International Journal of Innovative Research in Science and Engineering
Volume 08, Issue 04, 2022
www.ijirse.com
ISSN: 2454-9665

FACE DETECTION AND RECOGNIZATION USING RASPBERRY PI

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Abstract

In today's world, face recognition is an important part for the purpose of security and surveillance. Hence there is a need for an efficient and cost effective system. Our goal is to explore the feasibility of implementing Raspberry Pi based face recognition system using conventional face detection and recognition techniques such as Haar detection and PCA. This paper aims at taking face recognition to a level in which the system can replace the use of passwords and RF I-Cards for access to high security systems and buildings. With the use of the Raspberry Pi kit, we aim at making the system cost effective and easy to use, with high performance.

1. INTRODUCTION

The information age is quickly revolutionizing the way transactions are completed. There is a need for a faster and accurate user identification and authentication method. Face recognition has become one of the most important user identification methods. Literature survey statistics shows that research work in face recognition system is in its booming era, and in the past forty years, the research in this field has increased exponentially. Face recognition technology emulates the capabilities of human eyes to detect faces. This is done by smart computing that creates "face bunch" that consists of 70 nodal points. Features are extracted from the face and saved as templates. These templates are compared to the face detected. For this research, we interfaced an LCD, Camera and a Motor to the Raspberry Pi board. We have made a real time application, which compares the scans to records stored in the Raspberry Pi which in turn is used as a gate pass, wherein the name of the detected person is displayed on LCD and the motor will rotate indicating opening and closing of the gate [1].

2. LITERATURE SURVEY/BACKGROUND

Face recognition has been a fast growing and challenging area in the field of computer vision and real time applications. A lot of techniques have been developed over the years for face recognition. The following section gives an overview of some of the algorithms developed for this particular task. Local Binary Pattern (LBP): This technique is used for feature extraction. The face is divided into several small regions from which histograms are extracted .This algorithm is more robust to face conditions but it is not feasible in real time environments. Principal Component Analysis (PCA): Human recognition with the help of PCA was done by Turk and pent land .The recognition technique, called Eigen face technique defines an area which reduces the depth of the

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ISSN: 2454-9665

authentic data space. This reduced knowledge area is used for recognition. Genetic Algorithms: One of the main challenges in face recognition is feature selection. In fact, it is a global optimization problem in machine learning. It is used to remove the number of features and irrelevant, noisy, redundant data in order to improve efficiency and accuracy. Methods based on genetic algorithms have been proposed which help to optimize the search strategies for feature selection. This can be particularly useful in real time applications. They have been used in tandem with some other techniques like Principal Component Analysis and Discrete Cosine Transform to achieve up to 99% accuracy in face detection. Deep Learning and CNNs: Convolutional neural network is a class of deep neural networks, which has been successful for face recognition algorithms. Complete images can be provided to the network (for feature selection, extraction and training), but this can be a complex and time consuming task. Gupta, all have proposed a new way of using deep neural network for face recognition. This approach involves providing only the extracted facial features as input instead of providing raw pixels. This approach is less complex than the traditional method but still manages to achieve 97.05% accuracy. The neural network consists of four dense layers. Another framework called region based CNN (RCNN), which is a kind of CNN extension has been used for face detection. Sun, Xuedong, et al have proposed a method that improves the existing RCNN method that incorporates strategies like feature concatenation, hard negative mining, multi-scale training, etc. Although the efficiency and scalability of this method hasn't been addressed as of yet, it still managed to achieve cutting-edge performance when evaluated on the Face Detection Dataset and Benchmark (FDDB). For high-accuracy real time face verification, Mobile Face Nets, an extremely efficient CNN model has been proposed. It uses less than 1 million parameters and has an actual inference time of 18 milliseconds. It has been designed specifically for mobile devices due to their low computation power. It is very useful for real time applications. It uses a CNN model that has been trained using an artificially augmented dataset to successfully recognize pigs at a farm. Over time the accuracy of deep CNNs has been known to increase steadily, with the most recent deep CNN scoring more than the median of the forensic facial examiners.[4,5].

3. PROPOSED WORK /SYSTEM

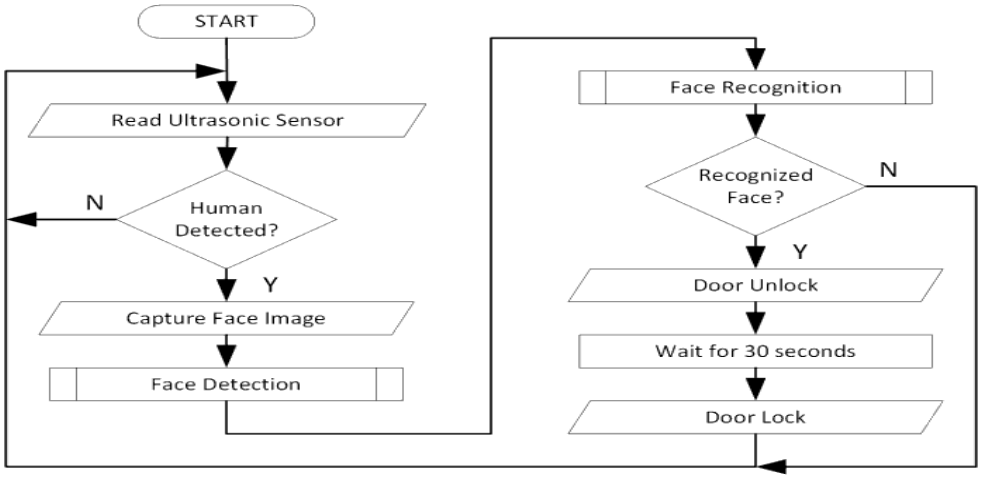

Figure 1: Flowchart of Face Detection and Reorganization Using Raspberry Pi

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ISSN: 2454-9665

Hardware Design:

It includes Raspberry Pi2development kit, connecting cables, LCD, DC Motor driver IC, DC motor, Power Supply, USB keyboard, USB mouse and USB webcam.

1. Raspberry Pi 2: Raspberry Pi is a small scale based computer, it performs efficiently when it comes to running games, image files, and documents. They can be manufactured using different configurations as per the user's needs. It runs at 700MHZ with nearly 256MB RAM, with on board graphic card capabilities. RaspberryPi2

are considered one of the few low power consumption CPU's The basic layout of the Raspberry pi2 consist of

1. Input/Output.
2. RAM
3. CPU/GPU
4. USB hub
5. Ethernet
6. HDMI Port

2. LCD: The LCD used here is 16 x 2 alphanumeric LCD. It is a very basic module which overcomes the disadvantage of the seven segment display as well as multi-segment LCD. It consists of command register to perform the user defined instructions and data register to display the data on LCD.

3. DC Motor Driver : The L293D Motor drivers provide voltages ranging from 5V TO 36 V with output current of 1 A per channel. L293D provides bi directional currents and can be operated at temperature up to 70 degree Celsius.

4. DC Motor

The speed of the motor can be changed by varying the voltage levels. Here the motor rotates in Clockwise and anticlockwise direction at a speed of 10,000RPM, representing opening and closing of Gate.

BLOCK DIAGRAM

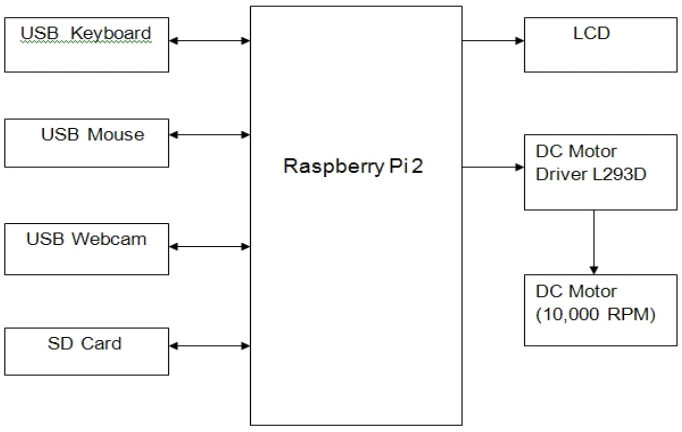

Figure1: Block Diagram Of Face Detection And Reorganization Using Raspberry PI

ISSN: 2454-9665

4. DISCUSSIONS

When face images are captured and trained several positive and negative images are created Capture positive.png. negative.png and mean.png files are created in the instance after obtaining the confidence value. In this section, the output of the training stage, experiment on face detection, and experiment of face recognition will be elaborated. The performance evaluation includes recognition rate, reliability, memory management and power management.[7].

5. CONCLUSION

This paper has presented a face recognition security system using Raspberry Pi. Python and OpenCV was used to implement the feature extraction and classifier, in which we used eigenface and PCA. The prototype design for real world implementation has been elaborated, in which the output of face recognition algorithm will lock or unlock the magnetic lock placed at the door using relay circuit. We have discussed the limited processing capability of

Rasperry Pi which affect the image resolution to be captured, processing time, as well as memory and power management. The recognition rate was found to be around 90% when tested with three persons. This proposed system could be connected using Internet to the smart home system for the added security capability. Further research includes optimization of hierarchical image processing, use different features extraction and classifer, or use parallel Raspberry Pi clusters to speedup the computation.

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