iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4559

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

Raspberry PI(3 b) based Smart Door

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Abstract: ***Recognition is a major issue in a control system in computer based communication. Face recognition is a very important subset of biometric authentication and is widely used in many applications, for example, video screen framework, human-PC communication, and entryway control framework and system security. This paper describes a face recognition door lock security system, developed to prevent robbery in highly secure areas like home environment with lesser power consumption and more reliable standalone security device for both intruder detection and for door security***
The door locks are meant to provide the best security aspects. Either it is a hostel or home, locks are important in order to ensure the safety and security of the environment. The traditional door locks are easy to access and hence they led to various security issues. The smart locks can be considered as the best alternative for the traditional locks. With the help of these locks one can ensure the maximum security in their environment
Index Terms: Face recognition system, automatic door lock, and authentication, bio-metric.

I. INTRODUCTION

Face recognition is as old as computer vision, both because of the practical importance of the topic and theoretical interest from cognitive scientists. Despite the fact that other methods of identification (such as fingerprints, or iris scans) can be more accurate, face recognition has always remains a major focus of research because of its noninvasive nature and because it is people's primary method of person identification. Face recognition technology is gradually evolving to a universal biometric solution since it requires virtually zero effort from the user end while compared with other biometric options. Biometric face recognition is basically used in three main domains: time attendance systems and employee management; visitor management systems; and last but not the least authorization systems and access control systems.
Face Recognition deploys computer algorithms to select specific, distinctive details from a face. These details, such as distance between the eyes or shape of the chin, are processed into a mathematical representation the similarity and dissimilarity on other faces are collected in a face recognition database.The information about a specific face is called a face template and is unique for a photo since it's intended to just incorporate certain specifics that can be utilized to recognize one face from another.

II. HARDWARE AND SOFTWARE COMPONENTS

Raspberry Pi- The Raspberry Pi hardware has evolved through several versions that feature variations in memory capacity and peripheral-device support.

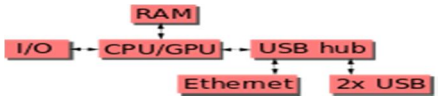

Fig1. Block diagram of raspberry pi 3

This block diagram describes Model B and B+; Model A, A+, and the Pi Zero are similar, but lack the Ethernet and
USB hub components. The Ethernet adapter is internally connected to an additional USB port. In Model A, A+, and the Pi Zero, the USB port is connected directly to the system on a chip (SoC). On the Pi 1 Model B+ and later models the USB/Ethernet chip contains a five-port USB hub, of which four ports are available, while the Pi 1 Model B only provides two. On the Pi Zero, the USB port is also connected directly to the SoC, but it uses a micro USB (OTG) port. The technical specifications are as follows:
SoC: Broadcom BCM2837
CPU: 4× ARM Cortex-A53, 1.2GHz
GPU: Broadcom Video Core IV RAM: 1GB LPDDR2 (900 MHz)
Networking: 10/100 Ethernet, 2.4GHz 802.11n wireless Bluetooth: Bluetooth 4.1 Classic, Bluetooth Low Energy Storage: micro SD
GPIO: 40-pin header, populated
Ports: HDMI, 3.5mm analogue audio-video jack, 4× USB 2.0, Ethernet, Camera Serial I Interface (CSI), Display Serial Interface (DSI)

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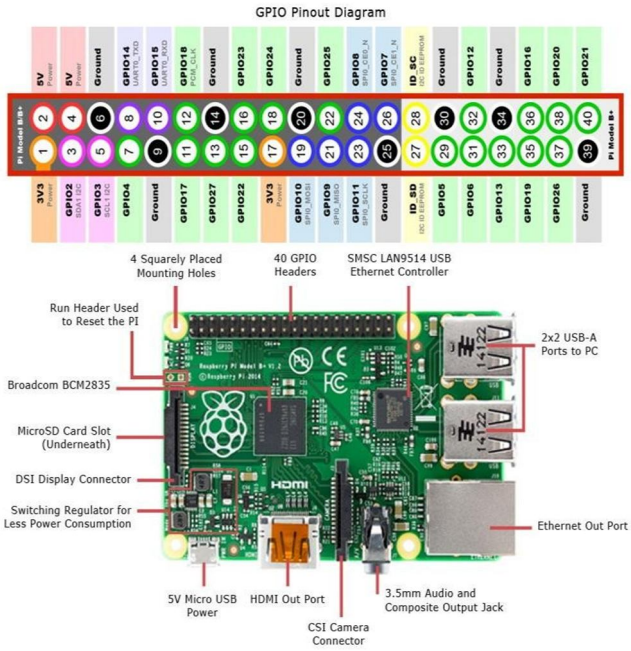

Fig 2. Raspberry pi components

Python IDE- Python is one of the most popular languages in the world and has been around for more than two decades. It is heavily used in academic environments and is a widely supported platform in modern applications, especially utilities, and desktop and Web applications. Python is highly recommended as a language that is easy for newcomers to program. With its easy-to-read syntax, the introduction is gentle and the overall experience much better for a newbie. The latest version of the Raspbian OS comes bundled with both Python 3.3 and Python 2.x tools. Python 3.x is the latest version of the Python language and is recommended by the Raspberry Pi Foundation too.

Stretch-Stretch is a way to make setting up a Raspberry Pi for the first time much, much easier. You won't need network access, and you won't need to download any special imaging software. Just head to the download page, grab a copy of the stretch zip file, and unpack it onto a freshly formatted 4GB (or larger) SD card. When you boot up for the first time, you'll see a menu prompting you to install one of several operating systems into the free space on the card. The choice means you can boot the Pi with a regular operating system like Raspbian, or with a media-centre specific OS like RaspBMC.

Once you've installed an operating system, your Pi will boot as normal. However, stretch stays resident on your card, so by holding shift down during boot you can return to the recovery interface. This allows you to switch to a different operating system, or overwrite a corrupted card with a fresh install of the current one; it also provides a handy tool to let you edit the config.txt configuration file for the currently installed operating system, and even a web browser so you can visit the forums or Google for pointers if you get stuck.

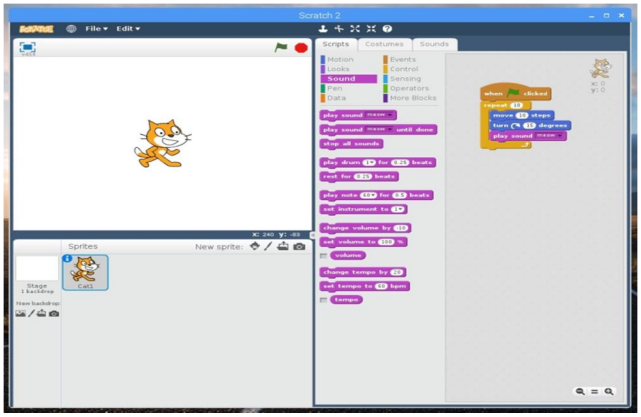

Fig 3. Stretch interface

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OPENCV- OpenCV supports the deep learning frameworks TensorFlow, Torch/PyTorch and Caffe.
The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 18 million. The library is used extensively in companies, research groups and by governmental bodies.
Along with well-established companies like Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, Toyota that employ the library, there are many startups such as Applied Minds, Video Surf, and Zeitera, that make extensive use of OpenCV. OpenCV's deployed uses span the range from stitching street view images together, detecting intrusions in surveillance video in Israel, monitoring mine equipment in China, helping robots navigate and pick up objects at Willow Garage, detection of swimming pool drowning accidents in Europe, running interactive art in Spain and New York, checking runways for debris in Turkey, inspecting labels on products in factories around the world on to rapid face detection in Japan. It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available. A full-featured CUDA and OpenCL interfaces are being actively developed right now. There are over 500 algorithms and about 10 times as many functions that compose or support those algorithms. OpenCV is written natively in C++ and has a templated interface that works seamlessly with STL containers.

III. PROPOSED WORK

The proposed work is to use image recognition to detect a human face if the face is present in our database the door is opened, if the face is not present in the database an e-mail is send to the owner from the Raspberry pi. This allows the user to lock and unlock a door from inside or outside a house. Followed by the operation of the Raspberry pi module in our design, the bell, and the pi-cam has been provided. Our smart digital door lock system operates over internet network by using raspberry pi3. The system structure consists of the following three phases: (i) input, (ii) processing and (iii) output. Input phase aims to input i.e. Pressing bell by a newcomer, as the bell is pressed a photo is taken. Processing phase extracts specific features from a face and after their conversion into mathematical vectors, they are matched within our database.If the match is successful the door is opened,if not then the photo is send to the user via e-mail. Output phase in the end makes sure that if the owner of the house wishes to allow newcomer to enter, the door gets opened by reverting back to the mail. This smart security system based on a Raspberry Pi model gives the full access to allow or deny the entrance of any intruder into the house, now the owner has the 100% access to who is visiting his place or not regardless of the owner being in the vicinity of the device as this device sends information over E-mail. This E-mail now has image of the intruder or the newcomer, and any revert back to this E-mail would open the locking system for the newcomer. Whereas denial to this email will not unlock the door and hence the property remains safe.

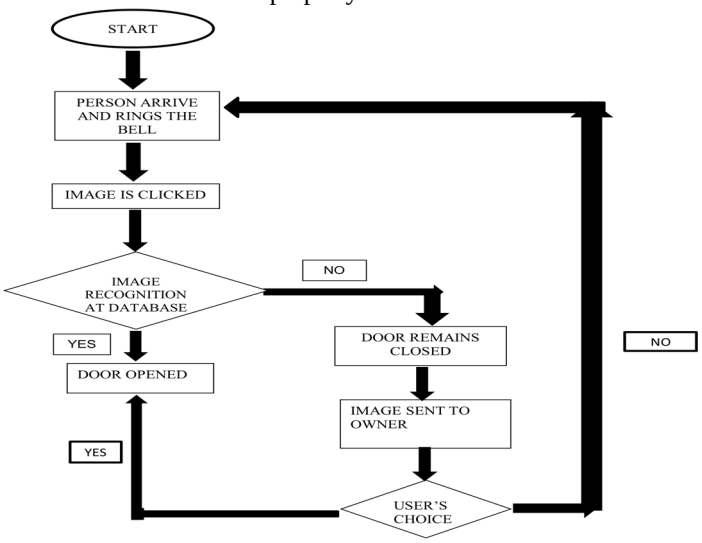

Fig 4 Flowchart for Design Methodology

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The hardware connections made are also shown below. An LED was used at every stage of the process for ease of understanding. When the image is taken for the first time through the camera(Webcam in this case), The image is sent from the camera module directly to the gmail account of the owner. After studying the image he can revert back to the account of the raspberry pi with a 'Yes' and the gate will open or subsequently send a 'No' and the gate will not open. After the person enters the house it is his responsibility to close the door.

IV. CONCLUSION

We designed the System which reduces human efforts and provide security. Proposed system is cheap, reliable and components are easily available. It is also portable and easily upgradable. System provides Security locks for door, comfort, connivance security and energy efficiency for user. Raspberry Pi-3Model B. cameras for capturing the image of the guest. The security level is increased due to the usage of Raspberry Pi-3Model B which sends the images to the user. It has in built capabilities of connecting to external devices. Raspberry pi proves to be smart economic and efficient platform for implementing the home security system and for automation. Two advantages provided by the system is that, Necessary action can be taken in short span of time. Smart door lock is one of the most popular digital consumer devices because of the user convenience and affordable price. In actuality, it is replacing a lot of conventional stypes of locks ,the system based on Raspberry Pi system is a low cost and efficient device for such purposes. In future, the android application should display support in controlling more doors, windows and basic home electronic appliances.

V. ACKNOWLEDGMENT

We will take this opportunity to express our profound gratitude and high regards to our teachers Mr. Sandeep Sharma and Mr. Risheek Kumar Mishra for their exemplary guidance, monitoring and critiques throughout the course of this project. We would also like to express our sincere gratitude to our mentor Ms. Maansi Gupta for providing her impeccable and invaluable guidance, comments, thoughts and encouragement throughout the particular endeavor

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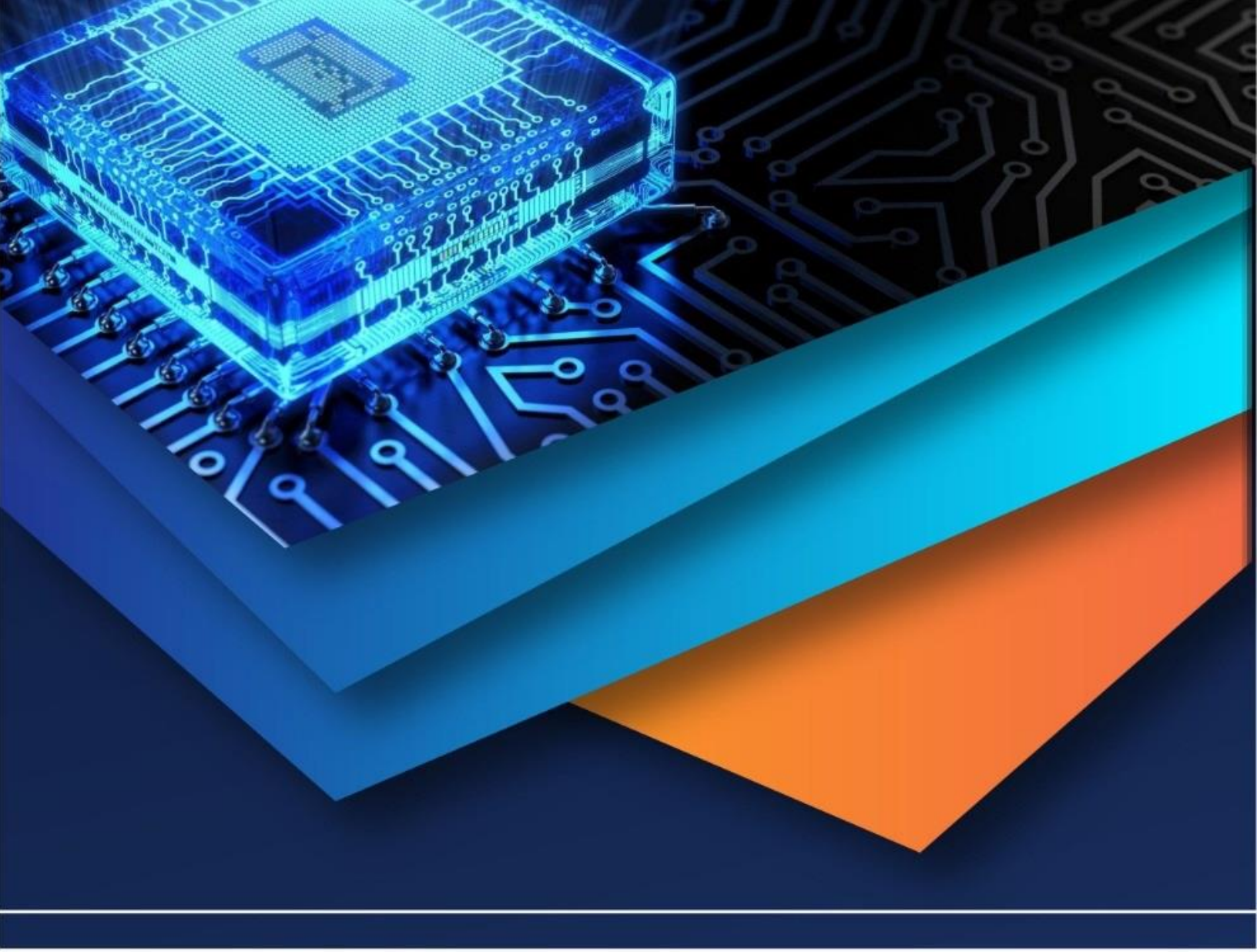

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