International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 10 Issue 7 ǁ July 2022 ǁ PP. 52-56

Hawk-Eye smart CCTV surveillance System

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ABSTRACT
This paper on Smart CCTV camera surveillance systems is to enhance the CCTV camera-based security systems, which presently exist in different places. Thissystem by using CCTV Cameras is designedusing wireless technology. The use of a surveillancesystem for image detection is becoming more important. An embedded surveillance system is frequently used in the home, office, or factory for image processing of the surveillance system and also for traffic monitoring but this configuration requires a high-performance core, which works against some advantagesof embedded systems, such as low power consumption and low cost.A video surveillance system is used for the monitoring of the behavior, activity, or other information generally of people in a specific area. The application of video surveillance is now not only limited to providing security for areas but expanded to the various sectors. We present Vigil, a real-time distributed wireless surveillance system that leverages edge computing to support real-time tracking and surveillance in enterprise campuses, retail stores, and smart cities.
Keywords: *Embedded surveillance, configuration.*

Date of Submission: 22-06-2022 Date of acceptance: 04-07-2022

I. INTRODUCTION

Security is a measure concern in every organization. To satisfy this issue the organizations use surveillance cameras. The limitation in using them is that there must be an operator to watch the stream from the cameras and take respective decisions. The use of camera-based surveillance has extended from security to track, environment, threat analysis, and many more. By using the power of modern computing and hardware it is possible to automate the process. The emergence of machine learning, deep learning, and computer vision tools has made this process efficient and feasible for general purpose use. Our paper, Smart CCTV camera surveillance system is to enhance the CCTV camera-based security systems, which presently exist in different places. Thissystem along with CCTV cameras is designed using wireless technology. The use of a surveillance system for image detection is becoming more important. An embedded surveillance system is frequently used in the home, office, or factory for image processing of the surveillance system. Some designspropose the use of different sensors to track the sequence ofhuman body movement.

II. LITERATURE SURVEY

For the development of this work, a review of two research papers was done.1n [1]A Progress Review of Intelligent CCTV Surveillance SystemsCCTV-based surveillance has developed from simple systems comprising a camera connected directly to a viewing screen with an observer in a control room, watching for incidents of crime or vandalism or searching for targeted individuals, to complex multi-camera systems with many computers. Another system was discussed in[2]Webcam Based Intelligent Surveillance System. The objective of this project is to develop a system that monitors the area in which it is being implemented. An Intelligent Monitoring Sensor is applicable in the area where no one is permissible to enter, also where we need to detect if any motion has been done. The camera used here is not movable. it is fixed in the monitoring area also the camera is continuously on.

III. METHODOLOGY

3.1 Local Binary Pattern Histogram Algorithm(LBPH)

This is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. It was first described in 1994 (LBP) and has since been found to be a powerful feature for texture classification. It has further been determined that when LBP is combined with histograms of oriented gradients (HOG) descriptors, it improves the detection performance considerably on some datasets. Using the LBP combined with histograms we can represent the face images with a simple data vector. Using the image generated, we can use the **Grid X** and **Grid Y** parameters todividethe image into multiple grids, as can be seen in the following image:

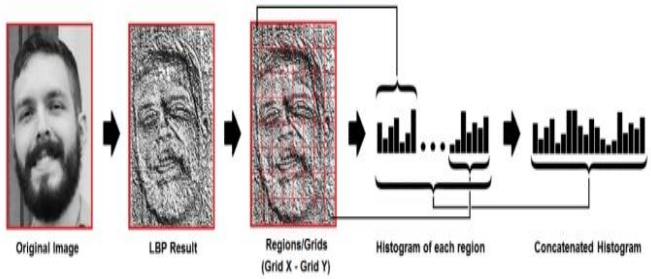

Fig: 1A 4-neighborhood LBP operator on a single image.

3.2 You Only Look Once(YOLO)

YOLO algorithm gives much better performance on all the parameters we discussed along with a high fps for real-time usage. YOLO algorithm is an algorithm based on regression, instead of selecting the interesting part of an Image, it predicts classes and bounding boxes for the whole image in one run of the Algorithm. To understand the YOLO algorithm, first, we need to understand what is actually being predicted. Ultimately, we aim to predict a class of an object and the bounding box specifying object location. Each bounding box can be described using four descriptors.

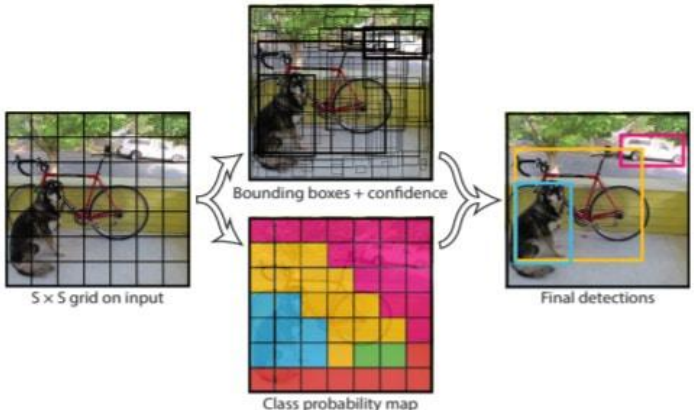

Fig: 2A simplified illustration of the YOLO object detector pipeline.

Fig 2 shows Each of the cells in this grid is responsible for predicting 'B' boxes all containing an object as well as a score representing the level of confidence for the object present in the box. If there are no objects in the cell, this score should be zero. Otherwise, if an object is in the cell, the score will be equal to the intersection over union (IoU) between the predicted box and the ground truth of the image.

3.3 Generic Object Tracking Using Regression Networks(GOTURN)

GOTURN changed the way we apply Deep Learning to the problem of tracking by learning the motion of an object in an offline manner. The GOTURN model is trained on thousands of video sequences and does not need to perform any learning at runtime. GOTURN takes two cropped frames as input and outputs the bounding box around the object in the second frame. In the first frame (also referred to as the previous frame), the location of the object is known, and the frame is cropped to two times the size of the bounding box around the object. The object in the first cropped frame is always centered.The location of the object in the second frame (also

referred to as the current frame) needs to be predicted. The bounding box used to crop the first frame is also used to crop the second frame. Because the object might have moved, the object is not centered in the second frame.A Convolutional Neural Network (CNN) is trained to predict the location of the bounding box in the second frame.

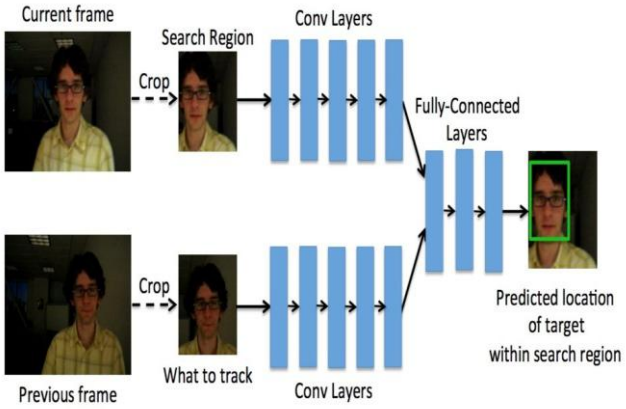

Fig: 3GOTURN Architecture.

IV. IMPLEMENTATION

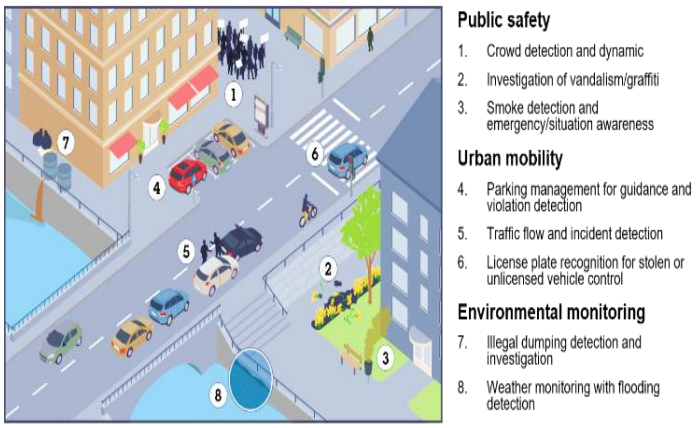

Fig: 4 Areas of implementation

In figure 4, the sensor camera's purpose is to reflect progress in the motion of entities that are observable to the camera, in this situation, physical movements. This camera's reliable monitoring mechanism can detect approaching items. The adaptive background removal technology proposed in this paper can accommodate frame changes. The prior background intensity inference will always be used to update the background frame. It will then analyze the method's effectiveness. Along with motion detection, it will only record moving frames, allowing the system to make the most of its capacity. The implementation is one phase of software development. Implementation is that stage in the project where theoretical design is turned into a working system.Implementation involves placing the complete and tested software system into the actual work environment. Implementation is concerned with translating design specifications with source code. The primary goal of implementation is to write the source code to its specification which can be achieved by making the source code as clear and straightforward as possible. Implementation means the process of converting a new or revised system design into an operational one. The implementation is the final stage and it's an important phase. It involves the individual programming, system testing, user training, and the operational running of the developed proposed system that constitutes the application subsystems. During this implementation phase system actually takes physical shape. Depending on the size of the organization and its requirements the implementation is divided into three parts:

4.1 Stage Implementation

Here the system is implemented in stages. The whole system is not implemented at once. Once the user starts working with the system and is familiar with it, then a stage is introduced and implemented. Also, the system is usually updated, regularly until a final system is sealed.

4.2Direct Implementation

The proposed new system is implemented directly and the user starts working on the new System.The shortcoming, if any, faced are then rectified later.

4.3Parallel Implementation

Our system was implemented on the approach of a prototype model whose functionality was increased day by day, as the client was given full liberty in choosing his needs and getting the maximum benefit out of the system developed. Implementation is that process plan where the theoretical design is put tothe real test.

V. EXPERIMENTS AND RESULTS

The following Fig:5 shows the design flow of the developed prototype for the security system. A few major components in this system include motion detection with OpenCV implementation, live video streaming, and email notification. Flask was used as a server to develop the platform for video streaming. The streaming of the video was performed by encoding the frames to a JPEG format and uploading them continuously to the server.

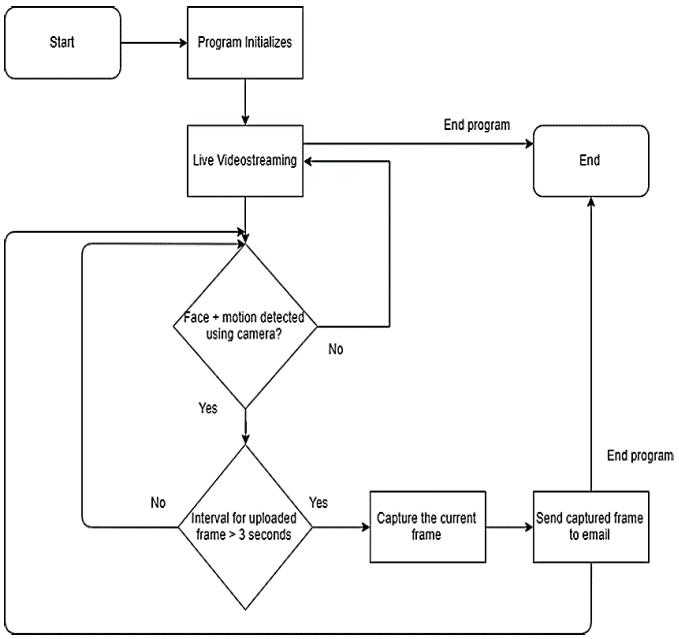

Fig: 5DFD of security system.

5.1 Performance Evaluation

Three experiments were conducted to compare the performance of the developed vision-basedsecurity system with the PIR-based motion detection system as follows:

i. Human motion detection – In this experiment, the ability to detect motion from a human being was tested.

ii. Motion detection under sunlight exposure – In this experiment, the systems were placed near a window and tested under sunlight exposure.

iii. Non-human detection

In each experiment, 10 trials or tests were performed and the number of passing results was recorded. It should be noted that in our conducted experimental procedures, a true or pass reading covers both true positive and true negative cases. On the other hand, a false or fail reading covers both false-positive and false-negative cases. Separate positive and negative tests werenot conducted and are planned as future work to further validate the reliability of the developed systems.

Table: 1 Comparisonof the performance of thedeveloped vision-based security system

Experiment	OpenCV camera motion detection	
	Accuracy (%)	Streaming latency(fps)
Human detection	100	
Motion detection under sunlight exposure	100	
- **10am**	100	15-24
- **2pm**	100	
- **5pm**	100	
Non-human detection	100	
Overall	100	15-24

VI. CONCLUSION AND FUTURE SCOPE

Since surveillance is most important and needed inall places, a securitysystemwithlowcostandlow power consumptionismostneededtoavoidtheftandother misbehaves.Here we implemented a new method without using CCTV cameras forsurveillance in the home, banks, and all other places.It's implemented with low cost, low power, and alsoto avoidmemoryusage.We haveprovidedsecurityespecially, in this paper, we have presented a multi-camera video surveillance system to automatethevideomonitoringandminimizethehuman involvement in monitoringwhichcan makesignificant impactsinthe securityindustry. The proposedapproach can detect andrecognizea human target fromvideostakenfrom cameras mounted on the wall.

This system has a wide range of uses in various fields, such as banking, forensic department, etc. The reason this system is quite useful is due to the fact that it is highly compact and it provides face detection. Recognition is the main part of any security system. Usually, for the best recognition system, we require a well-trained database, which can provide the base for our recognition. So, to obtain the database first, collect the images of the subject individual for recognition. Once we obtain and train our system, we can provide face recognition.

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