

# Office Automation with Face Detection and Counting System using Haar Cascade

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**Abstract** - The word automation means replacement of humans by machine. The automation system will work automatically without the involvement of human being. With increase in consumption of energy and population, there is a grave need to conserve energy in every possible way. People observation and counting is of interesting in many commercial and non-commercial scenarios. The Proposed system enables us the control of any or all electrical devices in our office. This project illustrates and demonstrates the effective implementation and controlling of office appliances and additionally the system will also counts the number of people in the office and also monitor number of visitors inside the office. Accordingly, it controls the electrical appliances to avoid excessive usage of electricity which results in less polluting and greener environment.

**Keywords**- Automation, Raspberry-Pi, Controller.

## I. INTRODUCTION

Now a day's most of the people spend their time in offices. Office environment should be leisure so that the employees can give their best as office environment directly affect the working efficiency of employees/workers. The automation system will work automatically without the involvement of human being. With increase in consumption of energy and population, there is a grave need to conserve energy in every possible way [1].

The project turns from sensor based to a vision based technology. The proposed system makes automation using face detection. Whenever a face is detected, the light and fan will automatically ON and they will be OFF when no face is detected. The Proposed system enables us the control of any or all electrical devices in our office. This project illustrates and demonstrates the effective implementation and controlling of office appliances and additionally the system will also counts the number of people in the office and also monitor number of visitors inside the office. Accordingly, it controls the electrical appliances to avoid excessive usage of electricity which results in less polluting and greener environment [2].

## II. RELATED WORK

Overview of various systems that identify human beings and count number of people in a particular area.

## A. People Identification And Counting System Using Raspberry Pi (Au-Picc: Raspberry Pi Customer Counter):

In this paper the authors discuss about implementation of open CV in an embedded system like raspberry-pi to create a mini-stand by alone station for counting people. The key feature is to count a number of interested people on target product in a pre-defined area along with simple face identification to avoid counting duplicates [1].

**B. IOT based Smart Security and Home Automation System:** In this paper the authors describe an approach discussed the idea of remotely connecting and monitoring real world objects to internet. This IOT project focuses on building a smarter wireless home security system which sends alert to the owner by using Internet [2].

**C. Security System using Raspberry Pi:** In this paper the authors introduce a system for monitor intelligent surveillance system that continuously monitors the targeted area and detects motion in each and every frame. If the system detects motion in the targeted area then a notification is automatically sent to the user by sms and the video starts getting recorded till the motion is stopped. Using this method the required memory space for storing the video is reduced since it doesn't store the entire video but stores the video only when a motion is detected. This is achieved by using real time video processing using open CV (computer vision / machine vision) technology and raspberry pi system [3].

**D. Face Detection and Tracking using Open Cv:** In this paper the authors introduce an application for tracking and detecting faces in videos and in cameras which can be used for multipurpose activities. The intention of the paper is deep study of face detection using open CV [4].

**E. Practical, Cheap Smart Home Implementation with General Purpose Embedded Hardware Raspberry Pi:** In this paper the authors introduces a complete system that make any home smart by using cheap, easily available hardware and open-source free software [5].

## III. BLOCK DIAGRAM DISCRPTION

Our system consists of DHT11 sensor from which we are getting the values of humidity and temperature. The monitor is used to display the values of temperature and humidity. The camera is used to capture the video and displays on the monitor. Haar cascade algorithm and Open CV library files are used for face detection. The output of 230v ac bulb is connected to the raspberry pi with the help of a switching

device called Relay. A 12v dc fan is connected to the Raspberry pi board. The automation system will work automatically without the involvement of human being. With increase in consumption of energy and population, there is a grave need to conserve energy in every way possible.

People observation and counting is of interesting in many commercial and non-commercial scenarios. The number of people in the office, the occupancy of office buildings or the passenger's count of commuter trains provide useful information to shop merchants and marketers, security officials or train operator.

**DHT11 Interfacing to Raspberry Pi** - DHT11 means Digital Output Humidity & Temperature sensor. It has three pins and it is connected to the raspberry pi GPIO pins.

**Camera Interfacing with Raspberry Pi** - In raspberry pi 3 models 4 USB ports are available. So we are taking USB portable webcam to interface with raspberry pi.

**Motor Driver Module (L293d) Interfacing with Raspberry Pi** - L293D is a 16 pin IC to drive the fan. The L293D is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V and it is connected to GPIO pins of raspberry pi 26&13.

**Relays Interfacing with Raspberry Pi** - One pin of relay is connected to ground of raspberry pi and another pin of relay is connected to vcc of raspberry pi.

#### Specifications of Processor:

- **Processor** : Broadcom BCM2837
- **CPU Core** : Quad core ARM Cortex-A53, 64Bit
- **Clock Speed**: 1.2GHz (Roughly 50% faster than Pi2)
- **RAM** : 1 GB
- **GPU** : 400 MHz Video Core IV@
- **Network Connectivity**: 1 x 10 / 100 Ethernet (RJ45 Port)
- **USB Ports**: 4 x USB 2.0

- **GPIOs**: 2 x 20 Pin Header
- **Camera Interface**: 15-pin MIPI

#### DHT11

- The DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with calibrated digital signal output.
- This sensor include a resistive type humidity measurement component and a NTC temperature measurement component, and connect a high performance 8-bit microcontroller.

#### CAMERA

- Video capture up to 1024\*768 pixels
- Photos: up to 5 megapixels
- Hi-speed clip fits laptops or LCD monitor
- Excellent quality and fashionable styles
- Motion detection
- Plug & play easy to interface
- Motion video capture

#### RELAY

- Circuits that operate at high voltages or at high currents cannot be controlled directly by an raspberry pi.
- Instead, you use a low-voltage control signal from the raspberry pi to control a relay, which is capable of handling and switching high-voltage or high power circuits.

#### L293DRIVER IC

- The power applied to the motor can be controlled by varying the width of these applied pulses and thereby varying the average DC voltage applied to the motor terminals [6].  
By changing or modulating the timing of pulses the speed of the motor can be controlled [6].

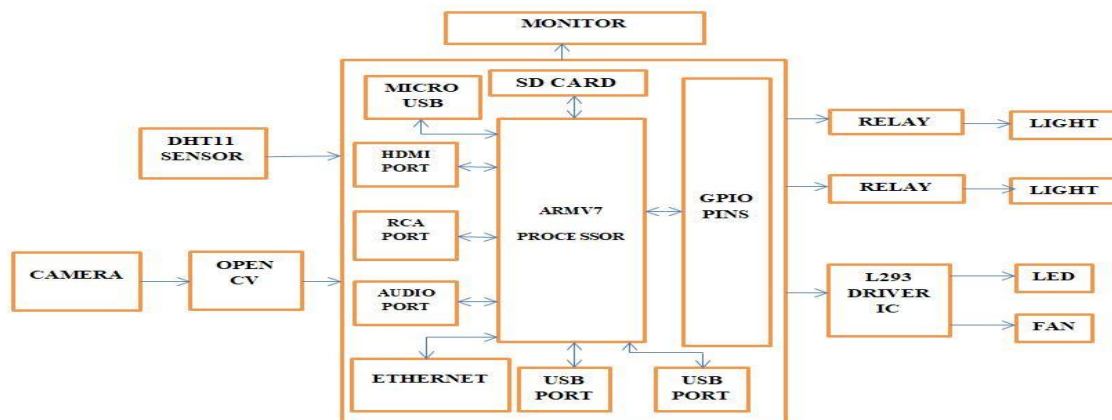


Figure 1: Block Diagram

## IV. HAAR CASCADE

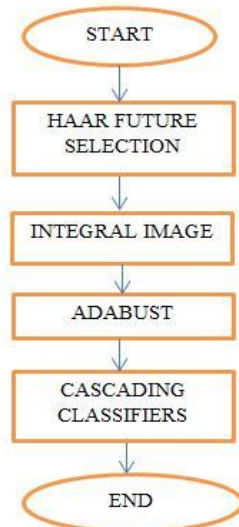


Figure 2: Flow chart

**HAAR FEATURES** - 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 fig: 5.2. 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 [7].

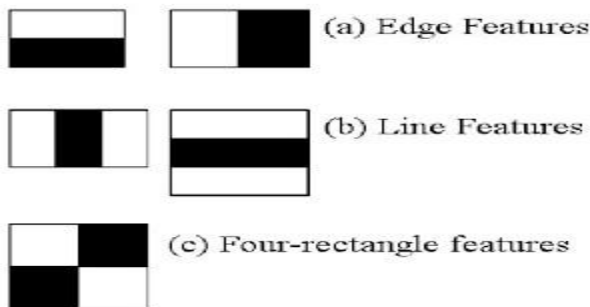


Figure 3: Haar features

Now all possible sizes and locations of each kernel is used to calculate plenty of features. (Even a 24x24 window results over 160000 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.

But among all these features we calculated, most of them are irrelevant. For example, consider the image below. Top row shows two good features. The first feature selected seems to

focus on the property that the region of the eyes is often darker than the region of the nose and cheeks. The second feature selected relies on the property that the eyes are darker than the bridge of the nose. But the same windows applying on cheeks or any other place is irrelevant. So how do we select the best features out of 160000+ features.

**ADABOOST:** It is a machine learning algorithm which select best feature among all. We have to reduce the dimension of the features. We have some relevant, irreverent features. We have to find the strong classifier [7].

In an image, most of the image region is non-face region. So it is a better idea to have a simple method to check if a window is not a face region. If it is not, discard it in a single shot. Don't process it again. Instead focus on region where there can be a face. This way, we can find more time to check a possible face region [7].

For this they introduced the concept of Cascade of Classifiers. Instead of applying all the 6000 features on a window, group the features into different stages of classifiers and apply one-by-one. (Normally first few stages will contain very less number of features). If a window fails the first stage, discard it. We don't consider remaining features on it. If it passes, apply the second stage of features and continue the process. The window which passes all stages is a face region [7].

**PEOPLE COUNTING:**

- The methodology used for counting is also based on computer vision.
- In terms of scale, the only variation is the scale of capture image or video footage being used for processing people, counting algorithms, namely large scale and small scale people counting.
- For small scale people counting it is mainly for counting a number in a group within a store or an area of interest using various technologies.
- Large scale people from afar within area. High density of people in an area creates an increasingly challenging situation to deal with including dynamic crowd motion and background interference [7].

## V. SOFTWARES REQUIRED

- RASPBIAN OS
- PYTHON

**RASPBERRY-PI OS:** Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. An operating system is the set of basic programs and utilities that make your Raspberry Pi run.

**PYTHON:** Python is a wonderful and powerful programming language that is easy to use with rasperry. The easiest

introduction to python is through IDLE python development environment. Open IDLE from the desktop or application.

**OPEN CV:**

- Open source computer vision library is released under a BSD license and hence it is free for both academic and commercial use. It has C,C++, Python, HTML and Java interfaces and supports windows,linux,mac os and android.
- Open CV was designed for computational efficiency and with a strong focus on real time applications.
- We can download the required algorithm using open hub.

**VI.RESULT AND OBSERVATION**

**6.1 Displaying temperature and humidity**

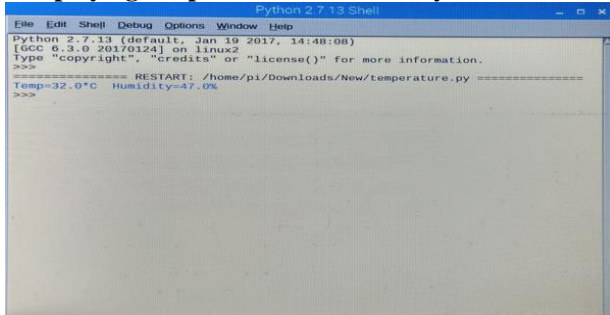


Figure 4: Displaying temperature and humidity

**6.2 Live video stream**

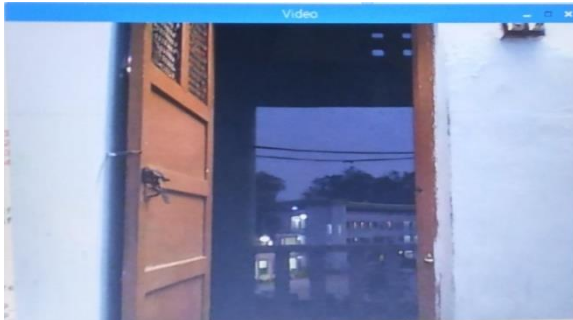


Figure 5: Live video stream

**6.3 Face detection**

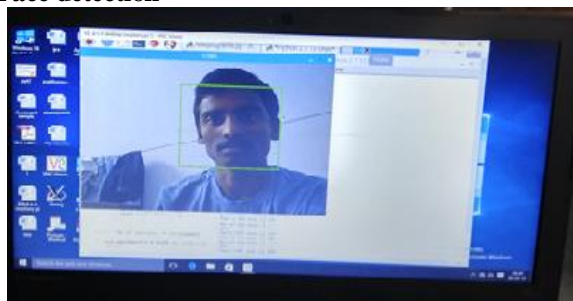


Figure 6: Face detection

**6.4 Face detected at left side**



Figure 7: Face detection

**6.5 Face detected at right side**



Figure 8: Face detection

**6.6 Face detected at both sides**

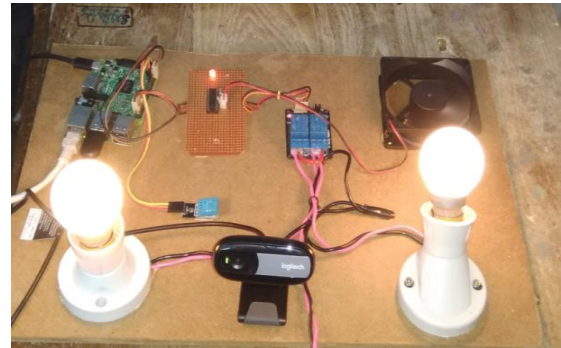


Figure 9: Face detection

**VII. ADVANTAGES**

- The energy is used efficiently.
- The methodology used for counting is also based on computer vision.
- The system is used for multipurpose applications
- The system is used to reduce the human effort.
- The system will reduce the electricity bill.
- We can monitor the room.
- It provides security to office.

### VIII. APPLICATIONS

- This system can be used in homes, offices, industries, schools, colleges etc.
- It is also used for Security purpose.
- For monitoring the number of people in a room.
- For temperature monitoring.
- It is used to detect the presence of human being.
- It also gives the number of people in the office.
- It is also used for counting number of people in a group within a room or area of interest.
- It is used to give the number of people in the shop, library, schools, airports, malls.

### IX. CONCLUSIONS

The experimental result has proved that the fetching of a good quality video is quick and clear. The use of the system more reliable and easy to use.

The system also measures the temperature and humidity. The fan speed also is regulated automatically based on temperature. It can detect the people and count the number of people. So it can be used in surveillance monitoring.

### X. FUTURE SCOPE

Raspberry pi 3 offers us so many features like HDMI port, GPU and offers 4 USB ports and 40 GPIO pins we should make use of it and try to build a very powerful and intelligent office automation system. In future we can use better algorithms to detect the human being presence and we can get the better result.

### XI. REFERENCES

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