Smart Surveillance System through Computer Vision

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Abstract - *In safety and security lie at the heart of the wealth of nation. Every person wants to feel safe and secure from pitfalls. But today security is tough in all view of our daily lives. This The usual surveillance system requires human interaction, to work more the number of cameras in home more human is required to monitor them. To deal with that problem, we suggest a smart surveillance system which is a python application made using high grew computer science field, which is "computer vision". The computer vision is a branch of computer science in which we use digital data such as images, video, or real time data to extract beneficial information to deal with real time problems, for now in this paper we are mostly highlights the features of smart surveillance system that are object detection, face recognition, object tracking, and alert system.*

***Key Words*: Object Detection, Face Recognition, Object Tracking, Alert System**

1. INTRODUCTION

Countless home and office security systems work on the same concept of security such as securing entry points of home or offices such as doors, windows etc. for security we use, CCTV cameras, that might be an issue using this, due to countless amount of cameras available in home or offices, security guards seems to all over watching over it, also the number of existing cameras exceeds the number of security guards to monitor them, that would be costly. By using computer vision tools with deep learning algorithms, we can detect weapons and other dangerous objects by using real time footage as well as pictures and scenes from video, to deal with the threat, so we can say that growth of computer vision is beneficial for society.

Computer vision is fast growing especially in the realm of homes or offices security technology. It contains features that cannot be forgotten, faked, or lost, because through computer vision, we are able to scan CCTV information in real time, so that security teams are alert when someone breaches the security.

As we know that, face recognition is very good for authentication, because face is a physiological trait that is simplest to identify between two people, it is one of the forensics technologies that is always being research and developed.

Computer Vision is a field of artificial intelligence (AI) that enables computers to drive meaningful information from digital images, and other visual inputs. And act or make recommendations based on that information. If AI enables computers to think, computer vision enables them to see, observe, and understand. Computer vision works much as the human vision, except humans have head start. Human sight has the advantage of lifetime of context to train how to tell objects apart, how far away they are, whether they are moving and whether there is something wrong in an image. Computer vision trains machines to perform these functions but it has to do it in much less time with cameras, data and algorithms rather than retinas, optics, nerves and a visual cortex. including detection, face recognition, tracking, alert system, the project's objective is to develop a smart surveillance system that incorporates computer vision to facilitate security in homes and offices.

Other research papers focused on constructing a security system that can recognize a face, where this study scans faces that have been entered into the database and then matches the photos obtained by the webcam, if the image is not match in the database, an alert is generate with tracking feature. In this project, we created a smart surveillance system. It aids in the selection of a suitable approach from many options based on our application needs, as well as the resolution of existing difficulties in real-time applications to some extent. In real-time scenarios with multiple variables and seamless settings, we obtain an accurate system. This technology may be described as an automated surveillance system. This technique is intended to be able to combat theft in homes that are frequently abandoned by their owners.

 This work is expected to make a substantial contribution to a new field of research on the use of face recognition, detection, tracking, and alert technology in surveillance systems. As a result, the purpose of this study is to develop a smart surveillance system to enhance security system and grammar.

2. REQUIREMENTS

As it is a software-based project. It must run on some hardware and operating system following are the requirements to run this software.

- Windows/Linux/Mac any version of python 3.

- Packages in Python.
- OpenCV.
- NumPy.
- Face Recognition.
- Visual Studio IDE.

In case of Hardware requirements, you don't need much but still some of the requirements such as

- Working PC.
- Flashlight/ LED if using this at night.
- Webcam with Drivers Installed.

3. METHODOLOGY

In our project we have established features. Below are the different features which can be performed by using this project.

1. Object Detection.
2. Object Tracking.
3. Face Recognition.
4. Alert System.

3.1 Object Detection

In this project our first task is to detect the instances of objects of a certain class within an image or videos and in real time. To perform object detection in real time, we use object detection techniques. Object detection technique is a computer technology related to computer vision, image processing, and deep learning that deals with detecting the instances of objects in an image or videos.

There are various techniques or algorithms to perform object detection in real time such as R-CNN (Region- Based Convolutional Neural Networks), Fast R-CNN (Fast Region Based Convolutional Neural Networks), and YOLO (You Look Only Once). In this project we use the YOLO algorithm to perform object detection in real time.
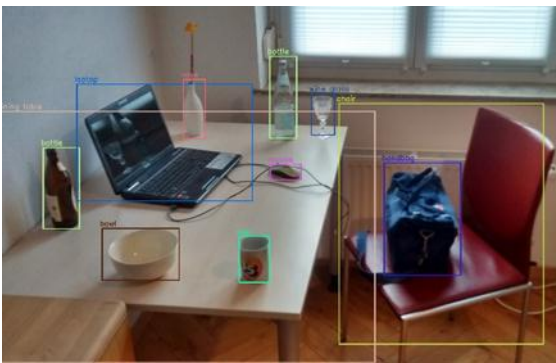

Fig -1: Object Detection

3.2 Object Detection

After detecting the instances of the various objects, our next task in our project is to track the movement of an objects. Object tracking usually involves the process of object detection.

- Object detection, where the algorithm classifies and detects the object by creating a bounding box around it.

- Assigning unique identification for each object (ID).

- Tracking the detected object as it moves through frames.

Fig -2: Object Tracking

3.3 Face Recognition

After detecting the instances of the various objects, our task is to recognize the faces of the person appear in a camera range. To verify the identity of the person. If the face of the person is not match in the face recognition database, then alert is generated by the system through SMS.

Fig -3: Face Recognition

3.4 Alert System

If an unknown person is detected by the system, then alert will be generated through the SMS service. To generate alert, we use Twilio python library which generates SMS. Twilio messaging API is being used globally to send and receive SMS.

The intelligence tracking features enable user to check if the message is delivered or not.
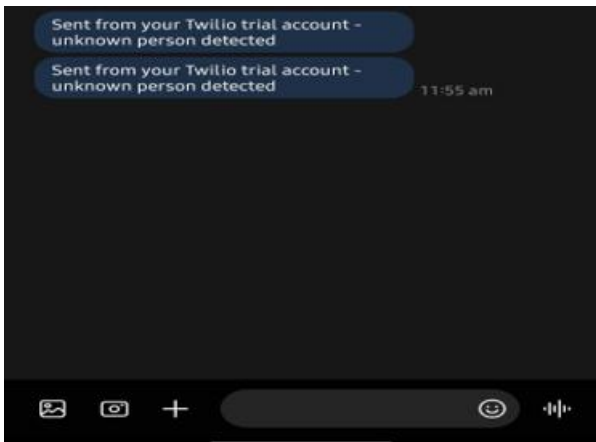

Fig -4: Alert System

4. SYSTEM DESIGN

For the system design, the design can be represented using the Use-Case Diagram and flow chart Diagram.
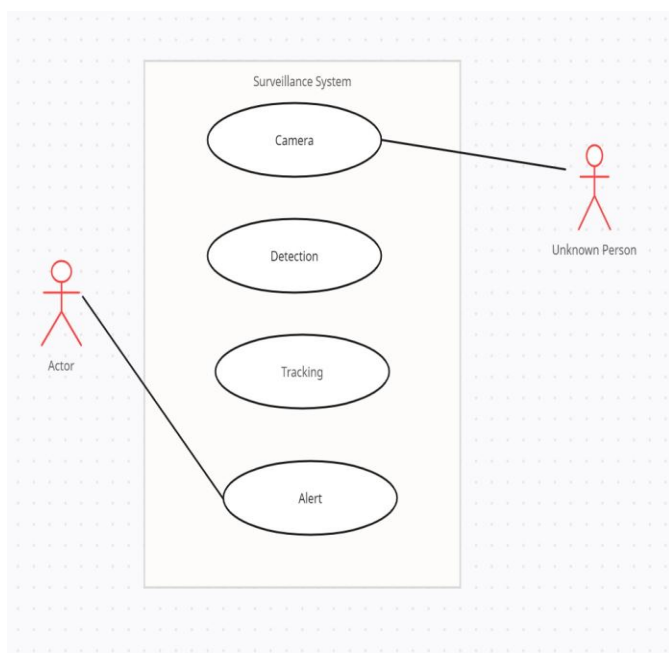
4.1 Use Case Diagram

Fig -5: Use-Case Diagram

According to the use-case illustration above, when the unknown person is detected by the camera through object detection, face recognition feature, a system generates the alert through SMS to inform security system.
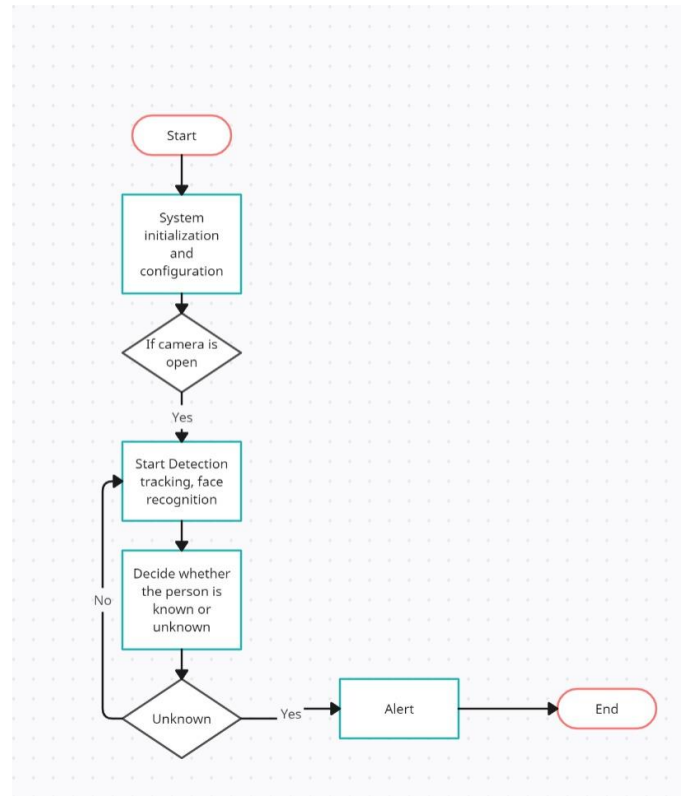
4.2 Flow Chart

Fig -6: Working Flow Chart

The smart surveillance system is initially initiated and configured, as shown in the flow chart diagram. After initialization and configuration of the system camera of the system is initiated, due to which detection, tracking, and face recognition occurs, if detecting person is unknown then, alert is generated by the system through SMS.

5. RESULTS

Fig -7: Face Recognition

Fig -7: Face Recognition with Tracking

6. Future Scope

When smart surveillance systems (SSS) identifies when someone or anything tries to breach a system or resources. An alert is generated through SMS for detecting unknown person. However, with future development, a drone can be used to track the unknown person's location of unknown person by following the unknown person and provide the location of the unknown person to the security system.

7. CONCLUSIONS

Extensive research is going on in the field of computer vision. In this project we will complete a bit of work to carry on the project. The motive is to detect instances of objects, if persons detected then process the faces, and identify whether these faces match in the face recognition database. If not match, then generate alert through SMS. Is still challenging to enhance the security, the system fails when the camera is damaged or does not work properly.

8. REFERENCES

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