# Smart Monitoring Technology

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***Abstract-*** *Recognition of facial identity has developed an attractive solution to identify many contemporary needs for identification and verification of identity claims.it brings to collaborate with other biometric systems, which attempt to tie identity to individually distinctive features of the body, and the more familiar functionality of visual surveillance systems. The real-time embedded video monitoring system sends video for authentication purpose and revert back an alert system for an thread found in a frame.*

*Keywords*- Raspberry Pi2; Pi Camera; Opencv; Haar Cascade Classifier

## I. INTRODUCTION

According to current scenario, surveillance is an basic need in every organization via devices such as a camera, CCTV etc., In these type of system, the person who is stationary and is located in that particular area can only view what is happening in that place. Whereas here, even if the user is moving form one place to another . The main advantage is used in security purpose and another advantage that it offers privacy on both sides since it is being viewed by only one person . The other major advantage is that it is simple circuit. The operating system used here is Raspbian OS.

Temperature and Humidity and Human motion are one of the most frequently observed parameters, and are extremely harmful at temperature and humidity and alert system for a long times. So proposed system capable to monitoring these outcomes indefinitely without any delay and without putting any harms way. Our proposed idea is implemented on Raspberry Pi and interfaced with two sensors and controlling the device also real time video streaming is implemented for quick action with alert system implemented using SMS or email system

There are system available other than CCTV such as Retina scanner, fingerprint scanner, IR laser, RFID systems only with the drawback that they are cost inefficient with high implementation and maintenance costs. Hence, such systems are not preferred way for security purpose for small scale applications. Proposed system covers all these drawbacks by its efficiency, complexity. This monitoring system is low-cost and user-friendly too.

## II. METHOD

The smart monitoring technology is developed in this study based on technology of facial detection and recognition.it is observing device operation such as human motion, facial identity and video capture. In the Figure 1 shows the smart monitoring technology architecture, When raspberry Pi B+ model, GSM and WIFI module are used to control this system to implement a platform which can provide face detection and face recognition with the help of raspberry pi which is credit card sized minicomputer and a pi camera which is made especially for the raspberry pi model. Thus, when dealing with the real-time image processing. Open source computer vision (OpenCV) software, a powerful library of image processing tools is a good choice. With the help of smart monitoring technology, we have achieved a system that can record the event, detect and recognize the person, A GSM module is used to send a message stating whether the person is an intruder or a visitor. If it is a visitor, then a command is sent by the user to perform some operation like-open the door (any type of automation is implemented) however if it is a stranger an alarm is generated to indicate that there is an intruder

## III. LOW COST SMART CAMERA WITH NIGHT VISION CAPABILITY USING RASPBERRY PI AND OPEN CV

CCTV(Closed Circuit Television) had provided a clear way to maintain security to people nowadays itself it is being utilized successfully. This study focussed on the design and implementation of a low cost smart technology with face recognition using raspberry pi (RPI) and OpenCV. The system was designed to be used inside a warehouse facility. It was human detection and smoke detection capability that can provide precaution to potential crimes and potential fire. The CREDIT CARD size Raspberry Pi(RPI) with open source computer vision (OpenCV) software handles the image processing, control algorithms for the alarms and sends captured pictures to user's email via Wi-Fi or SMS via GSM module. As part of its alarm system, it will play the recorded sounds: "intruder" or "smoke detected" when there is detection. The system uses ordinary webcam but its IR filter was removed in order to have night vision capability

## IV. BLOCK DIAGRAM

The figure 1 show below as a block diagram is pretty simple which consist of basic components which describes that it is efficient in generating the results as required.
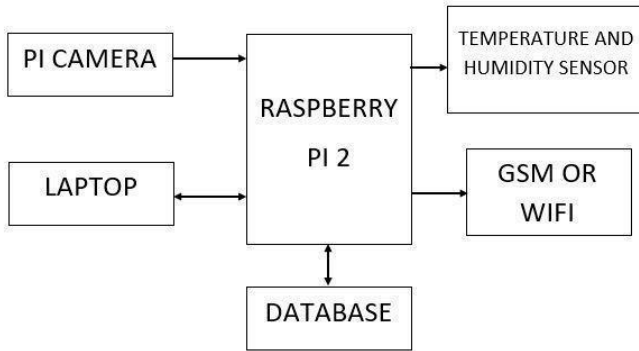


Fig. 1 Block diagram of the system

The input required is the real time images which will frames through camera and it is further carried through computer or laptop which is interfaced with raspberry pi which scrutinizes the faces .If any faces are detected then it is processed to identify if the face is comparable or not. Finally the output is generated.

II.      RASPBERRY PI 3: The Raspberry Pi, Raspberry Pi 2/3 and Raspberry Pi Zero are a series of ARM-powered, credit card-sized single-board computers (developer boards) made in the UK by the non-profit Raspberry Pi Foundation organization for educational and hobbyist purposes. These low power computers are mass produced at very low prices and the high number of units sold gives it massive community support. The Raspberry Pi is a low-cost credit-card     sized single-board computer. The Raspberry       Pi      was created   in        the UK by the Raspberry   Pi      Foundation. The      Raspberry Pi Foundation's goal is to "advance the education of adults and children, particularly in the field of computers, computer       science and       related subjects." Many people have used the Raspberry Pi to make things like cameras, gaming machines, robots, web servers and media centres.



1. PI CAMERA: The Raspberry Pi Camera Boardv2 is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens. It's capable of 3280 x 2464 pixel static images, and also supports 1080p30, 720p60, and 640x480p90 video. It attaches to the Pi by way of one of the small sockets on the board's upper surface and uses the dedicated interface, designed especially for interfacing to cameras. The Raspberry Pi Camera Board plugs directly into the CSI connector on the Raspberry Pi. It's able to deliver a crystal clear 5MP resolution image, or 1080p HD video recording at 30fps! Latest Version 1.3.Custom designed and manufactured by the Raspberry Pi Foundation in the UK, the Raspberry Pi Camera Board features a 5MP (2592×1944 pixels) Omnivision 5647 sensor in a fixed focus module. The module attaches to Raspberry Pi, by way of a 15 Pin Ribbon Cable, to the dedicated 15-pin MIPI Camera Serial Interface (CSI), which was designed especially for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data to the BCM2835 processor.



Fig 3.pi camera module

**III. GSM MODULE:** GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.as shown in figure below



Fig.4 GSM module SIM900

## V. SOFTWARE

RASPBIAN OS: A Raspbian image is a file that you can download onto an SD card which in turn can be used to boot your Raspberry Pi and Via APC into the Raspbian operating system. Using a Raspbian image is the easiest way for a new user to get started with Raspbian.

OPEN CV: OpenCV (Open Source Computer Vision Library) is released under a BSD license and hence it's free for both academic and commercial use. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. OpenCV was designed for computational efficiency and with a strong focus on real-time applications. Written in optimized C/C++, the library can take advantage of multi-core processing. Enabled with OpenCL, it can take advantage of the hardware acceleration of the underlying heterogeneous compute platform.

## VI. WORKING PRINCIPLE

The entire procedure of the output can be described with the help of flowchart. The image is captured by the pi camera which has 5MP pixel resolution with 30 FPS, this image is then followed by the face detection package, which checks the frame obtained for any faces that can be found with the help of the Haar like features if the face is detected then it is cropped out.
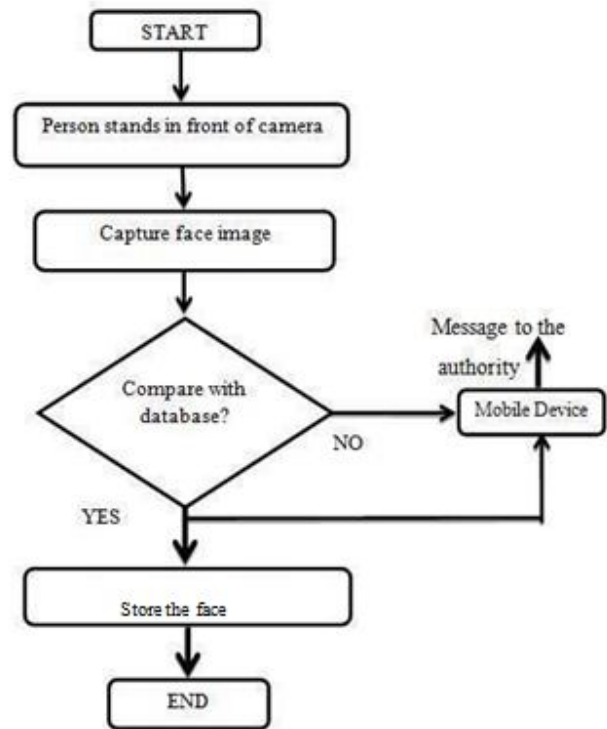


Fig.4. Flow chart of the smart monitoring technology

In above fig 4. shows that the flowchart of face captures and recognition process, at initial stage the authorized person comes in front of camera. The camera module will capture the face image with current poses. The captured face of current poses creates a data base ofthe authorized person and stores this. At the next time camera module will capture the current live face of the person. All this process is done in Raspberry pi module.

When comparison done successfully the image will be stored otherwise Raspberry pi module will capture an image once again through the camera and process is repeat Raspberry pi will send a command to the Mobile device send a message to the Authorized person is "FACE MATCHED" when comparison is done successfully otherwise send security alert "Unknown person is detected".

A) FACE DETECTION

All Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images. Face detection also refers to the psychological process by which humans locate and attend to faces in a visual scene. HAAR Cascade Haar-like features are digital image features used in object recognition. They owe their name to their intuitive similarity with Haar wavelets and were used in the first real-time face detector. Here we will work with face detection. Initially, the algorithm needs a lot of positive

images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, haar features shown in below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle. Now all possible sizes and locations of each kernel is used to calculate plenty of features. For each feature calculation, we need to find sum of pixels under white and black rectangles. To solve this, they introduced the integral images. It simplifies calculation of sum of pixels, how large may be the number of pixels, to an operation involving just four pixels
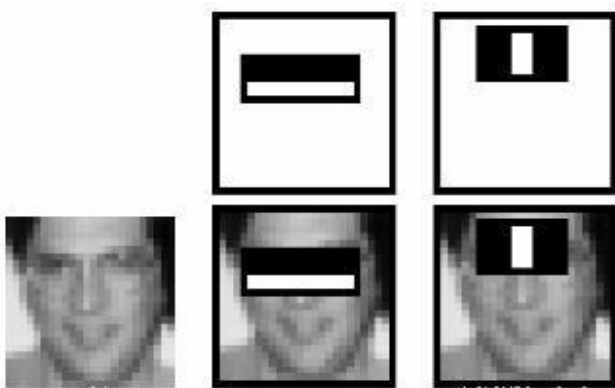


Fig.5 Haar like feature cascade classifier

## B) FACE DETECTION

The histogram of oriented gradients (HOG) is a feature descriptor used in computer and image processing for the purpose of recognition The technique counts occurrences of gradient orientation in localized portions of an image. This method is similar to that of edge orientation histograms, scale-invariant feature transform descriptors, and shape contexts, but differs in that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy. The essential thought behind the histogram of oriented gradients descriptor is that local object appearance and shape within an image can be described by the distribution of intensity gradients or edge directions. The image is divided into small connected regions called cells, and for the pixels within each cell, a histogram of gradient directions is compiled. The descriptor is the concatenation of these histograms. For improved accuracy, the local histograms can be contrast-normalized by calculating a measure of the intensity across a larger region of the image, called a block, and then using this value to normalize all cells within the block. This normalization results in better invariance to changes in illumination and shadowing. The final step in object recognition using histogram of oriented gradient descriptors is to feed the descriptors into some recognition

system based on supervised. The support vector machine (SVM) classifier is a binary classifier which looks for an optimal hyper plane as a decision function. Once trained on images containing some particular object, the SVM classifier can make decisions regarding the presence of an object, such as a human, in additional test images.
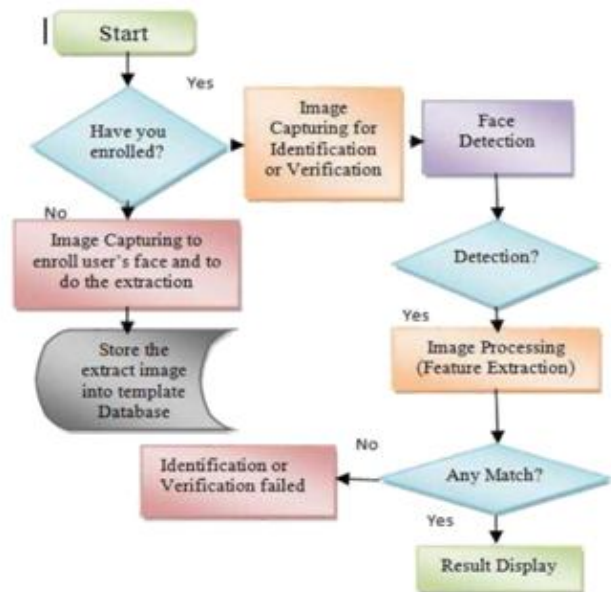


Fig.6 Flowchart of face recognition.

## VII. RESULT

The smart monitoring technology is very effective in terms of that it provides security by reducing the alarming raise of crime at home . The Face of the human being is detected easily with the help of the implemented algorithm via Haar like cascade classifier.The delay observed due to camera quality and frame rate that can adjusted by variations in algorithm.
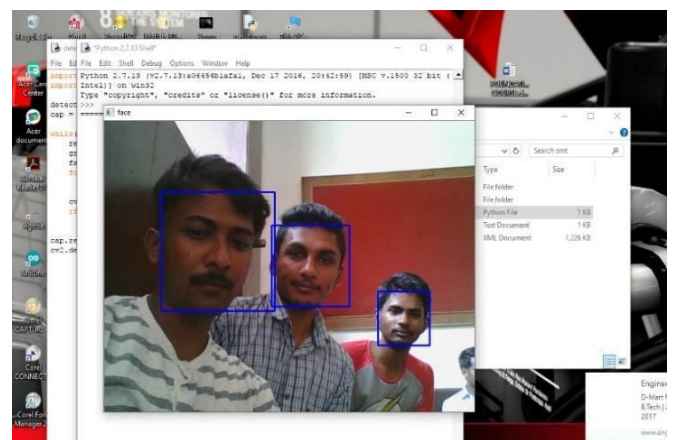


Fig.7 detected and found all faces correctly

Table 1 for experimental result

| | Image3 |
|---|---|
| Face Detected / Not Detected | Multiple Face Detected |
| Position of the Face | [165 52] [70 51] [165 52] [63 52] |

## VII. CONCLUSION

The design of the face recognition system using Raspberry pi can make the smaller, lighter and with lower power consumption, so it is more convenient than the PC-based face recognition system. Because of the open source code, it is freer to do software development on Linux. Face detection and tracking is being a challenge for many researchers with real time Image sensor. With the advancement the real time face detection in remote monitoring is helpful for building many efficient industrial and commercial applications. Moreover such technology can be useful in tracking the lost object under dynamic environment. Further enhancement of this work can be extended with stereo depth analysis of face detection using two image sensor interfaced with High speed Processor.
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## VIII. FUTURE SCOPE

Using raspberry pi 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 smart card swapping, finger detection, alcohol detection, agriculture 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.

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