

Home Automation and Security Using Raspberry PI

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Abstract: *With the advancement of Automation technology, life is getting simpler and easier in all aspects. In today's world, Automatic systems are being preferred over manual systems. The rapid increase in the number of users of the internet over the past decade has made the Internet a part and parcel of life, and IoT is the latest and emerging internet technology. The Internet of things is a growing network of everyday objects-from industrial machines to consumer goods that can share information and complete tasks while you are busy with other activities. Wireless Home Automation system(WHAS) using IoT is a system that uses computers or mobile devices to control basic home functions and features automatically through the internet from anywhere around the world, an automated home is sometimes called a smart home. It is meant to save electric power and human energy. The home automation system differs from other systems by allowing the user to operate the system from anywhere around the world through an internet connection.*

Keywords: Automation

I. INTRODUCTION

A home automation system is a means that allows users to control electric appliances of varying kinds. Given any content input image, our algorithm outputs an image with a general Painting-style filter. Eventually, our goal is to investigate methods in terms of the model architecture, the quality of the generated artworks and the efficiency of the whole generating process.

Many existing, well-established home automation systems are based on wired communication. This does not pose a problem until the system is planned well in advance and installed during the physical construction of the building. But for already existing buildings the implementation cost is very high. In contrast, Wireless systems can be of great help for automation systems. With the advancement of wireless technologies such as Wi-Fi and cloud networks in the recent past, wireless systems are used every day and everywhere

II. LITERATURE SURVEY

In the field of Home Automation Using Raspberry PI, Numerous works are available. The work discussed in [1]Real-Time Smart Home Surveillance System Based on Raspberry Pi(Published - 2nd IEEE Eurasia Conference on IoT, 2020)Combines Raspberry Pi with the Internet of Things and the foundation of artificial intelligence to develop a real-time smart home surveillance system to improve safety at home. With a remote control method, people may check the safety of their own homes in real-time. The realized smart system is based on Raspberry Pi 4B, adopts the Internet of Things architecture and combines several sensors and devices for home security to set up a safer home environment. The main method is to connect the Raspberry Pi to a network sharer or computer with a fixed IP and then input it into a computer or mobile phone to achieve remote control. To provide home safety for the elderly or challenged people, the proposed system combines a voice control module to improve user convenience.

[2]Design of Raspberry Pi Web-based Energy Monitoring System for Residential Electricity Consumption(Published - International Conference on Information Technology Systems and InnovationICITSI, 2020)This paper presents the design of electrical energy monitoring using the PZEM-004T energy sensor and Raspberry Pi 4 as a web server. The system is designed for measuring current, voltage, power, and energy and sending it to a database for the purpose of display on infographics web pages in real-time. The web page interface has a responsive design, so the stored data in the database can

be accessed on both desktop and mobile phones for flexibility. Based on the results for various loading, it can be concluded that the design of the electrical energy monitoring device is working well with an average error of less than 2%. The user interface also shows the real-time electrical parameter on both desktop and mobile phones.

[3] Real-Time Family Member Recognition Using Raspberry Pi for Visually Impaired People(Published - IEEE Region 10 Symposium, Dhaka, Bangladesh, 2020)This research work firstly describes the development and estimation of raspberry pi based smart glass system to recognize the family member of a blind man by using image processing. This system helps the blind man by giving the name of the family member as audio information. Raspberry Pi is a very powerful processor where machine learning can be integrated very easily like SVM, KNN, TensorFlow, etc. Blind People can easily identify their native family members by using their voices. When family members stop talking, it's quite impossible to identify the man near. In this system, they use raspberry pi face recognition, face encoding, and face database creation for family member face recognition.

[4] Advanced Air Quality Monitoring System Using Raspberry Pi(Published - IEEE, 2019)The system involves monitoring the air quality by considering parameters like Suspended particulate matter(SPM), Carbon dioxide, Ozone, Carbon monoxide, Smoke, temperature and humidity. The particulate matter is a very important parameter that gives a clear indication of pollution at that particular time in the area. These pollutant data are extracted using sensors like MQ7, MQ135, MQ9, DSM501A, DHT11, etc. Most of these sensors produce Analog output so an analogue-digital converter is required before supplying the data to the Raspberry pi 3B+ microcontroller. Using software and coding of the Raspberry Pi 3B+, the data are analyzed and a graph to show the changes in the locality and time in which the experiment is plotted. The results obtained were verified.

[6] Home Automation System with Raspberry Pi(Published - 7th International Conference on Energy Efficiency and AgriculturalEngineering (EE&AE), 2020)Introduces one home automation solution describing a combination of the chosen hardware components and a possible software solution. solution. A major hardware element in the project presented is a Raspberry Pi microcomputer, which is connected to sensors for data collection. The microcomputer runs a described software system for organising and processing this data, configures different home automation modes, manages different home devices and reports, and analyzes the collected data.

2.1 Description of Various Libraries

The ease of implementation of a software project is improved by the use of suitable libraries that can be imported. The various Python libraries used to help enhance our project are listed below:

PyTorch: PyTorch is an optimized tensor library primarily used for Deep Learning applications using GPUs and CPUs. It is an open-source machine learning library for Python, mainly developed by the Facebook AI Research team.

TensorFlow: TensorFlow is a popular open-source library for high-performance numerical computation developed by Google. Its name comes from its purpose of defining and running computations that involve tensors. Tensors are multidimensional arrays that have a uniform type and hold either character or data. It has great use in the domain of Machine Learning as it is used for the training and inference of deep neural networks.

2.2 Datasets Used

LFW: Labelled Faces in the Wild (LFW) is a database of face photographs designed for studying the problem of unconstrained face recognition. This database was created and maintained by researchers at the University of Massachusetts, Amherst (specific references are in the Acknowledgements section). 13,233 images of 5,749 people were detected and centred by the Viola-Jones face detector and collected from the web. 1,680 of the people pictured have two or more distinct photos in the dataset. The original database contains four different sets of LFW images and also three different types of "aligned" images. According to the researchers, deep-funnelled images produced superior results for most face verification algorithms compared to the other image types. Hence, the dataset uploaded here is the deep-funnelled version.

III. FACE RECOGNITION AND USER MANAGEMENT -DJANGO

Django is a high-level python web framework. Django is a web application framework written in the Python programming language. It is based on the MVT (Model-View-Template) design pattern. Django is very demanding due to its rapid

development. It takes less time to build an application after collecting client requirements. This framework uses a famous tagline: The web framework for perfectionists with deadlines.

Convolutional Neural Networks (CNN)

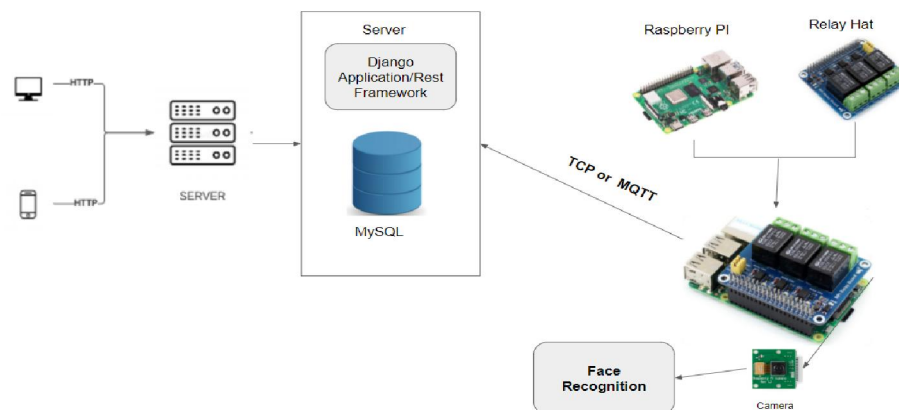
The term neural network is derived from the human brain or human nervous system which contains a massive number of neurons. These neurons are interconnected which helps us achieve different tasks. The Convolutional Neural Network consists of three basic components namely the convolutional layer, the pooling layer which is optional and the output layer. Each layer is made up of a set of neurons. We give input to the first convolutional layer, the output of which is obtained through an activation function. Pooling layers are then further added to reduce the number of parameters. Several convolutional and pooling layers are added before the prediction is made. It helps in extracting features. The output layer is a fully connected layer which presents the final output of the network.

FaceNet

FaceNet is the name of the facial recognition system that was proposed by Google Researchers in 2015 in the paper titled *FaceNet: A Unified Embedding for Face Recognition and Clustering*. [5] It achieved state-of-the-art results in the many benchmark face recognition dataset such as Labeled Faces in the Wild (LFW) and Youtube Face Database. They proposed an approach in which it generates a high-quality face mapping from the images using deep learning architectures such as ZF-Net and Inception. Then it used a method called **triplet loss** as a loss function to train this architecture.

IV. SYSTEM ARCHITECTURE

System Architecture



This system architecture diagram abstracts the overall outline of the software system and the relationships between components. It depicts how the features of data from the database will be extracted, and the data will be split into training and testing datasets (usually in the ratio of 80:20). The model will then be trained on the training data to reach an optimum level of accuracy. This trained model will be used to test the results of the testing data. The accuracy will be determined and the model with the best accuracy will be selected as the final model. This model can successfully be used to detect emotions from input data.

4.1 Algorithm Used

1. Import required library Facenet-Pytorch, torch, MTCNN, InceptionResnetV1, Opencv-Python, matplotlib
2. Detect faces using Viola-Jones Face Detection in OpenCV
3. Using MTCNN we will crop faces from the detected frame.
4. Get features using InceptionResnetV1.
5. Calculate the distance between Already given features.
6. Get minimum distance label

7. If label distance is less than 1 store print the label
8. Else print unknown

V. RESULTS

Our model detects faces in video frames with optimum accuracy. Model accuracy is the number of classifications a model correctly predicts divided by the number of predictions made.

VI. CONCLUSION

The main purpose of a home automation system is to provide ease to people to control different home appliances with the help of the android application present on their mobile phones and to save electricity, time and money. This system also helps the user to protect their homes from burglars when they are away from the home by using an alarm as the alarm will start ringing whenever a burglar tries to enter the house and the person will receive a message on his mobile phone whenever some other person will try to enter the owner's house.

FUTURE WORK

If better and more efficient systems for face detection are devised, the overall accuracy of this project will rise. If a night vision camera is used then it will increase night face detection capabilities. We could also use a better spec raspberry pi like device for better overall performance.

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