. METHODOLOGY AND BLOCK DIAGRAM

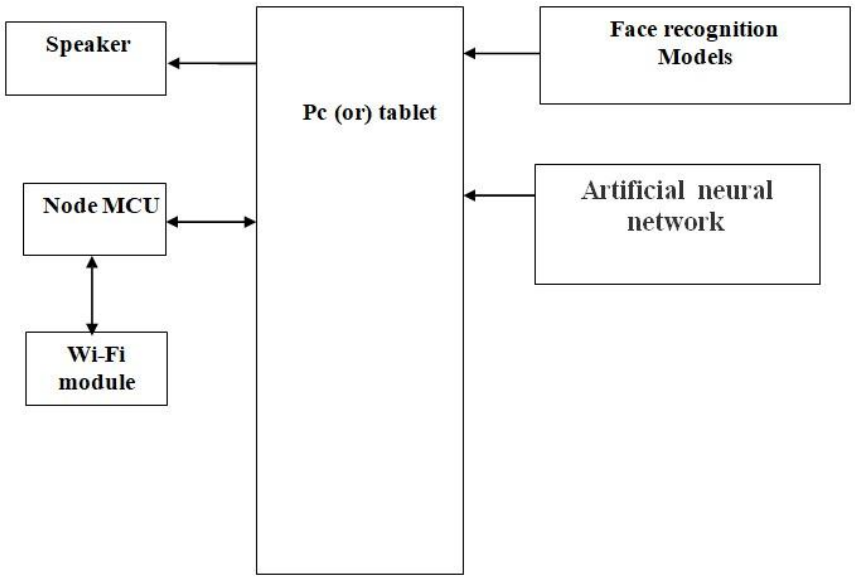


Figure 2: Shows Block Diagram of IOT System

ISSN: 2582 - 6379
Orange Publications
International Journal for Interdisciplinary Sciences and Engineering Applications
IJISEA - An International Peer- Reviewed Journal
2022,May, Volume 3 Issue 2
www.ijisea.org

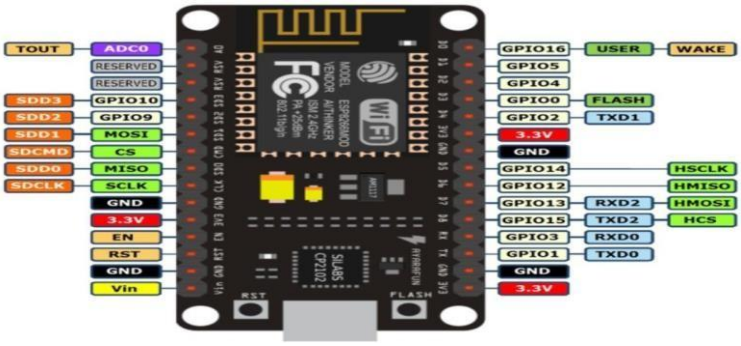


Figure 3 : Shows NODE MCU Pin Diagram

Nodemcu is an open source lua based firmware for the esp32 and esp8266 wifi soc from espressif and uses an on-module flash-based spiffs file system. nodemcu is implemented in c and is layered on the espressif esp-idf.the firmware was initially developed as is a companion project to the popular esp8266based nodemcu development modules, but the project is now community- supported, and the firmware can now be run on any esp module. since nodemcu is an open-source platform, its hardware design is open for dit/modify/build.nodemcu dev kit/board consist of esp8266 wifi enabled chip. The esp8266 is a low-cost Wi-Fi chip developed by espressif systems with tcp/ip protocol. for more information about esp8266, you can refer to the module. there is version2 (v2) available for nodemcu dev kit i.e. nodemcu development board v1.0 (version2), which usually comes in black colored pcb.nodemcu dev kit has arduino like analog (i.e. a0) and digital (d0- d8) pins on its board. it supports serial communication protocols i.e. uart, spi, i2c, etc. using such serial protocols we can connect it with serial devices like i2c enabled lcd display, magnetometer hmc5883, mpu-6050 gyro meter + accelerometer, rtc chips, gps modules, touch screen displays, sd cards, etc.

IV. FACIAL RECOGNITION

Ever since IBM introduced first personal computer on 1981, to the .com era in the early 2000s, to the online shopping trend in last 10 years, and the Internet of Things today, computers and information technologies are rapidly integrating into everyday human life. As the digital world and real world merge more and more together, how to accurately and effectively identify users and improve information security has become an important research topic.

Not only in the civil area, in particular, since the 9-11 terrorist attacks, governments all over the world have made urgent demands on this issue, prompting the development of emerging identification methods. Traditional identity recognition technology mainly rely on the individual's own memory (password, username, etc.) or foreign objects (ID card, key, etc.). However, whether by virtue of foreign objects or their own memory, there are serious security risks. It is not only difficult to regain the original identity material, but also the identity information is easily acquired by others if the identification items that prove their identity are stolen or forgotten. As a result, if the identity is impersonated by others, then there will be serious consequences.

Different from the traditional identity recognition technology, biometrics is the use of the inherent characteristics of the body for identification, such as fingerprints, irises, face and so on.

Compared with the traditional identity recognition technology, biological features have many advantages, as: 1. Reproducibility, biological characteristics are born with, cannot be changed, so it is impossible to copy other people's biological characteristics. 2. Availability, biological features as part of the human body, readily

ISSN: 2582 - 6379
Orange Publications
International Journal for Interdisciplinary Sciences and Engineering Applications
IJISEA - An International Peer- Reviewed Journal
2022,May, Volume 3 Issue 2
www.ijisea.org

available, and will never be forgotten. 3. Easy to use. Many biological characteristics will not require individuals to corporate with the examine device.

Based on the above advantages, biometrics has attracted the attention of major corporations and research institutes and has successfully replaced traditional recognition technologies in many fields. And with the rapid development of computer and artificial intelligence, biometrics technology is easy to cooperate with computers and networks to realize automation management, and is rapidly integrating into people's daily life.

When comparing the differences between different biometrics, we can see that the cost official recognition is low, the acceptance from user is easy, and the acquisition of information is easy.

Facial recognition is the use of computer vision technology and related algorithms, from the pictures or videos to find faces, and then analysis of the identity. In addition, further analysis of the acquired face, may conduct some additional attributes of the individual, such as gender, age, emotion, and etc.

V. RESULTS AND DISCUSSION

Face recognition is tested on two types which are by testing image and real-time to determine the system accuracy. For testing image, there are ten images that are not in the database are tested for each label which are authorized and unknown person. The tested image will have labeled the image with names for authorized person while unknown for unauthorized person.

Below Figures shows the tested image with positive and negative results for authorized and unknown. Real-time face recognition is performed using web camera. An authorized person can be recognized through the system and vice versa.

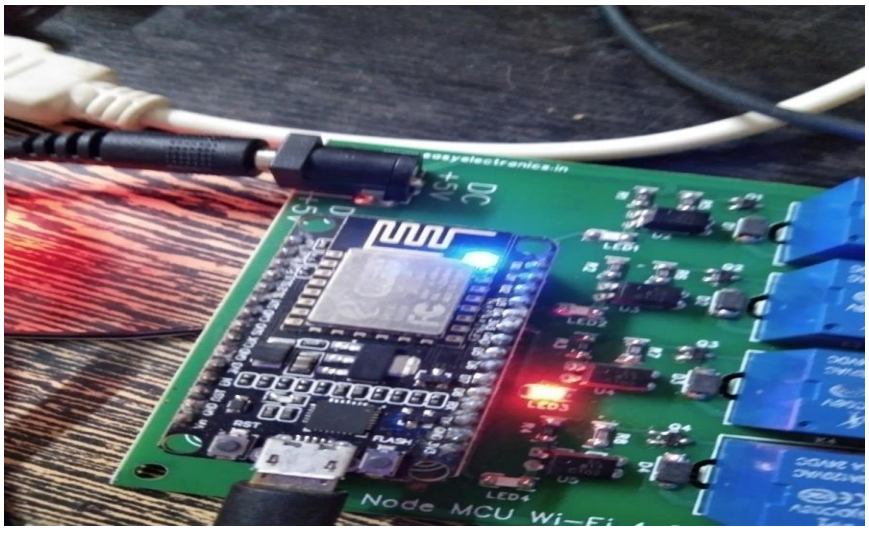


Figure 4: Shows WIFI Module

ISSN: 2582 - 6379
Orange Publications
International Journal for Interdisciplinary Sciences and Engineering Applications
IJISEA - An International Peer- Reviewed Journal
2022,May, Volume 3 Issue 2
www.ijisea.org



Figure 5: Shows frontal face detection using Haar cascade

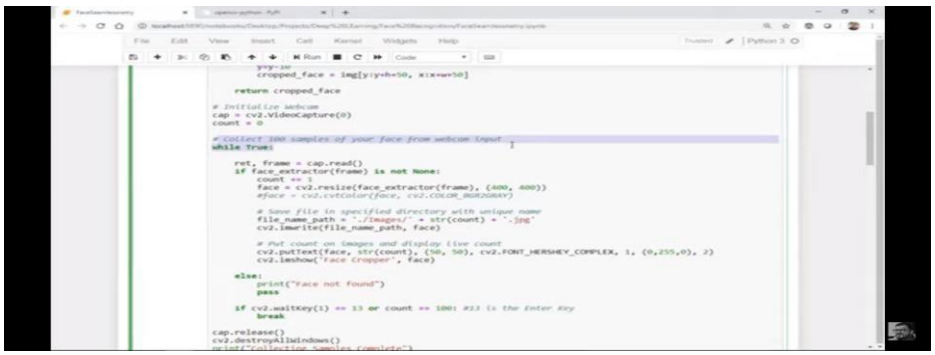


Figure 6: Shows collecting images



Figure 7: Shows Find outing known faces

ISSN: 2582 - 6379
Orange Publications
International Journal for Interdisciplinary Sciences and Engineering Applications
IJISEA - An International Peer- Reviewed Journal
2022,May, Volume 3 Issue 2
www.ijisea.org

VI. CONLUSION

As a conclusion, security system by using face recognition combined with IoT is successfully done. The face recognition is able to recognize the face and able to send notification to a user when an unknown being has been detected through IoT. On the other hand, this project is this project still has a big room of improvement to be done, especially in the efficiency of the image processing part. Due to the module used which is Raspberry Pi 3, the processing time of the coding took a long time so process the image taken and take action. By using another better module, this project can be improved greatly.

REFERENCES:

[1]Dubal, P., Mahadev, R., Kothawade, S., Dargan, K., & Iyer, R. (2018). Deployment of customized deep learning based video analytics on surveillance cameras. ArXiv preprint arXiv:1805.10604.

[2]Hinton, Geoffrey E., Simon Osindero, and Yee-Whye Teh. "A fast learning algorithm for deep belief nets." Neural computation 18.7 (2006): 1527-1554

[3]Kazemi, Vahid, and Josephine Sullivan. "One millisecond face alignment with an ensemble of regression trees." Proceedings of the IEEE conference on computer vision and pattern recognition. 2014.

[4]Lin, Tsung-Yi, et al. "Focal loss for dense object detection." Proceedings of the IEEE international conference on computer vision. 2017.

[5]Liu, Wei, et al. "Ssd: Single shot multibox detector." European conference on computer vision. Springer, Cham, 2016.

[6]Mao, J., Lin, Q., & Bian, J. (2018). Application of learning algorithms in smart home IoT system security. Mathematical Foundations of Computing, 1(1), 63-76
Parkhi, Omkar M., Andrea Vedaldi, and Andrew Zisserman. "Deep face recognition." bmvc. Vol. 1. No. 3. 2015.

[7]Schroff, Florian, Dmitry Kalenichenko, and James Philbin. "Facenet: A unified embedding for face recognition and clustering." Proceedings of the IEEE conference on computer vision and pattern recognition. 2015.

[8]Wen, Yandong, et al. "A discriminative feature learning approach for deep face recognition." European conference on computer vision. Springer, Cham, 2016.

