SMART SECURITY SYSTEM USING INTERNET OF THINGS (Raspberry Pi Board)

[1]SAURAV RAJPUROHIT, [2]Dr. RAVI SHETH,
[1] P.G. STUDENT (M.Tech.), [2]ASSISTANT PROFESSOR,
[1]INFORMATION & TECHNOLOGY (SPECILIZATION IN CYBER SECURITY) ,
[1&2] RAKSHA SHAKTI UNIVERSITY, LAVAD, GANDHINAGAR INDIA

Abstract : Security now a days is a very important issue so Smart Security System based on Frontal Face Detection Method was conceived with the idea that it will offer protection batter than current security system. This system consists of raspberry pi board and a camera with internet connectivity. It is done by Open Cv in Python using different image processing and comparison methods and techniques. The recognizer is trained earlier with the images stored in the database. As a face appears in front of the camera, it captures it and then the system compares it with those photos in the database. If the face of person is matched more than 60% than the IOT device will generate an alarming signal to nearest authorities with the location, person details and both images which captured and already stored image. Hence for police and authorities it will be easy to identify criminals and through this system a lot of time and resources will be saved. ATM is used here for implementation of this system because all ATMs are operated by centrally hosted system using interbank operation system so its easy to use one centralized server to store all suspects images and can be compared at different locations.

***Index Terms* – IOT, RASPBERRY-PI, OPEN-CV, DATABASE.**

I. INTRODUCTION

. In the present day's of the digital world, there are a number of practical implementations and research work is being performed to get rationalism for humanity. There are traditional ways and archaic being utilized even today but with vast resources, one wanted to be more meager and secured. Technically, the machines through applications are trained so that they can be affable both publically and individually.For an individual security system, researchers were working more on Biometrics and its applications. hence the archaic is of keys, passwords, etc. concentrating more on analog designs.

This system will be capable of capturing live images when ever any one come in front of camera and than it stores that images in database or we can prepare our own database and than we can compare that stored images with the live video and the system will tell the who is the person in the front of camera. If admin have set a flag for a particular person than it will send a alarming signal to the admin.

They are being used vastly because of their lightweight, compatibility and portability. They have their wide area of applications because of mentioned specifications i.e. human & animal detection, spying, body detector, etc. through camera module and wi-fi module, home-automation, machine robotics, and many more automated series which provides its real-time analysis working. Hence a lot of projects is done with previous Raspberry Pi models. Here the camera module is interfaced with Raspberry Pi 2 model B module with a display monitor with HDMI cable which gives its best and optimum proof on its specified properties like light-weight, portability & low power consumption with the help of an easy and the rationalized algorithm provided.

II. RASPBERRY-PI

To implement such a project, the main and most important step was finding the hardware to use for the device. We have chosen a Raspberry Pi 3 B+ model to use in our device. We have done a lot of research, and compared elements in different microcontrollers, like, cost, processing, and user-friendliness. The specific reasons for choosing this specific development board is the high processing capacity, relatively low price, and its ability to adapt in different programming modes.

The device uses Raspbian os as an operating system, which is capable of handling a large number of libraries and applications compatible with it. Raspberry Pi has an Ethernet port allowing us a network connection, as long as we are in the same subnet with the device we want to access and manage, 4 USB ports used to connect external hardware devices like a keyboard, mouse, PI camera, and other hardware devices which can be connected through a USB port, and an HDMI port is also provided which provides us access to the interface of the operating system which is installed, and can also be used the first time while installing the devices. It has 40 GPIOs pins that allow us to receive and Transmit signals to external devices.

They are divided in half into two groups: the 3V, and the 5V group. Therefore, some pins of the microcontroller give a voltage of 3V and the other 5V as per requirement. Raspberry Pi does not have an operating system previously installed, but that can be downloaded from the Raspberry website, and transferred to an SD card.

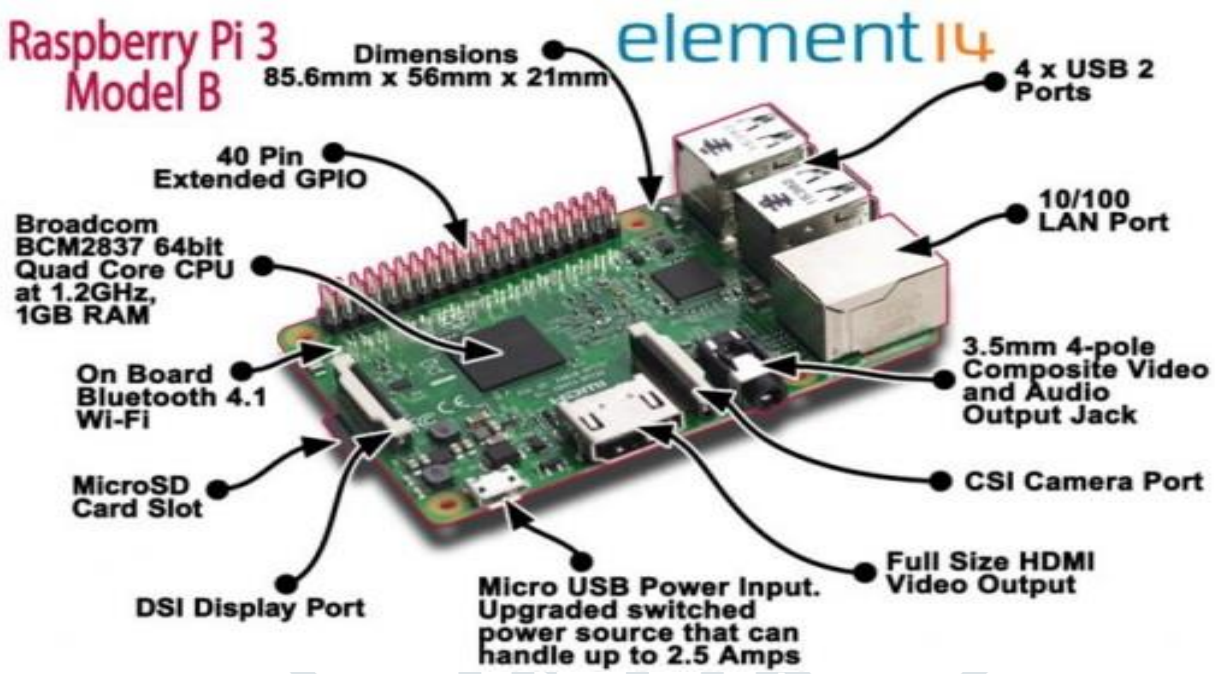

Fig 1. Raspberry pi 3B model

III. LITERATURE SURVEY

Now efficiency and optimum results are showing better results on digital designs and development, exemplary are digital signatures, image identifications, digital authentications, etc. experimentally. So, today more conveying is on embedded system design and development which is a podium for automation and its versatility. Since the embedded system always defined with hardware interfacing with recognized software combinations. Like Arduino boards, Polulu, TI Launch pad, etc. are standard embedded platforms that are being used both by beginners and experts. Hence it has its own operating systems and based on RISC architectures, and they very well profound the area of automation and their core applications. In recent years face recognition has received substantial attention from researchers in biometrics, pattern recognition, and computer vision communities. The machine learning and computer graphics communities are also increasingly involved in face recognition.

Books referred

[**1] K. Gopalakrishnan, V. Sathish Kumar :** They were used an Embedded platform which was very unique and easy to implement .They proposed an image capturing technique in an embedded system based on Raspberry Pi board and Considering the requirements of image capturing and recognition algorithm, Raspberry Pi processing module and its peripherals, implementing based on this platform, Finally they were concluded that the designed system is fast enough to run the image capturing, recognition algorithm, and the data stream can flow smoothly between the camera and the Raspberry Pi board.

[2] Tony Di Cola: His project was "Raspberry Pi Face Recognition in Treasure Box" a great example of how to use the Raspberry Pi and Pi camera with Open CV's computer vision algorithms. By compiling the latest version of Open CV, it can get access to the latest and most interesting computer vision algorithms like face recognition. Also he used a Solenoid double action lock which is lock/unlock using key after power off.

[**3] Kuldeep Soni:** He developed a system within advanced surveillance camera capable of face detection and at the same time recognizing the face detected using OPEN-CV library, Eigen face methodology and these all processing has been done on Raspbian OS on Raspberry Pi. For capturing the images he used Pi Camera Board. With the help office recognition capability he proved that the advanced surveillance camera system using face detection and at the same time recognizing the face detected is highly secured system.

[4] Meda kTeena Ravali, Prof. Ranga Sai Komaragiri: They proposed that a low cost alternative for DSP kits for image processing using Raspberry pi board with Open-cv package. In this proposed work the platform for image processing is or algorithm for face recognition is implemented on principal component analysis. There system has been designed on the criteria of resources optimization, low power consumption and improved operation speed.

[5] Anoop Mishra, Arshita Dixit: They proposed there work on Raspberry pi 2 B+ model with camera interface to capture an image and convert this capture image into gray image with digital processing image algorithm. Also they conclude that the practically applied result is rational and designed system is technically smarter than while performing the image interfacing system on a Personal Computer.

[6] KandlaArora: He proposed that real time application of Face Recognition concept by generating a matlab code using image acquisition tool box on the basic approach used is PCA using Eigen faces.

[7] Sanjana Prasad, P. Mahalakshmi, A. John Clement Sunder, R. Swathi: They implement Smart surveillance monitoring system using Raspberry pi and PIR sensor for mobile devices. Also their proposed work implements home security system captures information and transmits it via a 3G Dongle to a Smart phone using 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.

IV. WORKING

1. *FACE-DETECTION*

Face detection is a very psycho-logical process through which humans attend and locates faces in a visualized scene. Once any camera captures any image of an object the captured image data is stored somewhere. Here, we are using open-CV for the facial detection, Open-CV is basically written in C Language but there are many libraries and Bindings for python and PHP both. Here a python script will be used for detecting the frontal face and it's done by installing Open-CV and Python depended libraries in raspberry Pi. When any person comes in front of camera than the camera will identify the face if a face is detected than the Pi board will run pre installed script and captures the images of the person with complete visible face and stores the captured image in database with details stamp than it will crop the face area and it will start the comparison process . it will compares the captured image with the pre stored images of database.

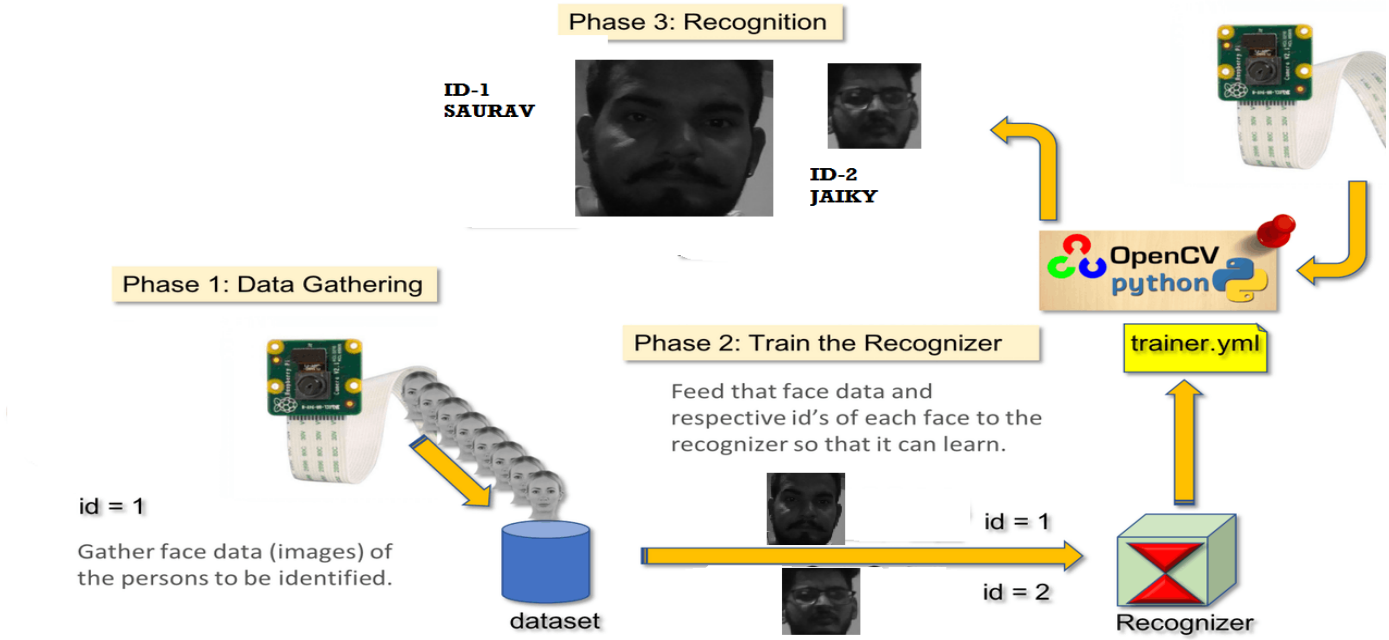

Fig. 2 Flow of the system

2. *DATA GATHERING*

Data gathering means collecting all the information regarding the face or any other thing which is related to it. Here data gathering means collecting the face data of the persons , here we are taking almost 30 samples 1 at every second and storing them in our database.

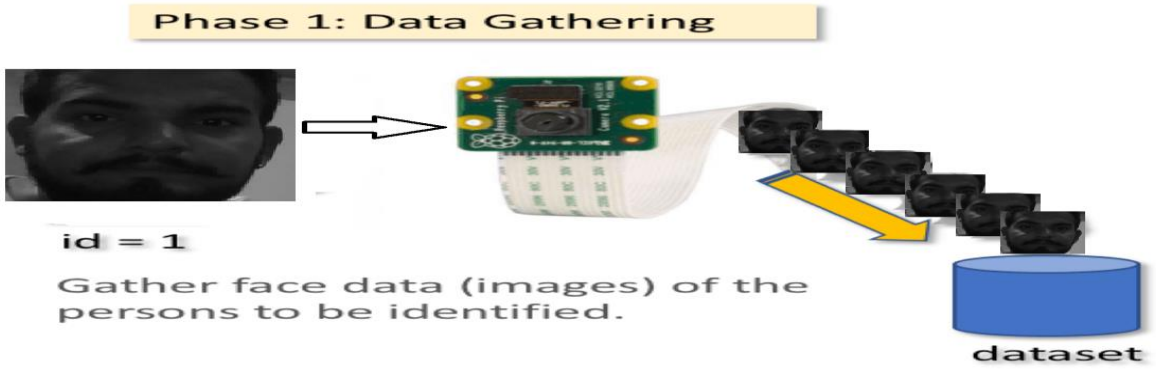

Fig. 3 Data gathering process

3. *TRAINER*

we must take all user data from our dataset and "trainer" the OpenCV Recognizer. This is done directly by a specific OpenCV function. The result will be a .yml file that will be saved on a "trainer/" directory. A file named "trainer.yml" will be saved in the trainer directory that was previously created by us. Training images means converting them to the format in which Open CV can read them and identify them.

4. *FACE RECOGNITION*

This is the final phase of our project so here, we will capture a fresh face on our camera and if this person had his face captured and trained before, our recognizer will make a "prediction" returning its id and an index, shown how confident the recognizer is with this match . it will compare with the stored faces of the persons in database and according to confidence match it will show the name of the person and its id with a square box on face whenever any person comes in front of camera, when persons data is not stored in database than it will indicate unknown.

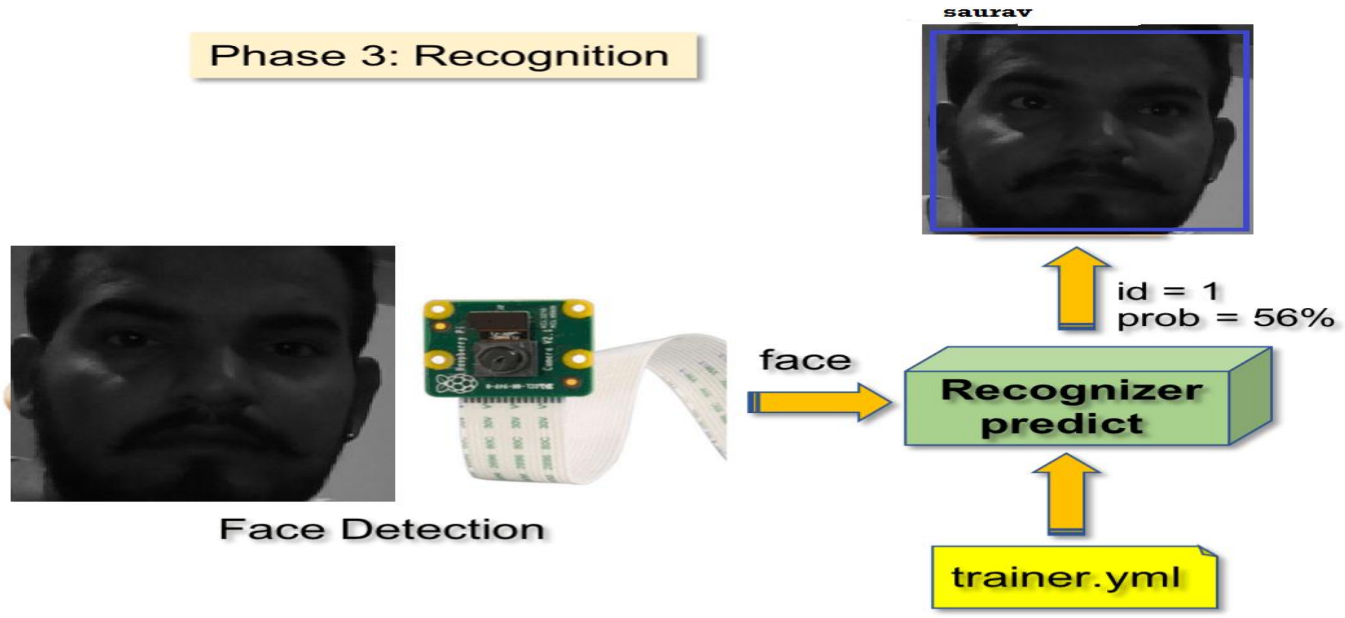

Fig. 4 face recognition and results

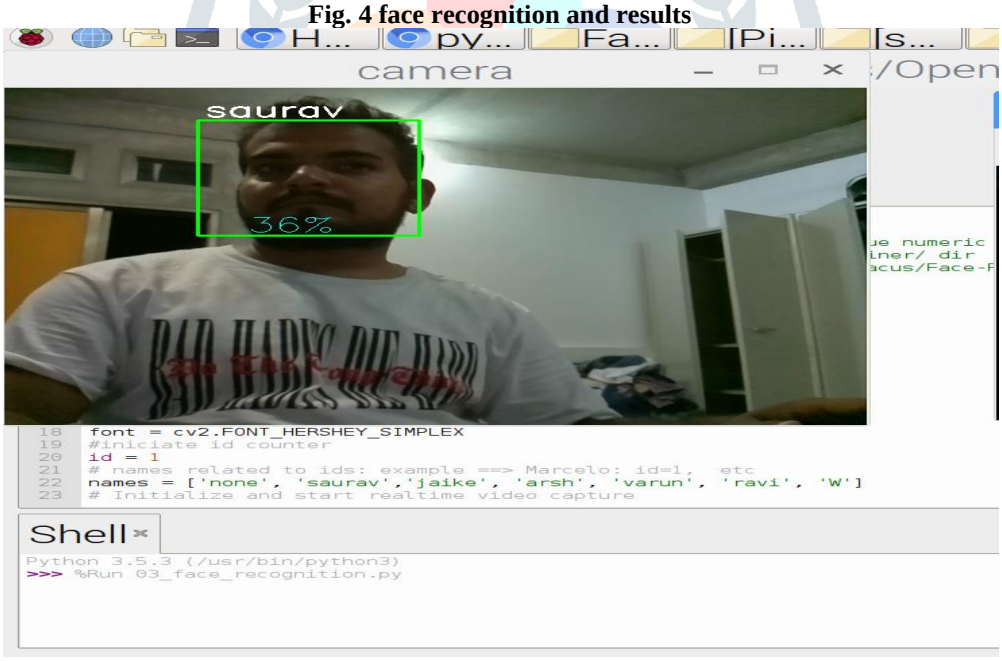

Fig.6 Final result with name and confidence %

5. *DATA TRANSMISSION*

When a face is successfully identified and admin of the monitoring system has kept a flag on any id which may be a suspects id of face so when the suspects face comes in front of camera and face recognition system has successfully identified the suspect so it will send an alarm to the monitoring admin which may be through many ways like e-mail or sms. For sending sms we may use gsm module with Raspberri pi by just making few GPIO connection and it will warn when ever any suspect comes in front of camera.

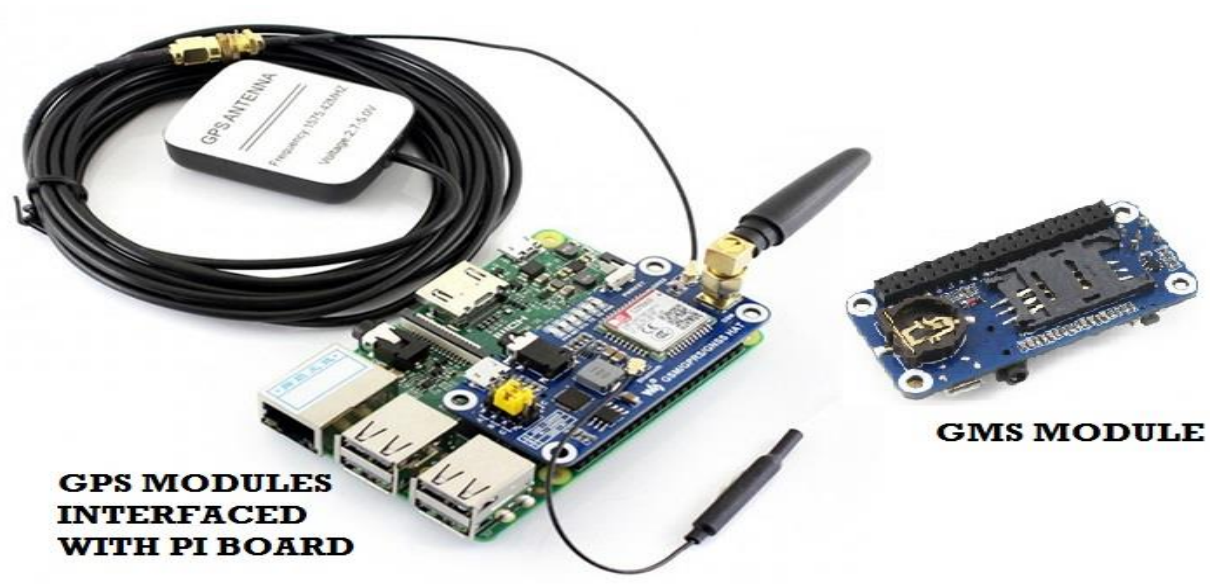

Fig. 7 GSM & GPS module interfaced with Raspberry Pi

V. FUTURE SCOPE

With the use of raspberry pi and many other IOT Development boards the current project can be modified by an Infrared camera interfacing it can be used in Smart Surveillance Monitoring security system which any type of public security is using Living body detection or spying, Also, it can be used in Attendance system of the class, Also some profound applications can be implemented using interfacing of Raspberry Pi and Arduino UNO board like sensor application of smartcard swapping, finger detection, amount of alcohol intake detection, in agriculture like soil humidity sensing, Temperature sensing using web server, and many more. New studies are being made to allow images to be processed on the GPU of the Raspberry Pi, achieving better results with the use of specific libraries and different depended files.

VI. APPLICATIONS

- Home security
- Public place security
- Can be use for smart attendance system
- For creating automated user log table
- ATM security
- Monitoring purposes
- Many more...

VII. CONCLUSION

A face detection smart security system was developed using Raspberry Pi. The system was programmed using Python programming language. Both Real time face detection and face detection from specific images, i.e object recognition, was carried out. The efficiency of the system was analyzed in terms of face detection rate. The analysis revealed that the current system may be updated to get more efficiency and accuracy and performance and even poor quality images can be used for face detection. Using Raspberry pi made this project more smaller scale, light weight and low power consumption as compared to a full size computer and its open source software and libraries made it very convenient.

VIII. ACKNOWLEDGMENT

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