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ENERGY EFFICIENT AUTOMATION AND INTRUDER ALERT SYSTEM USING MACHINE VISION AND IOT

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ABSTRACT

An energy efficient automation and intruder alert system using machine vision and IOT (Internet of Things) is developed and explored in this paper. Raspberry pi is the heart of this project and it is fueled by OpenCV (Open source computer vision) and IOT. The alert system and automation are activated based on the face recognition. The presence of people is identified using the OpenCV. The system is activated when the user left the house or office such that to turn ON surveillance at a specific time of the day. When the system detects an intruder by face recognition, it captures the image and it will be sent to Google Drop Box with the help od IOT. The human detection and face recognition is carried out by Background Subtraction and Vector Support Machine and thereafter, when the user enters the room automation will be taking place and only the required devices will be turned ON. This will reduce the unnecessary wastage of power.

KEYWORDS-Computer Vision, Face detection, Machine learning, Support Vector Machine, Neural Networks, InternetOfThings.

I. INTRODUCTION

THISProject deals with the with high end security and automation that has minimal percentage of error compared to sensor based system.By the combination of Machine learning algorithms combined with computer vision and Internet of things, gives a way new out of the league system. The proposed system contains the following modules such as human detection, face recognition, IOT and appliance governor module which are implemented using raspberry pi.

A Raspberry Pi is a credit card-sized computer originally designed for education. It is of small size and it was quickly adopted by tinkerers, makers and electronics enthusiasts for projects that require more than a basic microcontroller. The Raspberry Pi is open hardware, with the exception of the primary chip on the Raspberry Pi, the BroadcomSoC (system on a chip), which runs many of the main components of the board-CPU, graphics, memory, the USB controller, etc. Many of the projects made with a Raspberry Pi are open and well-documented as well and are the things you can build and modify yourself.

In human detection OpenCV ships with a pre-trained HOG and Linear SVM model that can be used to perform pedestrian detection in both images and video streams.Then import the non max suppression function from package so that the gist of the non-maxima suppression algorithm is to take multiple, overlapping bounding boxes and reduce them to only a single bounding box. This helps reduce the number of false-positives reported by the final object detector.

Similarly, for face recognition, we use FaceRecognizer for training the faces where the first step is to define our FaceRecognizer class used to encapsulate training our recognizer, predicting the label of new faces and serializing the classifier to disk. Then we define our constructor where our FaceRecognizer requires a single argument recognizer, which we assume to be an instantiation of the LBP recognizer since it allows us to update our model with new face images and is more robust to changes in orientation and lighting conditions than the Eigenfaces algorithm. Here we use two optional parameters, a Boolean used to indicate if the train method of the FaceRecognizer has been called, along with labels, which are the list of names associated with the faces.

II.EXISTING SYSTEM

CCTV is the current system used for surveillance and generally used as a complementary security and is widely used in industries, military, airports, shops, offices, factories, and even today many housing have been using and applying this technology. At present, we have decor-friendly gadgets for home automation with smart lock technology and for controlling appliances. CCTV uses signals that are closed, unlike the usual television that is broadcast signal. the use of

CCTV with face detection is expected to see the actual condition and detect any human presence on the video. CCTV cameras originally was created for the purpose of security surveillance (security surveillance system) to anticipate criminal crime (crime action), theft robbery, and many other things in connection with a crime and the activities that are not desirable.

III. PROPOSED SYSTEM

It focuses on Computer Vision and IOT based Intruder Alert and Energy Efficient Automation System by training, identifying and recognizing human faces using OpenCV. And also it replaces the sensor by camera. The Local Binary Pattern Histogram is used for face recognition algorithm.

Machine Vision

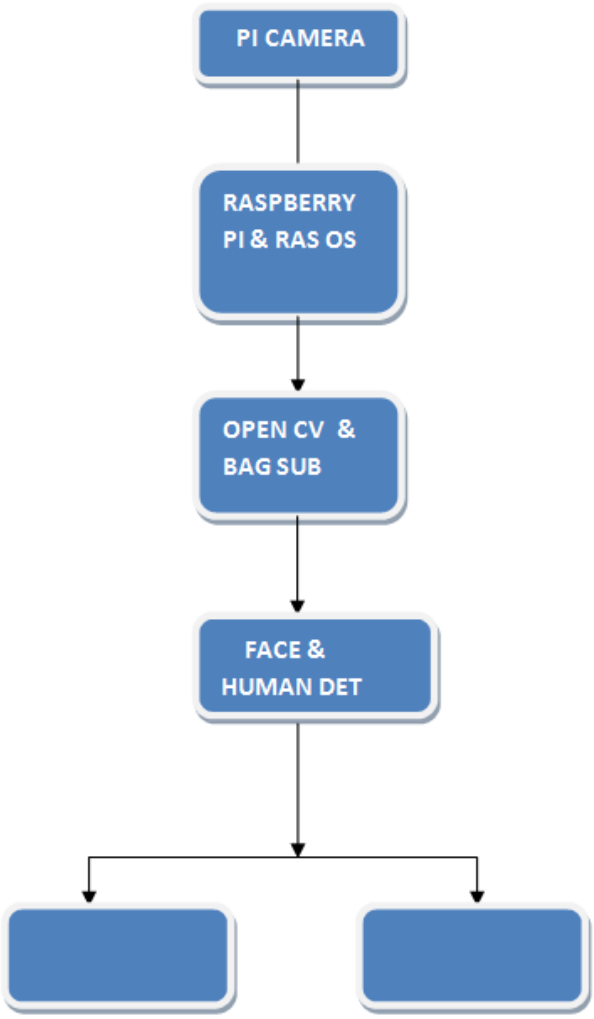
Computer vision is the science that aims to give a similar, if not better, capability to a machine or computer. Computer vision is concerned with the automatic extraction, analysis and understanding of useful information from a single image or a sequence of images. It involves the development of a theoretical and algorithmic basis to achieve automatic visual understanding. As a scientific discipline, computer vision is concerned with the theory and technology for building artificial systems that obtain information from images or multi-dimensional data.A significant part of artificial intelligence deals with planning or deliberation for system which can perform mechanical actions such as moving a robot through some environment. This type of processing typically needs input data provided by a computer vision system, acting as a vision sensor and providing high-level information about the environment and the robot.Other parts which sometimes are described as belonging to artificial intelligence and which are used in relation to computer vision is pattern recognition and learning techniques.

Internet of things (iot)

The Internet of Everything is the intelligent connection of people, process, data and things. The Internet of Everything brings together people, process, data and things to make networked connections more relevant and valuable than ever before - turning information into actions that create new capabilities, richer experiences and unprecedented economic opportunity for businesses, individuals and countries.

The “Internet of Everything” builds on the foundation of the "Internet of Things" by adding network intelligence that allows convergence, orchestration and visibility across previously disparate systems. The explosion of new connections joining the Internet of Everything is driven by the development of IP-enabled devices, the increase in global broadband availability and the advent of IPv6. People will continue to connect through devices, like smartphones, PCs and tablets, as well as through social networks, such as Facebook and LinkedIn. As the Internet of Everything emerges, the interaction of people on the Internet will evolve. For example, it may become common to wear sensors on our skin or in our clothes that collect and transmit data to healthcare providers. Some analysts even suggest that people may become individual nodes that produce a constant stream of static data.

IV. BLOCK DIAGRAM

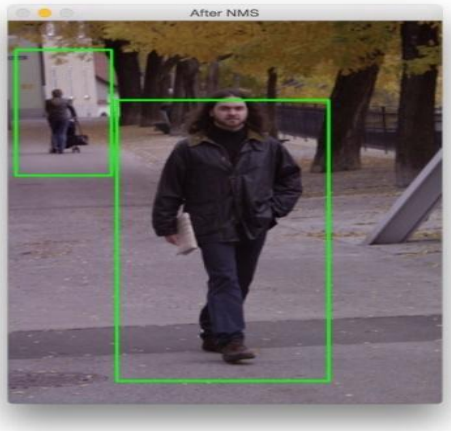


V. HUMAN DETECTION

The human detection can detect person's position and distance. The output of the distance result is divided into close

range, middle range and long range. The human detection utilizes the linear SVM (i.e., support vector machine). It is a newest and extremely fast machine learning algorithm for multiclass classification problem from ultra large data sets.

It also uses HOG (i.e., Histogram of Oriented Gradients) which is a "feature descriptor" used to generalize the object sc as to produce the same features when viewed under different conditions. Even though the Histogram of Oriented Gradients descriptor for object recognition is nearly a decade old, it is still heavily used today — and with fantastic results. The Histogram of Oriented Gradients method suggested by Dalal and Triggs in their seminal 2005 paper,"Histogram of Oriented Gradients for Human Detection" demonstrated that the Histogram of Oriented Gradients (HOG) image descriptor and a Linear Support Vector Machine (SVM) could be used to train highly accurate object classifiers or in their particular study, human detectors



VI. FACE RECOGNITION

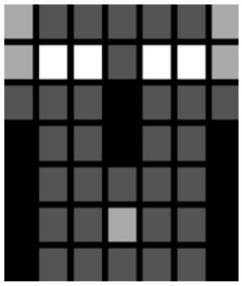
The initial step is to train the face recognizer and the face recognizer is trained by two arguments such as data and labels. Data is a Region Of Interest from the images and labels are the names of the people associated with the faces.The first step is to import the required modules -

Cv2- This is the OpenCV module and contains the functions for face detection and recognition.

OS- This module will be used to maneuver with image and directory names. First, we will use this module to extract the image names in the database directory and then from these names we will extract the individual number, which will be used as a label for the face in that image.Image- Since, the dataset images are in gif format and as of now, OpenCV does not support gif format, we will use Image module from PIL to read the image in grayscale format.

1. Numpy - Our images will be stored in numpy arrays.

The second step in face recognition is to Load the face detection Cascade. The first step is to detect the face in each image. Once, we get the region of interest containing the face in the image, we will use it for training the recognizer. For the purpose of face detection, we will use the Haar Cascade provided by OpenCV. The haar cascades that come with OpenCV are located in the /data/haarcascades> directory of your OpenCV installation. The next step is creating the face recognizer object. The face recognizer object has functions like FaceRecognizer.train to train the recognizer and FaceRecognizer.predict to recognize a face. OpenCV currently provides 3 face recognizers – Eigen and fisher face recognizer.Now the function must be defined where get_image_and_labels that takes the absolute path to the image database as input argument and returns tuple of 2 list, one containing the detected faces and the other containing the corresponding label for that face. Then the training set must be prepared where the get_images_and_labels function with the path of the database directory is to be passed. This path has to be the absolute path. We perform the training using the FaceRecognizer.train function. It requires 2 arguments, the features which in this case are the images of faces and the corresponding labels assigned to these faces which in this case are the individual number that we extracted from the image name.Testing the face recognizer takes place by using the images with. Sad extension which had not been used earlier. Then for each image in the list, we read it in grayscale format and detect faces in it. Once, we have the ROI containing the faces, we pass the ROI to the FaceRecognizer.predict function which will assign it a label and it will also tell us how confident it is about the recognition. The label is an integer that is one of the individual numbers we had assigned to the faces earlier. This label is stored in nbr_predicted. The more the value of confidence variable is, the less the recognizer has confidence in the recognition. A confidence value of 0.0 is a perfect recognition. The label nbr_predicted is extracted using the os module and the string operations from the name of the image.



VII. RELAY AND IOT

After detecting the human using the pi camera it sends the electrical signal to the relay where it controls the electrical appliances in home or office. So the particular electrical appliances will be switched ON when the respective human matches with human templates and also it recognizes the face to detect the intruder and alerts the owner by sending the intruder face picture to his mobile via dropbox or MMS through IOT.

VIII. ADVANTAGES

In CCTV systems there should be a dedicated PC portable module which is eliminated here.

- Very less expensive when compared to the other existing systems.
- Wide area can be captured.
- The camera motion can be controlled by the user.
- Image capturing devices are easy to mount, remove, replace and upgrade.
- Vision based services aimed at facilitating the monitoring of an area with poor visibility.
- Camera is one of the most versatile sensors.
- Facilitate recognition and tracking people.
- IOT provides advanced connectivity of devices, systems and services.

X. CONCLUSION

Thus this project identified the intruder and captured the image using background subtraction and vector support machine and sent the image using IOT to the google dropbox. The automation was activated accordingly using the OpenCV and relay. The home automation features adds a new dimension. The system can be modified to go to surveillance mode. It can also be set to surveillance mode automatically after a certain period of the day. Energy consumption in an efficient manner is also very important to create a balance in nature. With the help of Raspberry PI, this system is completely portable.

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