

# Camera based Home Automation System using OpenCV

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**Abstract** – In this project a design and implementation concept for a real-time good smart home automation system based on supported live streaming with digital or IP Webcam camera and OpenCV primarily based human detection algorithm using HOG by Arduino microcontroller board has been presented. The proposed automation system consists of three main hardware components: smart mobile phone which IP Webcam is installed in, laptop or PC to observe and detect the presence of human through IP Webcam and Arduino microcontroller board. The house appliances like light, fan, temperature system, etc. can be monitored, controlled and accessed mechanically or wirelessly by Arduino in response to any signals came from OpenCV algorithm. The human detection formula has been developed using python language with the library of OPenCV package of python. The algorithm used is based on Histogram of Oriented Gradients (HOG) algorithm. The proposed system is shown to be simple, cost effective, sensors free and flexible that produces smart home future.

**Keywords** – OpenCV, IP Webcam, HOG, Arduino.

## I. INTRODUCTION

Home automation system is turning into fashionable and day by day everywhere the globe is using nearly in every homes, corporate buildings, etc as a result to make life smoother and minimize the work load. It refers to the automated and electronic control of household appliances, features and activities. This project is depended on live streaming on android mobile and fetch to the computer or laptop where it detects the presence of humans with in the room. An important stream of analysis within computer vision that has gained a lot of importance in the last few years is the understanding of human action from a video. Understanding human activity has applications in various fields, the most important of which is surveillance and detection of human based on live streaming.

Before the complexness of human action can be understood, the necessity for automatic ways for locating humans in an image, or a video is employed. Once the human is detected, depending on the application, the system can do further process to go into the main points of understanding the human activity.

Using IP Webcam installed in android mobile, this live streaming is captured by the program written in python which interact continuously by live streaming human detection algorithm. To control the appliances, the system consists of hardware and software communication that work to integrate devices with one another. This project is non- interactive with humans that manage appliances from a remote location over the internet. To avoid the sheer loss of money and resources, automated surveillance camera system looks to detect whether the room is empty and accordingly switch on-off the lights and fans.

## II. PROBLEM STATEMENT

Till currently several home automation systems have been projected. The known automation uses different types of sensors which is usually connected with microcontroller thereby increasing the load on the Arduino. There are different drawbacks of sensor like

1. Lower sensitivity and low range
2. Less coverage
3. Insensitive to very slow motion
4. Does not operate greater than degree Celsius.

Even though home automation using Bluetooth has low range and also it needs interaction to operate. Now a days everyone uses surveillance camera so to reduce the extra load and electricity “Camera based home automation system” is introduced.

## III. PROJECT METHODOLOGY

Home automated system plays a very important role for power management to solve the problem of electricity wastage when people leaves rooms without switching off the lights and fans. It mainly includes two modules.

1. The first part is to feed a real time live streaming video by the IP Webcam to the laptop which uses OpenCV based HOG algorithm to detect the presence of human in a room.
2. The second part is responsible for switching off the electricity supply on receiving signal from OpenCV to microcontroller.

In the initial step, the human is detected by IP webcam using OpenCV. The human detection process uses HOG algorithm. This Project uses a Histogram of Oriented Gradient (HOG) algorithm as the feature space for building a classifier. The next step of this project is that using Wi-Fi module and Arduino Uno, the system will be

able to control lights, electric fan and other home appliances through the signal from algorithm. The controlling device for the automation in this project is Arduino Uno with the help of OpenCV. The live stream video is feed from IP Webcam to laptop which uses HOG algorithm, and then it detects the human presence. If there is detection, this data is sent from system over Wi-Fi and will be received by Wi-Fi module connected to Arduino Uno. Arduino reads the data and decide switching action of electrical devices connected it through relays.

Following are the important Components which are used in Camera based home automation system using OpenCV.

1. OpenCV
2. IP Webcam
3. HOG algorithm for human detection
4. Arduino

### 1. OpenCV

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library and it is a library of programming functions mainly aimed at real-time computer vision.

### 2. IP Webcam

An Internet Protocol camera is variety of web digital video camera application that records data or video and sends image data via the internet through unique protocol. They require no local recording device, they solely work on local area network and can be accessed on web browser by writing the URL. Our smart mobile can be turned into wireless camera using the popular and free android application IP Webcam that you can use within iSpy, including video ,audio, talk, text, text-to-speech and commands!

### 3. HOG algorithm

With the help of Support Vector Machine (SVM) the objects are detected by Histogram of Oriented Gradient (HOG) by using feature descriptor used in computer vision and image processing. This detection algorithm is fairly simple to understand

.To describe a person it uses a “global feature rather than a collection of “local feature”. To move around the image the HOG person detector uses a sliding window algorithm. The detection sliding window is computed at each position by HOG descriptor.

The pixels used by the detection window of HOG detector is 64 pixels in length and 128 pixels in height. We operates on 8\*8 pixels cells within the detection window in order to compute the HOG descriptor. These cells are organized into overlapping. The gradient vector at each pixel is computed within a cell. We take the 64 gradient vectors and placed them into a 9-bin histogram. There are 20 degrees per bin and histogram ranges from 0 to 180.

### 4. Arduino

Arduino is an open-source electronic platform and a microcontroller board used for building IOT projects

such as this one home automation system. Arduino consists of everything to support microcontroller and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, just simply connect it to computer via USB and power it with battery used to write and upload computer code to the physical board. The arduino board is able to receive input and turns into output activating some action such as turning on light etc.

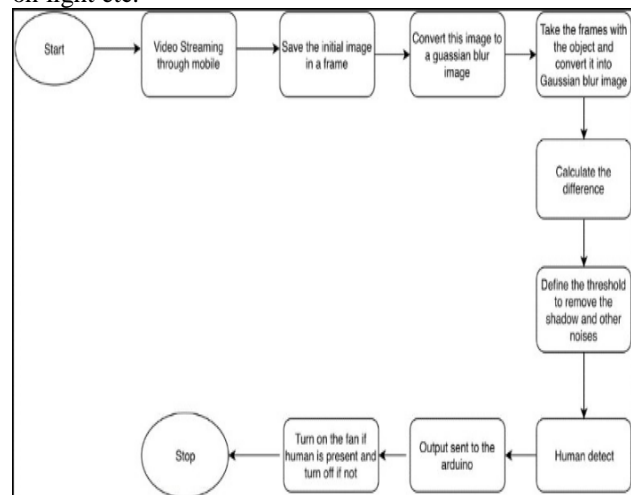


Fig.1. Process of the proposed home automation system.

## IV. ADVANTAGES

1. No need of Sensors.
2. Easy to handle and use.
3. No need of human interaction.
4. It is cost effectively.

## V. CONCLUSION

Camera Based Automation System using OpenCV is to converse electricity means it should be used when necessary and avoid wasting it. This means doing simple things, such

consist of OpenCV module for live streaming of videos as well as for human detection .home appliances can be monitored, controlled and accessed automatically in response to any signals came. This implemented system is easy and flexible that can be easily expanded and scaled up. The high pixel surveillance camera as well as IOT technologies can be added to proposed system for future enhancement.

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