

# IoT based Smart Home using Face Recognition

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**Abstract:** IoT describes the idea of connecting and monitoring real world objects through internet, which allows the objects to exchange data with each other. With influence of Internet in people's life a lot of technologies are coming up. IoT is evolving by combining various technologies that results in smart system which provides ubiquitous access and is pervasively spread.

IoT is one of the most rapidly emerging and trending technologies. Smart System is apt for modern lifestyle. In modern times, people prefer automatic systems than manual systems. When it comes to home or any organization this concept can be incorporated to make it smarter, safer and more flexible. This IoT based project focuses on building a Smart Wireless Home Security System by simply using a smart phone and interfacing all the components with raspberry pi, which sends security alert messages to authorised users in case of any trespassers trying to enter the house by Face Detection and Face Recognition. This project provides controlling and monitoring the home as well as it provides security from illegal entry. It presents a proposed system for Smart Home Automation with Raspberry Pi using IoT which is done by interfacing the camera and all the components to raspberry pi using IoT and image processing. It will also consume less power and provide more security for Intruder Detection. It enhances the use of wireless communication which provides the user more flexibility and ease to deal with various electrical and electronic devices. In this project we will automatically detect the person's presence to ON/OFF the light, fan which will help in saving light power. Using this we can control and monitor home appliances connected through internet.

**Keywords:** Face Detection, Face Recognition, Home Security System, Image processing, Raspberry, pi.

## I. INTRODUCTION

### A. Overview

The emergence of smart devices has boosted the concept of connecting everyday objects via the existing networks. The major increase of connected devices has crossed the boundaries of the conventional networks, resulting in major demand for "Internet of Things (IoT)". IoT is rapidly growing network of devices and objects, which are uniquely addressable within the network and capable of identifying

and sharing information with or without human intervention. The concept of Home Automation was a topic of interest since long time, with time and advancement of technology, human expectations about Home Automation and how they should access their home has dramatically changed. The added expectations and convenience of access has brought new security challenges to the Home Automation. In this sense, learning and understanding human behaviour has emerged as a relevant issue, the analysis of the human & system interaction with a smart home has become crucial.

## II. SYSTEM DESIGN & IMPLEMENTATION

### A. Proposed System

The project provides additional security and automation using Face Recognition and IoT. Initially camera will capture the face of

the person and that image will be compared with authorised images in database.If the image is recognised as authorised image then the person will be allowed to enter inside,else the image will be sent to authorised person via web page which can be accessed using android app.A request will be sent to that authorised member to provide added security to access the image sent on web page,after checking the image on web page the authorised person will decide if the person is to be allowed inside or not,if the person is authorised then the authorised user will will give command to open the door which will rotate the motor and the door will be opened,some delay will be given and after that particular time the motor will rotate anti-clockwise which will close the door.Incase the authorised person doesn't recognise the person then the command to open the door will not be given and buzzer will be on which will alert that the person arrived at the door is unknown.Gas and Temperature sensors will be

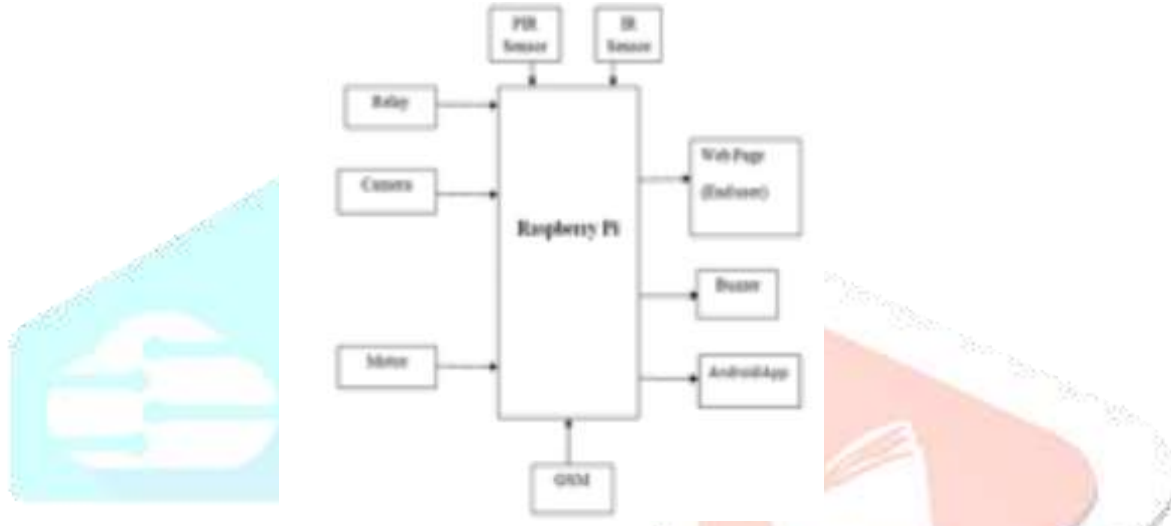


Fig 1: Block Diagram of Proposed System

nterfaced with raspberry pi which will help to detect the temperature and leakage of gas alerting the members of the home.Temperature detection will help in knowing the temperature in that particular area which will decide if the fan should be ON or OFF when the person enters the room.

**B. Flow Chart of Proposed System**



Fig 2: Flow chart

**C. Proposed System Functions**

The proposed home automation system has the capabilities to control the following components and appliances in users home,this

will be done by interfacing all the components to raspberry pi.

- Face Detection and face Recognition
- Temperature
- Lights on/off
- Fan on/off
- Gas Leakage

#### D. Software Design

##### Front End Design: PHP

It is a server-side scripting language designed primarily for web development but also used as a general-purpose programming language. PHP code may be embedded with various web template systems, web management systems. The web server combines the results of the interpreted and executed PHP code, which may be any type of data, including images, with the generated webpage.

##### Back End Design: MySQL

MySQL is an open source relational database management system (RDBMS) based on SQL. MySQL runs on virtually all platforms, including Linux, UNIX, and Windows. Although it can be used in a wide range of applications, MySQL is most often associated with web-based applications.

### III. ALGORITHMS

#### 2) Eigen Face - used for Face Recognition

##### 1) Viola Jones - used for Face Detection

This algorithm is used for Face Detection. Humans can easily do this but for a system to detect the face is not easy, for this Viola Jones is used which requires full view upright faces to detect, the quality might degrade if the faces are little tilted. It distinguishes faces from non-faces.

##### Features of Viola Jones:

1. Robust : It has a very high detection rate (it may be true or false negative).
  2. It can be perfectly used for Real Time applications.
  3. Implemented in OpenCV library.
- Only Haar Feature Selection will be used for face Detection.
  - Working of Haar Feature Selection.
  - All human faces share some similar features. These features can be matched using Haar Features.

##### Rectangle features:

Value =  $\Sigma$  (pixels in black area) -  $\Sigma$  (pixels in white area)

Three types: two, three, four-rectangles.

Viola & Jones uses two-rectangle features

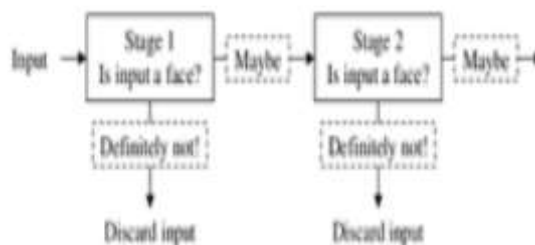


Fig 3: Working of Viola Jones

Eigenfaces is the name given to a set of eigenvectors when used for problem of human recognition. The eigenvectors are derived from

the covariance matrix of the probability distribution over the high-dimensional vector space of face images. The eigenfaces themselves form a basis set of all images used to construct the covariance matrix. Classification can be achieved by comparing how faces are represented by the basis set.

**Features of EigenFace:**

- 1.Its training process is completely automatic and easy to code.
- 2.It reduces complexity in face image representation.
- 3.Face recognition can be achieved in real time. 4.It can handle large database.

**IV.RESULTS**

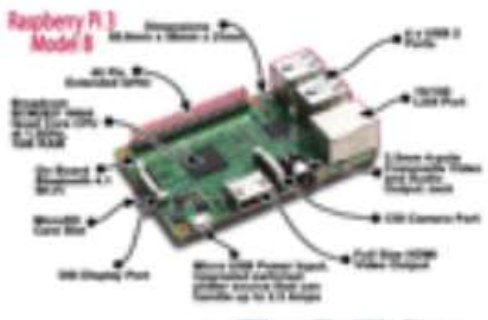


**Fig 4: Web Server Page**

After successfully capturing the image of the person at the door the image is sent to web page for authentication to check if the person will be granted entry or not,It will have a unique Id and password which will be used to login to

**V. HARDWARE USED**

**A. Raspberry Pi**



**D. Web camera**



**Fig 5: Raspberry Pi**

Raspberry pi is a credit card-sized development board.It is very versatile board with application in several areas.entrance,the captured image will be sent to the web.

**B. PIR detection**



**Fig 6: PIR Detector**

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. It will detect the presence of the person using the PIR sensor in that particular area where the sensor is deployed.

### C. PIR sensor



**Fig 8: Web Camera**

A web camera is a video camera that feeds or streams image in real time. After capturing the image it can be sent to other networks via internet or can be emailed. It can be used anywhere at any location irrespective of environment, climate etc..

### E. Gas Leakage Detector



**Fig9: Gas Sensor**

A gas sensor is a device which detects the presence of gas within any specific area. It is a type of equipment that can detect a gas leak and the working of the sensor is interfaced with the raspberry pi. On detecting the gas leakage the alarm is raised alerting the members in the place to move away from that place.

### F. Temperature Sensor



The temperature sensor is a device typically a thermocouple that provides temperature measurement through an electrical signal.

## VI. CONCLUSION

In this project, an architecture for low cost flexible home controlling and monitoring system using a Android phone is proposed. The proposed system uses web application for communication between user and home devices. It uses effective algorithms names Viola Jones & Eigen Face for face detection and recognition. Any android device which has active internet connection like Wifi or mobile cellular networks 3G or 4G can be used to control and monitor the home/ organization.

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