IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SMART SURVEILLANCE SYSTEM USING MACHINE LEARNING

[1]Sharon C D'souza, [2]Sandeep Benny, [3]Shaham Abdulla C P, [4]Sahad Abdulla C P, [5]Albin John

[1]Assistant Professor, [2]Student, [3]Student, [4]Student, [5]Student

[1]Department of Computer Science and Engineering,

[1]A.J Institute of Engineering and Technology, Manguluru, India

[2]A.J Institute of Engineering and Technology, Manguluru, India

[3]A.J Institute of Engineering and Technology, Manguluru, India

[4]A.J Institute of Engineering and Technology, Manguluru, India

[5]A.J Institute of Engineering and Technology, Manguluru, India

Abstract: In the modern world, welfare, and security are important considerations. Whether at home or at business, people hire security systems to secure their belongings. In a typical surveillance setup, anything that occurs is recorded while people just wait for something to happen. The recommended system is a Python GUI application developed with the most recent programming language and the quickly growing discipline of computer science known as "computer vision," which translates to "this allows the computer to observe" or "gives the computer the capacity to see." In our study, we are largely emphasizing the components of smart surveillance that are monitored—at least for the time being. The goal of gaining a deeper knowledge of computer vision systems is currently outside the scope of the high-tech expansion of computer vision. video recording, features, facial recognition, noise detection, in-room visitor detection, and noise reduction.

Index Terms - Computer Vision, Object Detection, Real-Time Alerts, Face Identification.

I. INTRODUCTION

Due to recent international events, the security paradigm has shifted from "investigation of occurrences" to "prevention of Due to recent international events, the security paradigm has shifted from "investigation of occurrences" to "prevention of potentially catastrophic crises." The current generation of digital CCTV surveillance systems only provide the technology necessary to record, store, and display video; they are entirely dependent on human operators to detect dangers. It takes a lot of work to manually monitor security footage. According to one of the conclusions of a recent study by the US National Institute of Justice on the effectiveness of human monitoring of surveillance video, "These studies demonstrated that such a task [manually detecting events in CCTV surveillance video], even when assigned to a person who is dedicated and well-intentioned, will not support an effective security system."

An innovative idea that combines the advantages of surveillance technology with the power of artificial intelligence is a smart surveillance system using machine learning.With the aid of machine learning algorithms, such a system seeks to increase the surveillance's accuracy and effectiveness by automatically identifying and alerting to potential security dangers. This may entail identifying people, following their movements, spotting odd behaviour, and spotting suspicious things or vehicles.

The system may learn to distinguish between routine activities and potential security issues by using machine learning to analyse and interpret data from cameras, sensors, and other sources. The system can then produce alerts or take other necessary measures as needed.

The "pre-emption investigation" With the use of autonomous visual analysis technology, the paradigm of modern video surveillance systems can shift from investigative to preventive [1]. In order to make the system scalable and dependable, the suggested solution largely focuses on avoiding human participation and applying machine learning techniques. Our project consists of four modules, each of which is capable of "preventing incidents through real-time alarms for suspicious situations" and "Situational awareness-Through combined awareness of identification and activity of objects in the monitored space."

In conclusion, a machine learning-based smart surveillance system has the ability to greatly improve the security and safety of a variety of situations, including public spaces, airports, shopping malls, and more. Additionally, it can facilitate quicker reaction times to security threats and lessen the workload of human security personnel.

II. LITERATURE SURVEY

"Intrusion detection of specific area based on video[1]".This research is carried out with the purpose to solve the problems of object detection and object tracking under complex scenes in video, this paper proposes a way to improve Gaussian Mixture Model algorithm based on the traditional Gaussian Mixture Model. When the model is updated, according to the characteristics of continuous video frame, the background model is divided into static regions and dynamic regions, and the background is updated in different strategies.

Then, this paper presents an algorithm for the intrusion detection. Intrusion is judged by whether the centroid of the target is in the specific area. If the centroid is located outside the area, it shows that the target does not invade the specific area, otherwise the target invades the specific area. If so, the system triggers alarm and label information appear on the video frames. Experiments show that this algorithm can realize the intrusion detection of specific area. “Object Detection based on deep learning [2]”. As one of the important tasks in computer vision, target detection has become an important research hotspot in the past 20 years and has been widely used. It aims to quickly and accurately identify and locate a large number of objects of predefined categories in a given image. According to the model training method, the algorithms can be divided into two types: single-stage detection algorithm and two-stage detection algorithm.
Three machine learning approaches—Integral Image, AdaBoost, and cascade—for visual object detection that can process images very quickly and achieve high detection rates are described in the paper Rapid Object Detection using Boosted a cascade of Simple Features by Paul Viola Michael Jeffrey Jones [7].

The identification and recognition of facial traits of people using the Principal component Analysis (PCA) Algorithm is discussed in the work "Smart surveillance system using deep learning" by Dayana r, Suganya M, Balaji P, Mohamed Thahir A, and Arunkumar P [2]. This accuracy rate is 88.5%.

In the "Comparison of PCS and LBPH algorithm for future extraction on face recognition system" paper by Icshan taufic, Maya Mushtopa, Aldy Riadly, Muhamad Ali Ramahan, Yana Aditia Gerhana, Narang Ismail [3], in this paper the characteristic extraction algorithm such as Principal Component Analysis (PCA), Local Binary Pattern (LBP) is tested against several scenarios of different sunlight and lights, objects facing the camera and not facing the camera.
Umme Sara, Morium Akter, and Mojammed Shorifuddin published "Image Quality Assessment through FSIM, SSIM, MSE and PSNR - A Comparative Study Paper" [9] in which they examined various image quality metrics, including FSIM, SSIM, MSE, and PSNR, to provide a thorough overview. Denoising is used to test these measures using a benchmark image and different sun and light sources, as well as objects facing the camera and those that are not.
Ivan Ozhiganov's article "convolution Neural Networks vs. Cascade Classifier for Object Detection" [4]. They used CNN and cascade classifiers to identify objects on vehicle number plates and road signs, and they compared their performance in terms of accuracy and recall, scale invariance, the number of tries necessary to get a functioning model, processing time, and consistency with tilting objects.
“Face Recognition Research Based on the Fusion of Layered LBP Feature [4]”. Local Binary Pattern (LBP) is an operator to describe the local texture of face, which has the characteristics of rotation invariance and grayscale invariance. This paper proposed a face recognition arithmetic based on the fusion of layered LBP feature(F-LLBP), using the LBP operator to extract the layered texture feature, fusing the characteristics of each layer, reducing the dimension with Principal Component Analysis and Linear Discriminant Analysis (PCA-LDA) to get a set of low dimensional characteristic which are easy to classify, finally using the KNN arithmetic to classify. The experiments on ORL face database verifies the effectiveness of the FLLBP, the experimental results indicate that the recognition rate of FLLBP increased 8% relative to the traditional LBP feature combined with PCA dimension reduction arithmetic
“Tracking a Human Intrusion through a CCTV[5]”. Detection of an object and tracking its movement is a challenging problem in the field of computer vision and image processing. In this paper an efficient scheme has been proposed to detect intrusion in a security-critical environment and to track the movement of the intrusion by automatically shifting the focus of a CCTV camera by rotating it using a motor which has been interfaced through an Arduino Uno microcontroller with a monitor program written using matlab

III. REQUIREMENTS

As the project is software-based. The required hardware and operating system for this software's operation are as follows.

3.1 SOFTWARE REQUIREMENTS

- Windows/Linux/mac any version of python 3
- Packages in Python
- OpenCV
- Ski-mage
- Numpy
- Django
- Tkinter

3.2 HARDWARE REQUIREMENTS

In case of Hardware requirements, you don’t need much but still some of the requirements

- Working PC or Laptop.
- Flashlight/LED if using this at night.
- Webcam with drivers installed.

IV. METHODOLOGY

A data flow diagram (DFD) maps out the flow of the information for any process or system. It uses defined symbols like rectangles, circles and arrows, plus short text labels, to show data inputs, outputs, storage points and the routes between each destination. Data flowcharts can range from simple, even hand-drawn process overviews, to in-depth, multi- level DFDs that dig progressively deeper into how the data is handles. They can be used to analyze an existing system or model a new one.

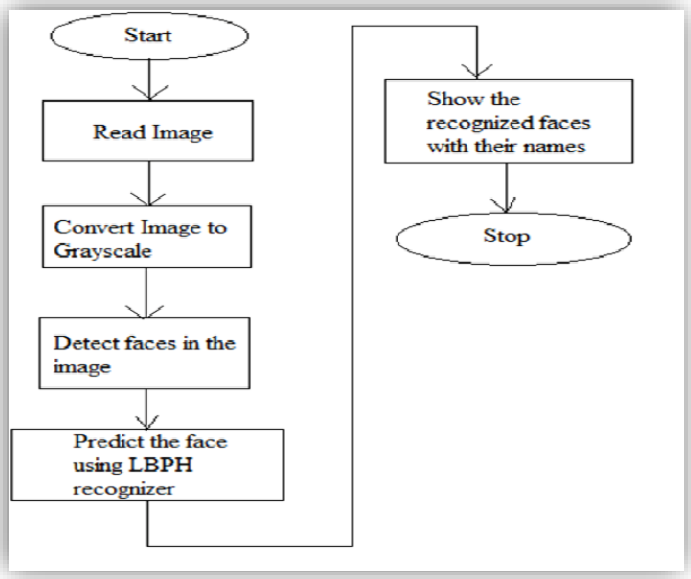


Figure 4: Dataflow Diagram

We have established elements in our project such item monitoring, noise detection, facial recognition, and guest in and out detection. The various functions that can be carried out with this project are listed below:

- Monitor
- Identify the person
- Detect the noise
- In and out Detection

1. Monitoring Feature

To determine what was captured from the webcam-visible frame, use this method. It plays the alert after continuously scanning the frames to determine which object the burglar has taken out. This uses structural similarity to compare the two frames and find their differences. Before any noise started, the first frame was captured, and after it had ended, the second frame was captured.

The Structural Similarity Index Metrics (SSIM) is a measure used to assess how comparable two given pictures are to one another. The three main characteristics that the structural similarity index (SSIM) metric extracts from an image are luminance, contrast, and structure.

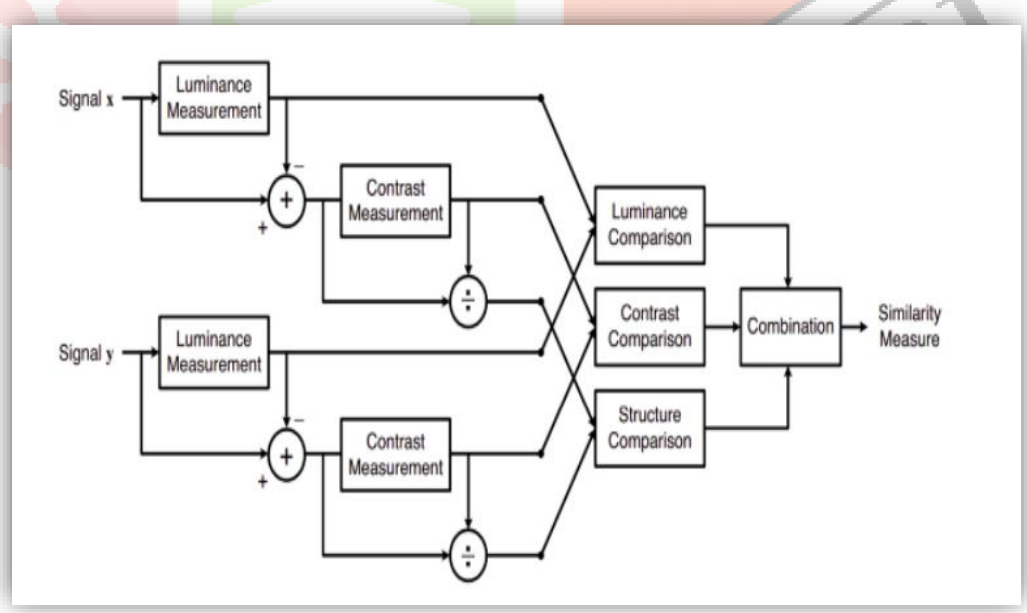


Figure 1: Structural Similarity Index Matrix Chart

2. Identify Feature

This feature is used to find if the person in the Frame is known or Unknown.

This is done in two steps:

2.1 Detect Faces in the Frames

This is done via Haar-cascade classifiers which are built in the OpenCV module of Python.

Haar cascade classifiers

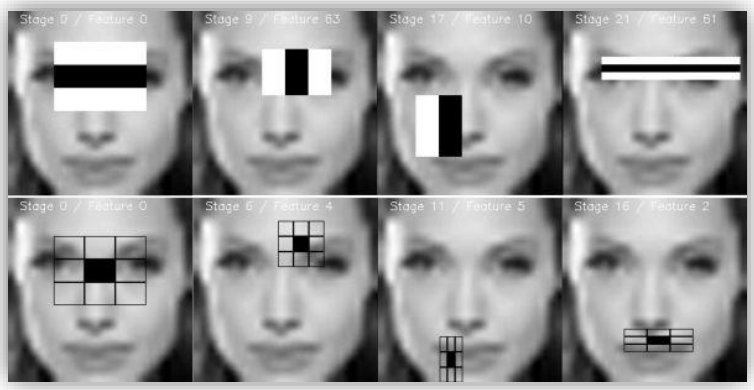


Figure 2: Working of Cascade Classifier

2.1.1 Use LBPH Algorithm for face recognition

Radius, neighbors, grid x, and grid y are the four parameters employed by the LBPH.
Initial LBPH Generates an intermediate image based on the radius and neighbors of the parameter that accurately represents the original image.

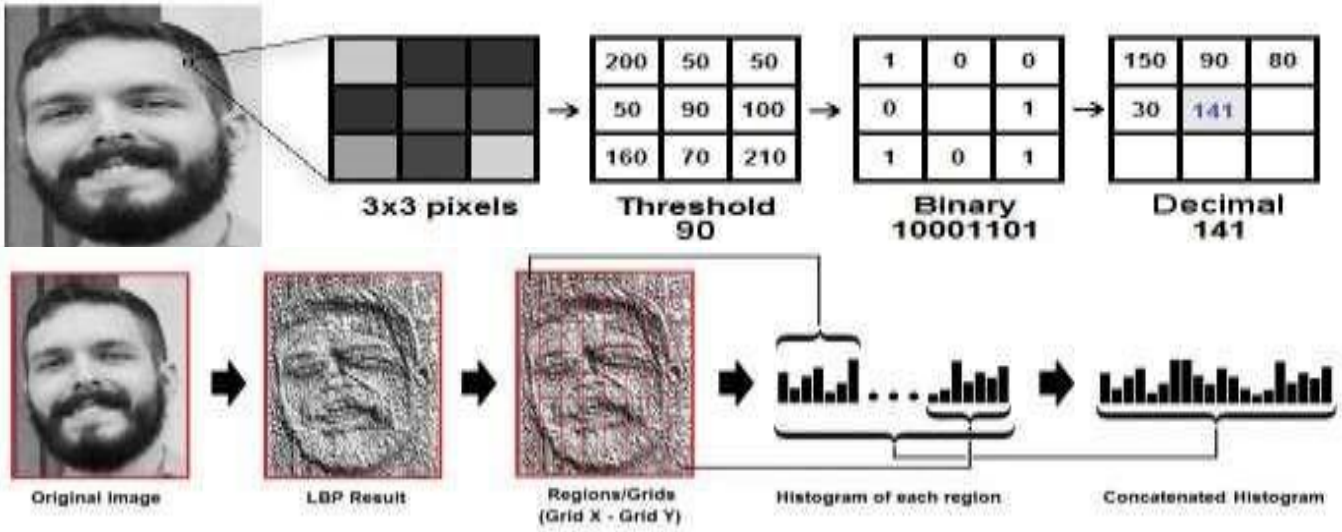
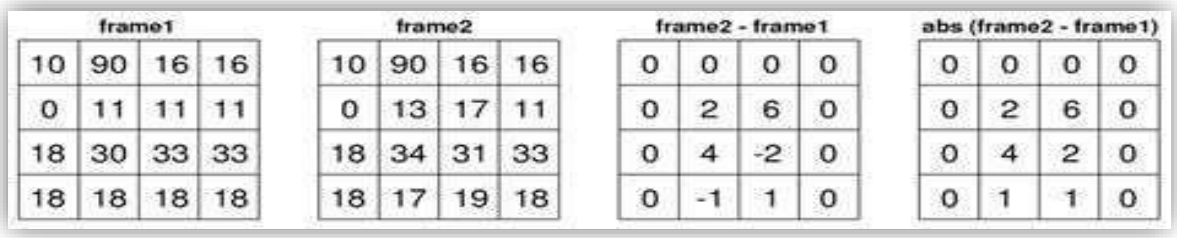


Figure 2.1.1: LBPH for Face Recognition

3. Detection of noise in the frame

This function locates the noise in the frames. It continuously examines and checks for noise in new frames. To assess and define the difference between two images (identify motion boundaries), merely calculate the absolute difference between two frames. There is no motion if there are no borders; motion exists when there are borders. Since the integer or float value of each pixel in picture determines its brightness, each pixel has those brightness values. We therefore only compute the absolute difference as the negative is illogical.



frame1			
10	90	16	16
0	11	11	11
18	30	33	33
18	18	18	18

frame2			
10	90	16	16
0	13	17	11
18	34	31	33
18	17	19	18

frame2 - frame1			
0	0	0	0
0	2	6	0
0	4	-2	0
0	-1	1	0

abs (frame2 - frame1)			
0	0	0	0
0	2	6	0
0	4	2	0
0	1	1	0

Figure 3: Noise detection Grid matrix

4. Visitor entry/exit monitoring

This function looks to see if anyone entered or exited the space. Here is how it works:
1. It begins by scanning the frame for noise.
2. If motion is present, it is next assessed whether it is coming from the left or the right.
The frame will be taken if motion is detected from left to right and is considered to have entered.
or the opposite.

As a result, this particular feature does not operate in a sophisticated mathematical way. As a result, we first detect motion, then we draw a rectangle over the noise, and last we verify the coordinates to establish which side the motion came from. The motion is then categorized whether those points lean left.

V. RESULT

1.Home Page

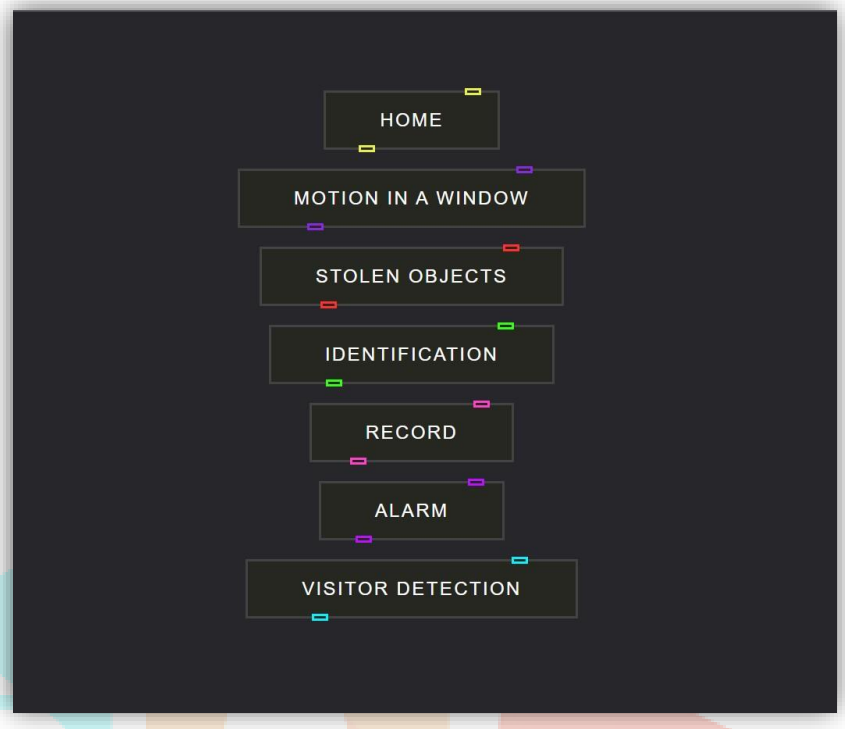


Figure 5.1 : Home Page

Home Page: When a user logs into your smart surveillance system, they are directed to the home page. It gives customers easy access to the various functionalities and gives an overview of the features that are available.
Face recognition: This function recognises and identifies people based on their facial traits using machine learning techniques. It can be used for security reasons, such as allowing only authorised people access to places that are prohibited.
Stolen Objects: The ability to detect whether any objects have been stolen from the location makes use of machine learning methods. It can be used to keep an eye on priceless objects like jewellery or electronics and notify the user if anything disappears.
Visitor Detection: This feature enables users to keep track of and monitor site visits. It can be used to monitor visitor movements throughout the property and make sure that only authorised people are granted entry.
Alarm System: This function determines when an alert is activated using machine learning algorithms. It can be utilised to keep an eye out for trespassers or other security breaches and notify the user when an alarm is set off.
Motion in a window: This function employs machine learning methods to identify any movement inside the area of view of the camera. It can be used to keep an eye out for trespassers or other unusual activities and notify the user if any movement is seen.

2. Motion in a window

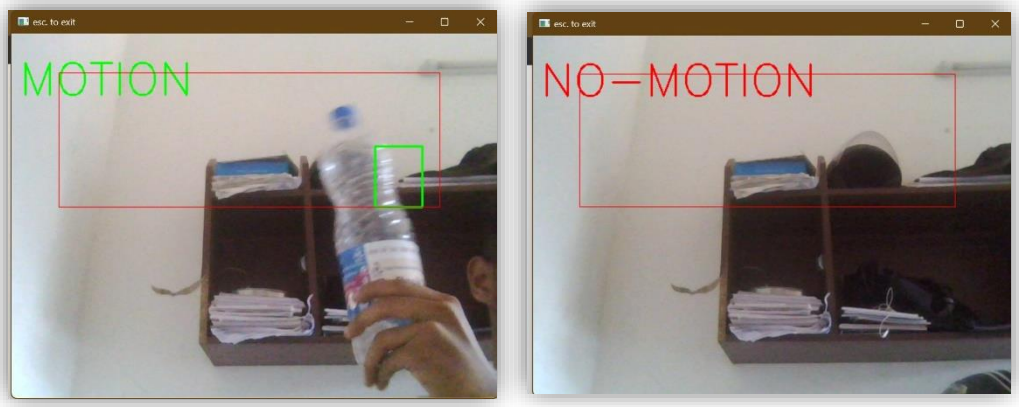


Figure 5.2: Motion in a Window

The "motion in a frame" feature is intended to identify any movement within the camera's field of vision. When this function is activated, the system examines the camera's video stream using machine learning methods to see if motion is there in the frame.
The user or administrator will receive a notification whenever the system detects motion within the frame, letting them know that anything is going on in the area that the camera can see. This can help to improve the overall security of the property by being beneficial for keeping an eye out for burglars or other suspicious activities in a particular region.

However, the system won't sound any alerts or alarms if no motion is detected within the frame. This is due to the fact that the feature only works when motion is truly present in the camera's frame of view. This contributes to reducing false alarms or pointless warnings, which can be disruptive and lower the system's overall efficacy.

3. Stolen Objects

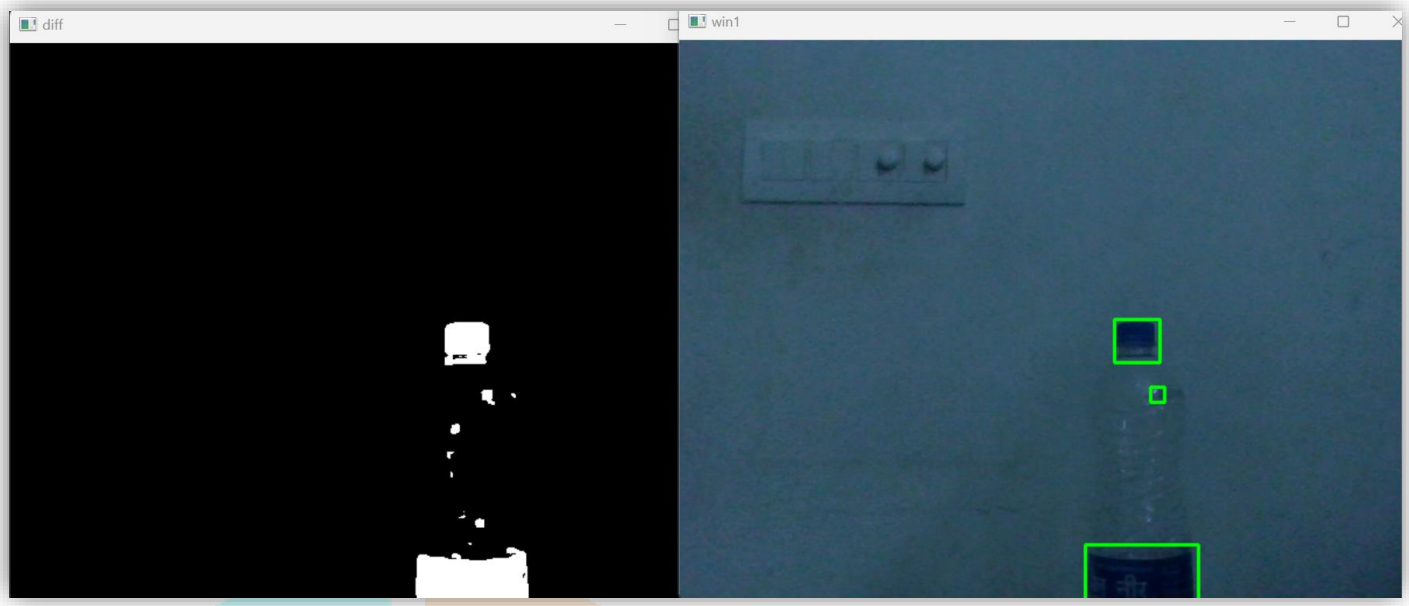


Figure 5.3 Stolen Objects

Your smart surveillance project's "stolen objects" feature is intended to assist in identifying any items that have been taken from the property. Using structural similarity algorithms, the feature compares two video stream frames to see if any objects have been added, moved, or removed from the second frame relative to the first.
To use this feature, you must first choose a beginning frame from the video feed that depicts the condition of the monitored region in its "before" state. Then, at a later time, you choose a second frame to depict the same area's "after" state. After that, the system examines both frames and compares them using structural similarity techniques to see if the items have changed.

4. Identification

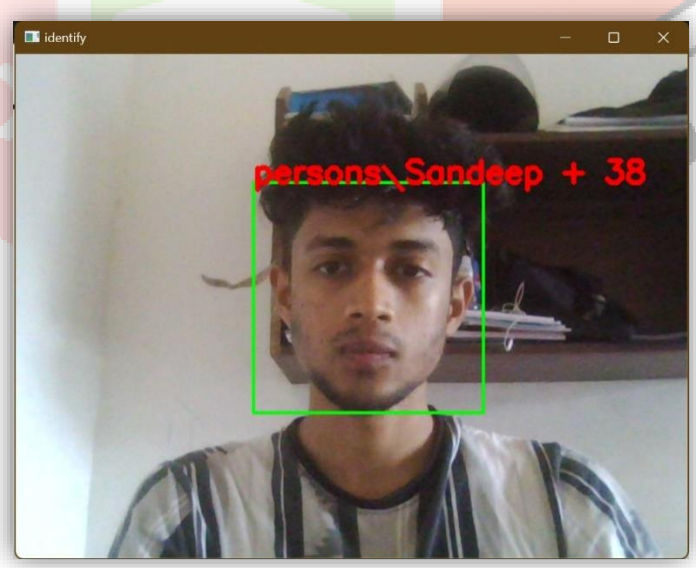
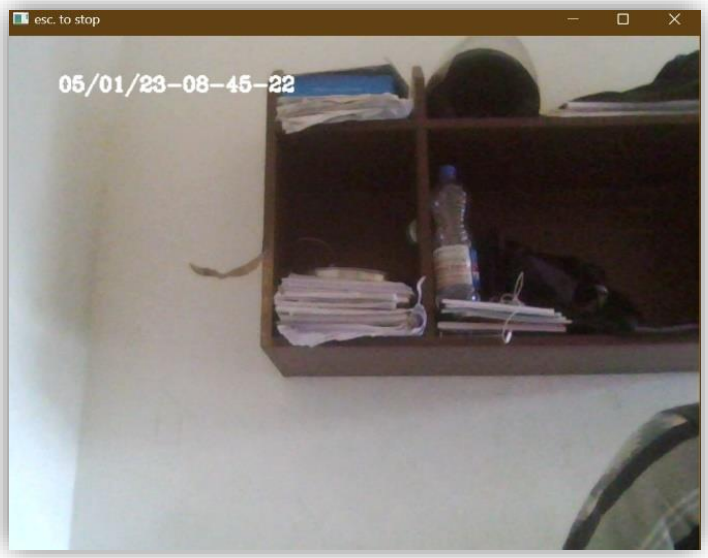


Figure 5.4 Identification

Your smart surveillance project's "Identification" feature is intended to recognize and identify people based on their visual traits. The function involves using a set of photos with faces and their matching names or IDs to train a machine-learning model.
For this feature to work, you must first train the model using a dataset of approximately 500 images of people with their matching names or IDs. Using these images, the system can train a model to recognize and identify people based on their facial features.
When the system is in operation, it examines the camera's video feed to search for faces in the frame. The system checks to see if a face it detects matches any of the people in the dataset by comparing it to the trained model. If a match is made, the system will notify the user in some other way or display the name or ID of the person who was recognized.

5. Record



\

Figure 5.5 Record

Your smart surveillance project's "Record" feature is made to let you capture live video feed from the camera. The feature operates by periodically taking still images from the camera stream and saving them as video files on the system's storage device.
Simply select the "Record" option to use this feature, and the system will start recording and storing frames from the camera feed. The video content is kept in a file format that can be viewed by common media players or video editing programmes.
The "Record" feature not only records video, but it also adds a date and time stamp to each frame that matches the time and date on the system clock. When evaluating film in the event of an incident or security breach, this makes it simple to find and examine footage from specified dates or hours.

6. Alarm

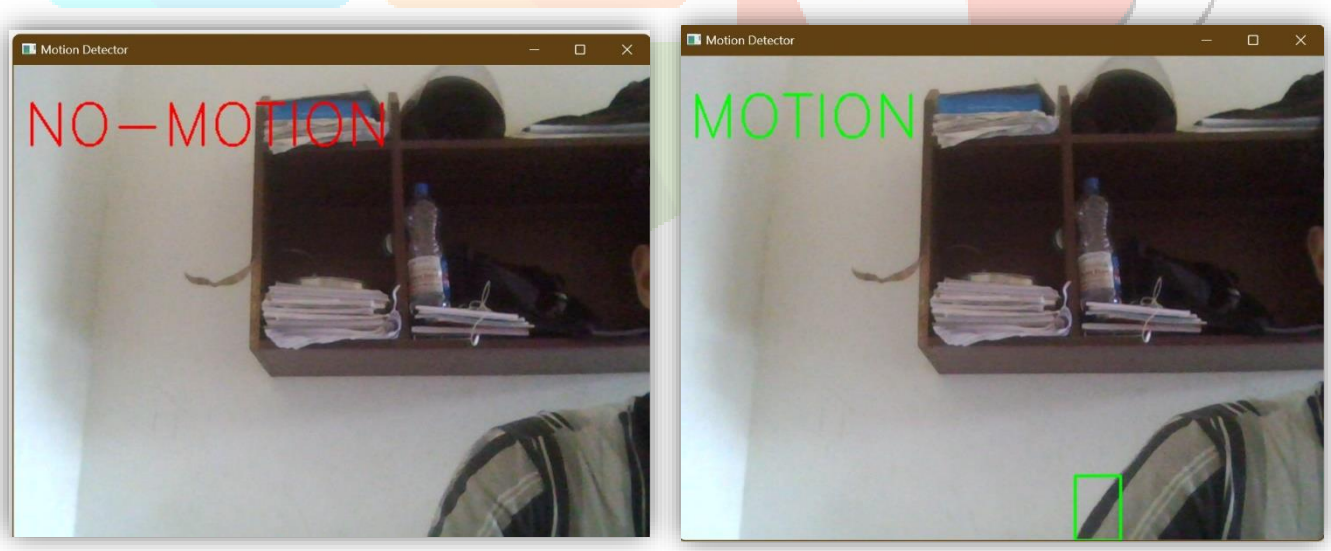


Figure 5.6 Alarm

When motion is detected within the camera's field of view, the "Alarm" feature in your smart surveillance project is intended to generate an auditory alert. The function operates by watching the camera's video feed and looking for any motion or movement within the frame.
The system sets off an alarm when motion is detected, which plays an auditory alert to notify the user or administrator of the movement. The alarm can be programmed to go off automatically after a predetermined amount of time and can be adjusted to sound at different volumes or frequencies.
The device won't sound the alarm if there is no motion within the frame, which helps to cut down on false alarms and avoid unneeded noise or disturbances.

7. Visitors Detection

Figure 5.7 Visitors Detection

Your smart surveillance project's "Visitors" feature is made to take pictures of people as they go within the camera's field of vision. The function operates by watching the camera's video feed and recognizing when someone enters or leaves the frame from the left or right side.

The technology takes a picture of a person's face when they cross the end of the frame and stores it to a database or storage medium. The image can be used in the future for identification or analysis, and it can be used to monitor people's movements about the building.

VI. CONCLUSION

There is a lot of research being done in the area of computer vision. We successfully completed the work required for this project's advancement. The objective is to recognise faces, study them, and decide whether they resemble saved faces that are kept in the database (which comprises pre-encoded training faces). Look for any moves in the picture, and if you spot any suspicious activities, alert the authorities. However, reducing the cost of running a surveillance facility and enhancing security continue to be challenging tasks. Current computer vision research still faces difficulties with this.

VII. FUTURE SCOPE

Since technology has made significant advancements, this work can be applied widely. The following is a list of the utilisations for this project.

The detection of deadly weapons, accidents, fire, and many other features are also included. Create programmes like Python that can operate independently and without assistance. The project would have a greater scope if DL support was included because it would make it possible to incorporate a lot more functionality.

REFERENCES

[1] Arun Hampapur, Lisa Brown, Jonathan Connell, Sharat Pankanti, Andrew Senior and Yingli Tian. Smart surveillance: - Applications, technologies and implications. Researchgate. January 2004.

[2] Dayana R, Suganyam M, Balaji P, Mohammad Thahir A, Arunkumar P. Smart surveillance system using Deep Learning. International journal of Recent Technology and Engineering. May2020

[3] Icshan IT taufic, Maya Mushthopa, Aldy Riadly, Muhamad Ali Ramahani, Yana Aditia Gerhana, Narang Jsmail. Comparison of Principal component Analysis algorithm and local binary pattern for feature extraction on face recognition system. MATEC Web of conferences. January 2018

[4] Ivan ozhiganov. Convolution neural network vs cascade classifiers for object detection. DZone. May 2017.

[5] Kelvin salton do prado. Face Recognition on understanding LBPH Algorithm. Towards Data science. Nov 2017.

[6] Mrinal Tyagi. HOG (Histogram of oriented gradients): An overview. Towards Data science. Jul 4 2021.

[7] Paul Viola, Michael Jones. Rapid Object Detection using Boosted a cascade of simple features. Reserchgate. May 2004.

[8] Pranjal Datta. All about structural similarity index SSIM: - theory + code in pytorch. SRM MIC. Sep 2020.

[9] Umme sara, morium akter Mohammad shorif uddin. Image quality assessment through FSIM, SSIM, MSR and PSNR - A comparative study. Journal of Computer and Communications. January 2019.

[10] Vaibhav Hariramani. Face Identification using Haar cascade classifier. Geeky bawa. October 2020