

ACTIVITY TRACKING OF EMPLOYEES IN INDUSTRIES USING COMPUTER VISION

Submitted in partial fulfillment of the requirements for
the award of
Bachelor of Engineering degree in Computer Science and Engineering

by

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BONAFIDE CERTIFICATE

This is to certify that this project report is the bonafide work of **YUGANTHINI P (Reg. No. 37110877)** and **VIGNESWARI A (Reg. No.37110837)** who carried out the project entitled "**ACTIVITY TRACKING OF EMPLOYEES IN INDUSTRY USING COMPUTER VISION**" under my supervision from **August 2020** to **March 2021**.

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2

DECLARATION

I **YUGANTHINI P AND VIGNESWARI A** hereby declare that the Project Report entitled “**ACTIVITY TRACKING OF EMPLOYEES IN INDUSTRY USING COMPUTER VISION**” is done by me under the guidance of **Dr. S.Jancy M.Tech., Ph.D** Department of Computer Science and Engineering at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering.

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ABSTRACT

Human resource management is integral to every organization. Its employees are managed based on various aspects such as time management and efficiency monitoring which never goes out of scope at every level in an organization. Many strategies and methods have been proposed and used by the human resource department as a routine to monitor employees to effectively utilize the employee's man-hours and properly train those who lack certain efficient working skills. This paper discusses effective monitoring of employees in the workplace through computer vision technology using CCTV cameras in an organization. The employees are detected within their work region and the effective time spent within are mapped against their efficiency of work completed within the stipulated time. In this proposed method, the effective working hours of an employee are consolidated where the cost of implementation is much simpler than existing strategies and methods used in employee monitoring.

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CHAPTER I

INTRODUCTION

GENERAL

Computer vision is a field of artificial intelligence where the computers are trained to decode and apprehend the visual world. Digital images and Videos from Surveillance cameras are used with Convolutional Neural Network models that facilitate the machines and they can precisely identify and distinguish objects. Computer vision plays a vital role in the problems it could solve by enabling the interaction between the digital world and the physical world.

Computer vision facilitates various applications such as object detection, human tracking, image processing, video processing, colour detection, autonomous vehicles.

II. Human Detection

Human detection is an application of computer vision which widely monitors the human activities movements and positions in a frame and executes a set of responses based on desired condition [3]. The widely used human detection is the human motion detection in highly restricted areas [2]. Slowly the Human detection technology is replacing the security professional sitting in front of a number of surveillance monitors to suspect any suspicious activities [14].

In the attendance system the human detection and tracking technology is majorly used in head counting, crowd management in commercial spaces [16], emergency evacuations, face detections, crowd classification, etc.

III. Attendance Systems

Attendance is a mandatory factor that plays an important role in any field of work. This ensures the organization's discipline and smooth functioning. Its sole purpose is to maintain the track of entry and exit time of employees at an organization. There are several methods to time-track employees at an organization.

PROJECT OUTLINE

This project discusses about effective monitoring of employees and to calculate

the efficient working hours of each employee who are monitored under the surveillance camera within a specific region. The result obtained can further be validated with the existing biometric system to obtain the efficient working hours.

OBJECTIVE

To provide the time spent by the employee in his/her allotted working region with respect to the time he/she checks in into the office. This can be achieved by using the existing surveillance camera in the premises and to extract the effective working hours of an employee at any field of work without any human supervision.

MOTIVATION

Attendance plays a vital role in every organization and some of the organization's salary will be determined purely based on the working hours. The technology has given a lot of automatic attendance monitor systems by using fingerprints, face perception, smart access cards and tracking the GPS of workers in the marketing field. The attendance system will vary according to the field of work but there are some uncertainties in the effective time calculation using those existing biometric systems for an instance an employee's initial presence inside the organization and the employee's exit time alone is recorded through these systems. But these systems fail to monitor the activities of employees after the check in time. In order to monitor the activity of each employee the organisation must employ few individuals to supervise other employees. So, to overcome this we thought of using the existing surveillance camera which could detect and track employee's efficient working hours.

CHAPTER 2

LITERATURE SURVEY

In this application, the following modules are mainly used,

OpenCV is one of the most popular open-source libraries or packages that plays a vital role in many technologies like computer vision, Machine Learning, Artificial Intelligence and, Deep learning. It was developed in C++ and now It can be implemented by using many languages like c, python, and, java and it is platform- independent too It can be used with any type of operating system like Windows, Linux, Mac OS, IOS and, Android. It has come across many versions currently we are using OpenCV 4.5.1. It is integrated with many inbuilt functions, packages and, algorithms. Processes like image analysis, video processing, object detection become more accurate and effective with help of OpenCV.

CV2 computer vision solves many real-time applications and provides an effective solution it becomes possible only with the help of the cv2 module. It is a building block for computer vision.cv2 provides many inbuilt methods which can be used for a various operation like extracting or gathering information from an image or video, loading the input from various source, applying the various methodology to remove unwanted information like blur, noise and to provide a crystal-clear information by adjusting threshold value and grayscale rating to provide better results.

NumPy computer vision introduced very fundamentally scientific computing packages to perform various advanced and comprehensive mathematical computer vision. It is widely used to perform various operations in structure and its magnitude such as translation, rotation, resizing, displaying, sorting detecting edges, etc.

Video capture() Many real-time applications are based on the video source videos plays a key role in many application which can be used as a proof for many security purposes so in-order to load a video input and to process them for better utilization computer vision provides with a very useful inbuilt method that is video capture we can use this function to capture a live stream with the camera with the help of this method

we can take our input in many ways like it can be from webcam which is

internally integrated with our machine or to get data from the webcam which are connected externally or we can provide a direct video file. It also supports different video formats like MP4, AVI, MOV, WMV, etc. This method can be implemented with a various argument that argument specifies the different source. If its parameter is 0 or -1 then it refers to own camera data. If the index is other than 0 or -1 it points to the camera which is connected. After input data gets loaded this method works with another method to perform its function effectively.

Imread() It is used to load an image from a specified location. It usually returns in the form of the matrix. If it fails to load due to unsupported or invalid format, the improper path will return an empty matrix instead of throwing an error which may abort the whole process from execution. This method contains a two-parameter path (a string that provides a location from which an image can be loaded) and a flag – It mentions the procedure the image should read.

Imshow() It is used to display the image in the output. It is implemented with two arguments: the string which specifies the window's name in which the image is going to display and the image name or the path of the data which are going to display. It has been introduced with many inbuilt features like it can create an image from 2-dimensional NumPy array. Each element of an array is represented with a square and each square is represented with particular color which is corresponding to that array element.

Waitkey() is one of the useful methods in OpenCV packages. As the name implies it works dependent on keyboard event and it waits for user instruction to proceed with the execution. This keyboard binding function is used to display output for a particular specified duration. It mostly takes input as an integer and it is converted into ASCII value corresponds to provide input. We usually pass a period the output needs to be displayed in milliseconds as an input. If we provide a '0' as an input it will display output for an infinity amount of time until the user presses any key and we can also provide alphabets that are converted into ASCII value based on the key pressed. `waitkey(0)` – waits for the user without any limitation, `waitkey(1)` It detects

the button for every 1ms whether it has any keyboard event, waitkey(100) by using this method the program detects a keystroke every 100ms.

distroyAllWindows() simply destroy all the windows which are created while execution. If we want to destroy any specific window, we can provide this function with a particular window's name as an argument. It is the process of returning the memory to operating like how we destroy the object created and return 0 in many programming languages.

Non_maximum_suppression () is an important feature to extract the best among many outputs It is integrated with a cluster of the algorithm. It is very useful to select a particular clear entity out of many without any overlapping. Most of the object detections algorithm uses this technique in their algorithm it overcomes the drawback of many existing algorithms like RCNN, Yolo v3, SSD, etc. once the detector outputs many bounding boxes it is necessary to pick the best one. For this purpose, NMS plays a vital role. It is considered as the essence of many successful algorithms like K-means, nearest neighbor, DB scan, The non_maximum_supression algorithm gone through this below-specified procedure.

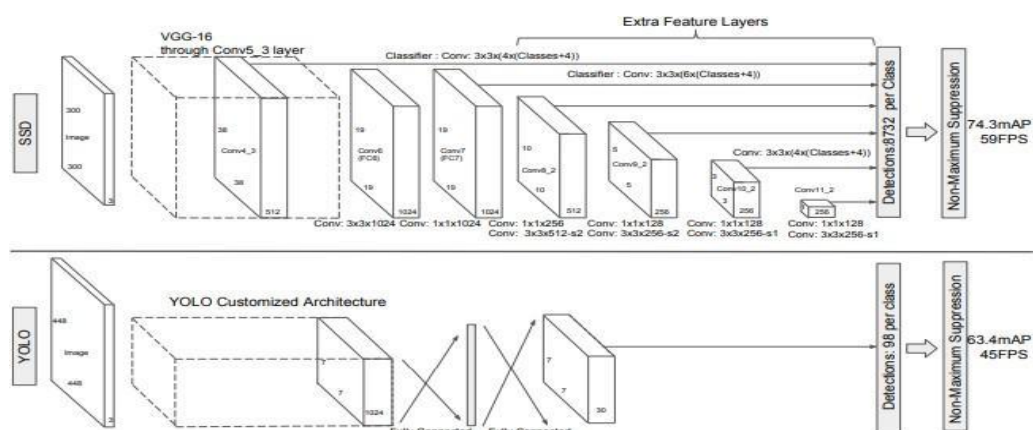


FIG 2.1 BLOCK DIAGRAM OF NON_MAX_SUPRESSION ALGORITHM

Blobfromimage It is one of the pre-trained deep learning methodologies used for image preprocessing and to classify them. The image is processed by following two operations such as mean subtraction and scaling. Mean subtraction is the process in which the illuminate changes are made in the data set. It optionally resizes and crop images from the center, subtract mean values, scale values with the help of scale factor. This function creates a 4dimensional blob from an image.

MobileNet-SSD It is one of the deep neural Caffe models which is used to detect and track an object. Caffe is a deep learning framework made with effective speed, modularity, and expression. This method allows loading pre-trained models from most popular frameworks like TensorFlow, Caffe, Darknet, Torch, etc. It can also compatible with other OpenCV packages such as YOLO, Squeeze Net, ResNet.

Caffe Model: It is one of the most useful Deep learning frameworks It is a preferable module as it is used for implementation and to access the Expression, Speed, Modularity, Openness in an object detection system.

RELATED WORK

Jianpeng Zhou, Jack Hoang [4] has developed Real-Time Robust Human Detection and Tracking System by this method and they tried to detect and track them and it involves false object Identification. Many approaches have failed because it fails to distinguish between human motion with other movements like trees, vehicles on the road and some shadow motions so they overcome these defects with the process of false object detection by using the colour histogram. Colour histogram mainly focuses on the various types of colour on the input may be an image or a frame from a video instead of the spatial location of the colours and the foreground and background distribution are in a different distribution. This task is performed by calculating pixel count for every 256 scales with some colour spaces like RGB or HSV. It also performs colour quantization in which the images are divided into small intervals which are called a bin in case of large images by keeping this as a prerequisites steps for classification and to track the

individual they have used the

method which is purely dependent on colour irrespective of its shape and appearance and it fails to distinguish a two different object with same structure for (e.g.) It unable to differentiate white and red cap and its high noise interference sensitive these are two drawbacks of colour histogram methodology.

Pedro Simao, Jose Fonseca, Vasco Santos [10] has introduced a new solution for an attendance management system which is high time-consuming but a necessary process in almost every organization. Equal priority should be given in terms of security. They have used the wireless Zigbee Technique which is most popular in security than others It is a protocol with low-cost, low-power, wireless mesh characteristics, it includes many cyper models like cryptographic keys, ciphering frames to provide better security. They can be implemented in various types such as Zigbee coordinator, Zigbee router, Zigbee end device over network and application protocols layer successfully. This technology is provided with C, C++ simulation by which user can perform modification and make the system more effective the biometrics along with fingerprint detection was used. This system is designed in such a way that it automatically records the attendance based on fingerprint matching. This is achieved using Zigbee technology which requires high maintenance and low network stability.

Changyan Li, Lijun Guo, Yichen Hu [2] have introduced a new method to monitor the individuals and to track them in a video with a methodology called Kalman filter. This filter integrated with a dynamic model which can act as a control system to the systems and it can also provide the measurement in multiple sequential ways. It was more popular because of its efficient recursive attribute. The estimation of systems internal state can be done very accurately, sometimes it can be worked with the combination of a linear belief function and belief filter to state the equation by using evidential updates. The observation and process model is referred to as a complex system categorize as a non-linear filter to work with those non-linear systems we can use either extended or unscented Kalman filter. This technique was used to improve human detection accuracy and to reduce the search time they implemented their research as a two-modules first they tried to get the human features from the depiction. Second, the Kalman filter plays a role to predict human movement in the next frame. Although the technique was efficient it fails to detect multiple humans in a video.

Swapnil V. Tathe, Sandipan P. Narote [4] has proposed the system to find the movement of human detection and their activities by extracting the biometric feature from an image like face and eyes. Face detection is done using a Skin color-based method especially they used the YCbCr color model and the Projection Function method was also used to detect the eye region and also non-parametric feature space analysis technique which is called as Mean shift algorithm using this method the maximum density function can be located it has many applications among those in tracking it plays a vital role using this method confidence map can be drawn in a new image by assigning a probability on each pixel of the new image which is the probability of the pixel color occurring of the previous image objects. This algorithm is preferred as it is an independent tool and it does not rely on predefined shapes on data clusters. It can and the Kalman filter is used to improve efficiency. Although it has many advantages it was not preferable due to the lack of robustness.

Yuqing Chen, Yang Xue [15] has designed a system through which we can find the activity of an individual like jumping, walking quickly, walking upstairs and, apart from just pointing the presence of an individual using a single accelerometer they tried to overcome the drawback of FFT which is a DFT signal used for the computation of the Discrete Fourier Transform of sequences different frequency component DFT signals are generated with the distribution of value and DCT coefficient method is used to compress the image by reducing the pixel value this method provides us a high compression without loss of data which can be transmitted over the networking which extraction can be performed only in the same axis rather than the different axis but this system was restricted with a limited number of activities as it can detect only a few ventures.

NazareKancahn Jayant, Surekha Borra [8] has developed an Attendance Management system that uses Hybrid Face Recognition Techniques In this system camera was used to monitor attendance. In this method, the image which was captured at present is compared with the image which is stored in the Database. If a match occurs then the student will be marked as present else, he/she will be considered absent. The Object detection Viola-Jones algorithm was used which is the most popular framework. It is mostly used to detect a particular object in a frame. It proceeds with four different stages such as Haar Feature selection, creating an integral image, Adaboost Training, cascading classifiers. It can also work with the

KLT algorithm to detect an object in a video when they are in movement along with the salient features. It also indicates the motion by drawing bounding boxes. It has high demand because of its Robust, impressive speed property. which is highly luminous sensitive was used, so it fails in some cases where it needs to detect faces in various lighting conditions.

NarraDhanalakshmi, Saketi Goutham Kumar [9] has introduced a different Attendance management system and new concept by including various technology like Fingerprint, Aadhaar Based Biometric observation. This system has introduced an alternate way in case of failure where first they tried to record an attendance based on fingerprint but it fails to recognize, then they tried to extract the biometric feature such as fingerprint from the Aadhaar number which is unique and includes all the details of a person. It was not reliable and we have to get proper permission and details from UIDAI for using CIDR which is not practical for all the organization.

Vis`12akha K, Sidharth S Prakash [14] has developed a technique to monitor the sensitive area by detecting and tracking the movement and activity of an individual by using one of the most trending technologies Computer vision which includes many useful concepts and methodology to bring a great revolution in image advancing field. By this method, it reduces the manual effort which needs to be put into securing or monitoring a particular region using Haar Classifier is used to focus on a specific position in a detected window and pixel intensities can be calculated in every region based on the computed value it categorizes the subsections of an image it always works with cascade classifier to become more effective. It is highly preferable because of its computational speed irrespective of the size of an image it will take constant time for all sizes of the computationally expensive frame.

Dima MaharikaDinama, QurrotaA'Yun [3] has designed an application to detect and to track the motion from surveillance using recognition and classification procedure to detect an object in a video Footage or live which is possible using one of the most neural networks Convolutional neural Networks They are made up with learnable weights and biases neurons by passing through an activation function. In this approach, the image to pass through a convolution layer which is the topmost layer in neural networks then it moves along the source image known as a filter. This filtering task is used to accumulate

the original pixel value this network is mixed with

a nonlinear and pooling layer by using this method they detect a human in a video and track them by drawing rectangular contour over them to improve efficiency. It uses some filters like spatial correlation to remove blur, background noise and to move a filter over the image.

Karthikeyan B, Kabilan M [5] has developed the technique which uses laser point to perform human detection and tracking efficiently even when there are many traditional methods to detect and effectively track the human, it fails to give the accurate result when they are out of focus. To overcome this drawback, they introduced the Raspberry Pi technique through a laser which can be used as an indicator in the camera through which it can rotate itself to 360° so that it can cover the entire focus of an individual but it is not compatible with all the environment.

INFERENCE FROM THE LITERATURE

We have come across many methods which are reducing manual effort by making the process automatic like automatic attendance management, library management, speech recognition, capturing gesture, tracking activities and so on. Through this project we try to improve the efficiency of existing methods. There is a technology to automate and validate the attendance system in the existing methods they have used highly reliable and low power consuming method like Zigbee wireless technology to record attendance using fingerprint and Viola-Jones object detection framework, biometric technologies which are known for its high security, convenience, uniqueness, and assurance characteristics but it is not preferable to use because of its cost, bias, and inaccuracy. Detection and activities of humans are tracked by utilizing various algorithms like Kalman, Mean shift algorithm, Colour histogram method, Hog, Haar classifier. Where the Kalman filter is used to predict the future scenario in an image or video frame. It was included in many projects as it has the capacity to produce accurate results with low memory consumption and has high computing speed. Hog is mainly used for its easy and accurate way of extraction of features from image or video. Mean shift algorithm provides a solution for other machine learning algorithms like K-means, Gaussian mixture; it does not rely on assumption; it is not necessary to make any assumption model. Haar cascade classifiers are unique for their high-speed computational power.

Although

many methods have been introduced efficiently the attendance system checks the presence of an individual in a specific area. In this paper we provide a validation for the existing system as well as provide the total efficient working hours of an employee. We use this with the existing biometric system to avoid proxy attendance [8] and to facilitate within workplace monitoring of employees. By our method we get the benefit of the location tracking from a GPS based system as well as the biometric system. We in turn calculate the work efficiency and ideal time spent by each employee in a workplace.

CHAPTER 3

AIM AND SCOPE OF THE PROJECT

AIM

To determine the efficient working hours of an employee at an organisation and compare the extracted time with the time entered in the biometric system during the check in and check out.

GOAL OF THE PROJECT

Goal of the project is to attain the efficient time spent by an employee in a specific area apart from his leisure time spent during the intervals. So, by this an organisation can come up to a conclusion that how much time a job needs for its completion and how efficient their workers are in completing the given work without any wastage of time.

We focus on detecting the worker within the certain defined region and extract the time he/she has spent in that certain region and compare it with the existing biometric attendance system and calculate the actual effective working hours of the worker. with the help of OpenCV, Python, surveillance camera using Computer Vision.

SCOPE OF THE PROJECT

This project deals about the problem faced in the real world in an industrial working environment to supervise and monitor work efficiency of the worker. It is further used to validate the measured time with the existing biometric attendance systems

Existing Attendance Systems

(i) Biometric attendance system

Biometric attendance system is used to scan the fingerprint of an employee into a device which in turn stores it into a database as unique Id. [17],[18] So, the next time the employee places his finger to scan, it recognises the fingerprint that is stored in the database and confirms their presence with the in-clock time. The same happens while they exit out.

(ii) Facial Recognition attendance system

Facial recognition involves capturing features of a human face to identify them and classify to mark their attendance. Facial recognition system uses image processing as its backbone to classify and abstract features of images as well as live camera inputs. [13] discusses the recognition and detection eye and contours in a human's face. It compares the skin tone to extract and match with the existing database. [8] states about the effective recognition which is then stored with the time stamp in an excel sheet for further processing of attendance.

(iii) GPS based attendance system

GPS attendance system is a mobile based application which helps in managing employees' attendance with their check in and check out time along with their location data. The location data is acquired with the every check in and check out and it then gets validated with the list of allowed locations to be clocked in [20]. It is used mainly for remote workforce and comes handy with their hand-held devices and the cost of implementation is lesser when compared to biometrics which in turn requires certain sophisticated hardware and systems to implement it.

(iv) RFID based attendance system

Radio Frequency Identification is a attendance system which works on proximity based passive radio frequency identification which could be made as a ID card to simply monitor the check in and check out. It is also used in replacement to those long tiring processes of attendances in schools and colleges[19]. This attendance system is much similar to the biometric system, just the recognition is much faster compared to the traditional fingerprint systems.

(v) Comparing existing system with our system

Our method focuses on the key factor of human detection within a work region with existing surveillance cameras to monitor the time spent within the region from his total work time in the office. Our method acts as an add on to the existing attendance system to facilitate the precise efficiency of the worker in a workplace against the work output throughout that day. It is also used to validate the existing attendance system as they check only the check in and check out time [17],[18]. In this paper we provide a validation for the existing system as well as provide the total efficient working hours of an

employee. We use this with the existing biometric system to

avoid proxy attendance [8] and to facilitate within workplace monitoring of employees. By our method we get the benefit of the location tracking from a GPS based system as well as the biometric system. We in turn calculate the work efficiency and ideal time spent by each employee in a workplace.

CHAPTER 4

METHODOLOGY

PROPOSED METHOD

Any process that involves processing of images should come across a feature descriptor in order to identify the type of object in the given frame and extract the necessary features from it. There are several feature extraction algorithms

- HOG: Histogram of Oriented Gradients
- SIFT: Scale Invariant Feature Transform
- SURF: Speeded-Up Robust Feature

In which HOG algorithm is the most utilized and it is highly reliable for detecting humans in a precise manner.

HOG - Histogram of Oriented Gradients. This algorithm mainly extracts the structure and features of an object [2]. It is also used to detect the edges and definitions using its gradient and orientation abstraction.

Caffe model is a convolutional architecture for fast feature embedding used for detecting the objects and person in a frame with more accuracy at a rate of 92% and it is much faster compared to other CNN models for feature detection.

The person detection is carried out by existing algorithms which were used widely in the field of human detection and tracking such as HOG with Kalman filter, Caffe model, CNN, RCNN and certain other deep learning methodologies.

In this paper, all static surveillance camera feeds will be acquired from a workplace and the desired work regions of every employee will be plotted within the feed. While the employee enters the office premises which is confirmed by the biometrics at the entry the feed starts to monitor the specified region for the detection of the person.

In our method, the person in our field of view is detected using both the above algorithm and a rectangular contour is mapped inscribing the person in it. The centroid of the rectangular contour is mapped as points by the centroid tracker which finds the centroid of any given dynamic moving contour within a frame precisely and yields a value as a coordinate. Our pre-mapped specific work regions will then be plotted against it to identify whether the centroid of the contour is lying within the specified mapped work region.

Once our condition satisfies the timer counts the time spent by the specific person

inside a specific word region. Whenever the person leaves the specific mapped region, the timer holds and resumes after the person enters the region again. The cumulative time of the person spending inside and outside the region is summed up. This total time spent within the region is then compared with the biometric time which is the clock in time to the clock out time by excluding other constrained leisure hours allotted to each of the employees. From this we could arrive at the total efficient working hours of an employee by the ratio of the total time spent within the region to the total biometric time of the employee on that day.

SYSTEM REQUIREMENT

- OpenCV - a library of programming functions mainly aimed at real-time computer vision.
- Python3 - Python is an interpreted, high-level, and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace
- OpenCV Processing Libraries –
 - Imutils –they are a series of convenience functions to make basic image processing functions such as translation, rotation, resizing, skeletonization, and displaying Matplotlib images easier with OpenCV and Python
 - Hog –Pedestrian detection algorithm.

ALGORITHM USED:

Centroid Tracking.

Almost all computer vision applications are based on the process of object detection or tracking. To perform this task the cv comes with an effective strategy which is implemented as three different modules and they are dependent on one another they function in a cascade manner where 1st process output will be given as input to the proceeding steps. The methodology includes (i) Taking a frame and find the object and take that object bounding box coordinates. (ii) Assigning a unique ID for each of the

objects which are detected with bounding boxes. (iii) It

tracks the object in subsequent video frames and maintains a unique Id for an object. This algorithm relies on Euclidean distance and an assumption on that distance. Euclidean distances are calculated between the centroid of the current frame and with the centroid which is calculated for the previous frame. The centroid tracking algorithm is a multi-step process.

Step-1: Accept bounding box coordinates.

This algorithm assumes that we send bounding box coordinates for every single frame. After finding the bounding boxes unique IDs will be assigned to them for further process. Generally, the bounding boxes and objects are detected by using various algorithms like Haar cascades, HOG, SSDs, SVM, R-CNNs, etc.

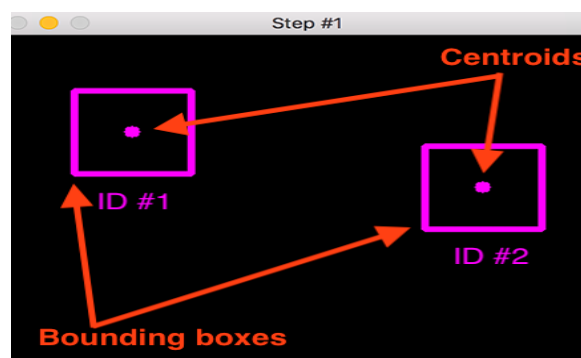


FIG 4.1 FINDING CENTROID

Step-2: Compute Euclidean distance

The bounding box calculation is followed by the Euclidean distance calculation for every subsequent frame. To avoid the confusion where the same object can with different Id. We try to relate the new object coordinates with the old object by using Euclidean distance. It was calculated for all the existing pairs of the object with all the combinations and to try to match with the previous one.

In the above picture, distances are calculated for all the combinations of an object.

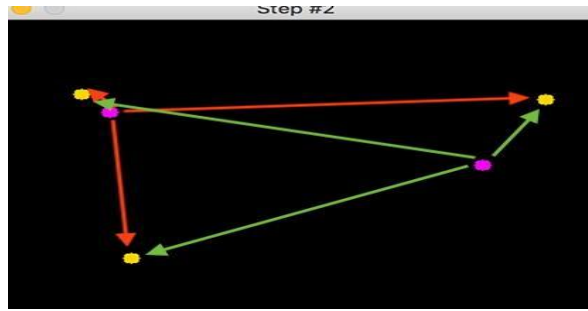


FIG 4.2 COMPUTING EUCLIDEAN DISTANCE

Step-3 Update coordinates of existing objects.

The primary assumption plays an effective role in this step, here the comparison made between the Euclidean distance calculated and with the possible distance in which an object can potentially move. If the calculated distance is less than or equal to the specified distance then it will be considered as the same objects and it will be assigned with the same unique Id.

In the below image we can find the actual process of this algorithm in which it tries to associate the new object with the previous one. As among five new objects, four objects are with minimum distance so that two objects are associated with the old object which can be provided with the same Id.



FIG 4.3 ASSIGNING ID TO OBJECTS

Step-4: Register new objects

In this step we work with the object which cannot be associate with any other old object then it will consider as a new object it will be assigned with a new Id and its bounding box coordinates are stored. After this, the process reverts to step 2 and proceed with preparation for all the upcoming frames.



FIG 4.4 REGISTERING NEW OBJECTS

Step-5: Deregister old objects.

It comes in to picture whenever we faced a situation of object loss (i.e.) it may disappear or left the field of view. In that situation, we deregister the objects by taking back the Id given to them previously and deleting its bounding box coordinates from the list when it cannot be associated with any other detection for longer in a total N subsequent frame.

Histogram of oriented gradients (HOG).

Hog algorithm counts the occurrence of gradients orientation in the location of a frame and thereby it detects the objects and is used in many image processing techniques.

Hog descriptor is implemented as follows

- (i) Initially it divides the image into small connected regions which are known as cells then the edge orientation or histogram of gradients are computed for each pixel within the cell.
- (ii) According to the orientation of the gradient each cell is discretized to its corresponding angular bins.
- (iii) Each cell's pixel contributes a weighted gradient to its corresponding angular bins.

(iv) Then for the proceeding process, all the adjacent cells are grouped as a spatial region which is referred to as blocks. This formation is considered as the normalization of histograms.

(iv) The combined group of the normalized histogram represents a block histogram and in turn, the descriptors are represented by the block of histograms.

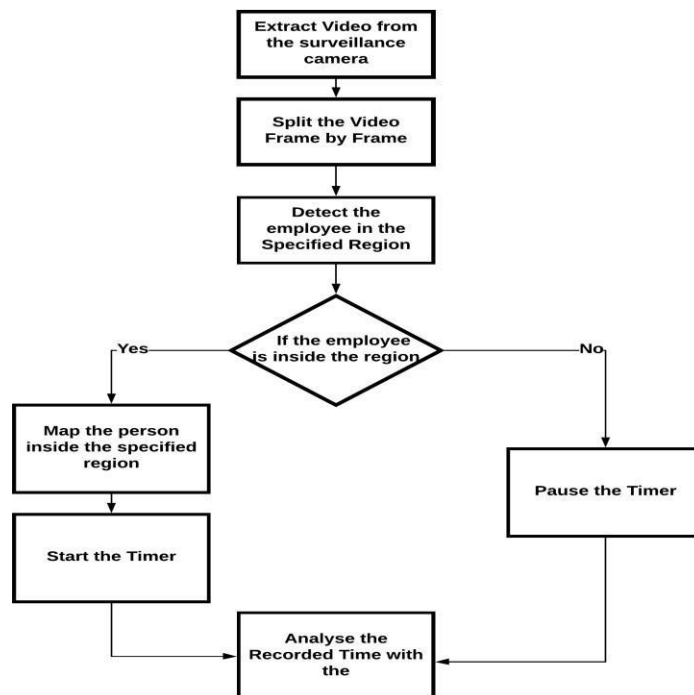
To utilize the Hog algorithm in an effective way some of the pre-requisites must be followed with configuration parameters such as.

- Mask to compute derivatives and gradients
- The geometry of splitting an image into cells and grouping cells into a block.
- Block overlapping.
- Normalization parameters.

.

FLOW OF THE PROPOSED SYSTEM

The footage from the surveillance camera is processed frame by frame and specific regions are discretized and the employees are detected in those regions and the total time spent by an employee when he or she is inside the region is calculated by the in-frame time. The below given workflow represents the stepwise process.

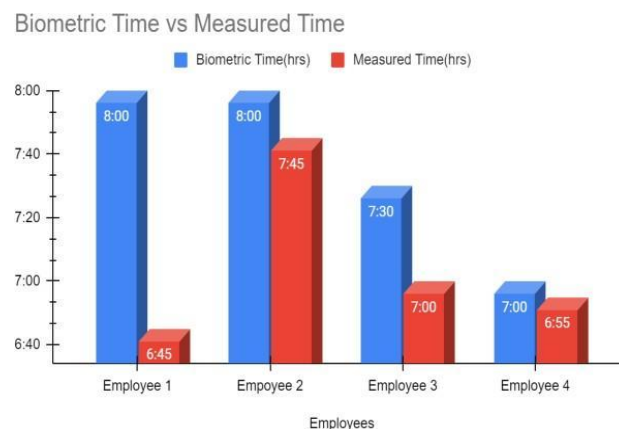


MODULE IMPLEMENTATION

	Biometric Time			Our Measured Time		Efficiency
	In Time	Out Time	Effective Working Hrs	Sec	Hrs:mins	
Employee 1	09:05	17:35	08:00	24300	06:45	84.4
Employee 2	09:15	17:45	08:00	27900	07:45	96.9
Employee 3	09:10	17:10	07:30	25200	07:00	93.3
Employee 4	10:00	17:30	07:00	24900	06:55	98.8

Table 1. COMPARING BIOMETRIC TIME VS MEASURED TIME

The above table is represented graphically for better understanding, the above values are taken as sample values in order to find the efficient working hours of an employee and to determine the best among them.



The above graph shows us the representation of the time in which each employee has spent in the organization. We are comparing the biometric time versus the time measured by the surveillance camera. We could clearly see that Employee 1 has given his biometric check in and check out which is denoted in blue colour, whereas his presence at his actual workplace is very less compared to his biometric time. Similarly, we have calculated the same for employee 2, employee 3 and employee 4. Finally, we could come up with a conclusion that employee 4 has spent efficient working hours at the organization when compared to other employees. Proceeding

to employee 2, who has also spent some efficient hours at the workplace. We could know that an employee is efficient when he/she matches the biometric working hours with that of the measured working hours through the surveillance camera. So, if an employee marks his presence only in the biometric system but not inside his working region for more than the specified amount of time interval then the employee is considered as not so efficient.

From the above case we could come up with a conclusion that,

EMPLOYEE 4 > EMPLOYEE 2 > EMPLOYEE 3 > EMPLOYEE 1.

The efficiency of employee 4 is greater than compared to the rest of the three employees.

EFFICIENCY CALCULATION

The efficiency of an employee can be calculated by the total time measured in the specific region to the time measured using the biometric system.

$$\text{Efficiency of an Employee (\%)} = \frac{\text{Total Time Measured in the Specified Region} \times 100}{\text{Total Time measured using the Biometric System}}$$

This will give us the efficiency percentage of each employee.

C

5.1 RESULT

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The below output snap shots were taken from the video footage recorded by the surveillance camera installed in a small-scale industry and tested for monitoring its employees and validating with their existing biometric fingerprint system by our code. Firstly, the surveillance camera was automated in order to get the contours of the employees in frame then the time frame of each contours in a specified region is calculated in seconds when the employee is in frame. The desired region is mapped based on their specific requirement and the employees were mapped and detected within that specific region.

1.DETECTING HUMAN AT WORKPLACE

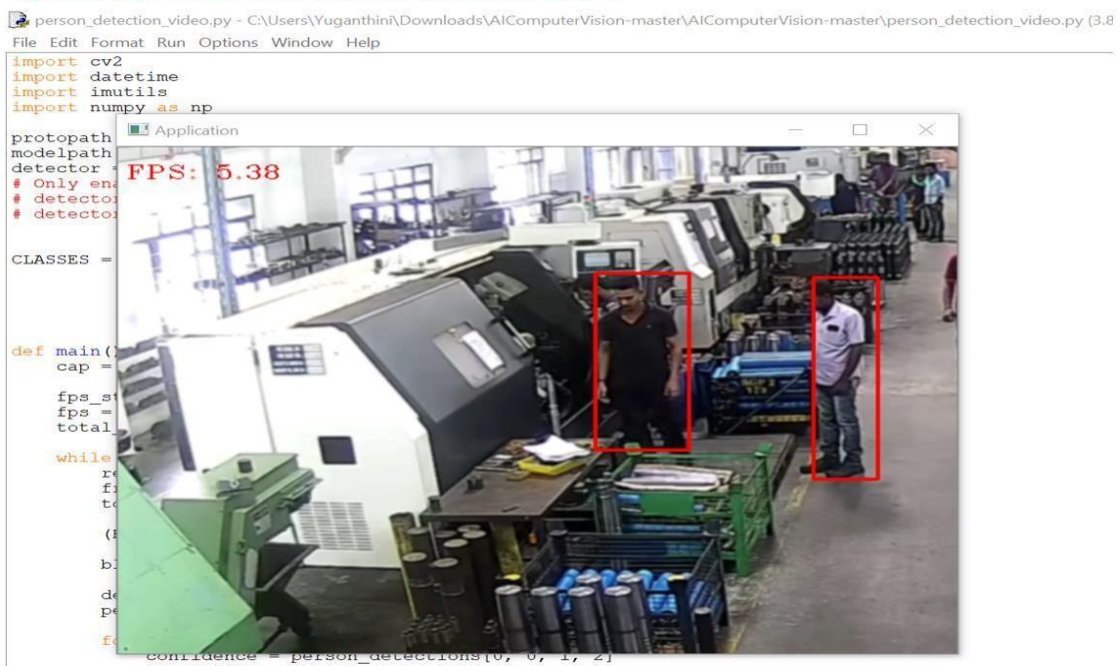


FIG 5.1 DETECTING EMPLOYEE AT WORKPLACE

Similarly, we tried mapping each employee in that company by mapping their employees with their existing CCTV cameras. The main intention behind implementing this method of monitoring were to track the employees in a wider work space where number of supervisors were need to monitor each one of them. Many will roam around the cafeteria and other non-work-related areas by punching their biometric. As intent to reduce the effort on supervisors this method of monitoring is

developed and implemented.

2.DETECTING HUMAN AND MEASURING HIS WORKTIME PRESENCE

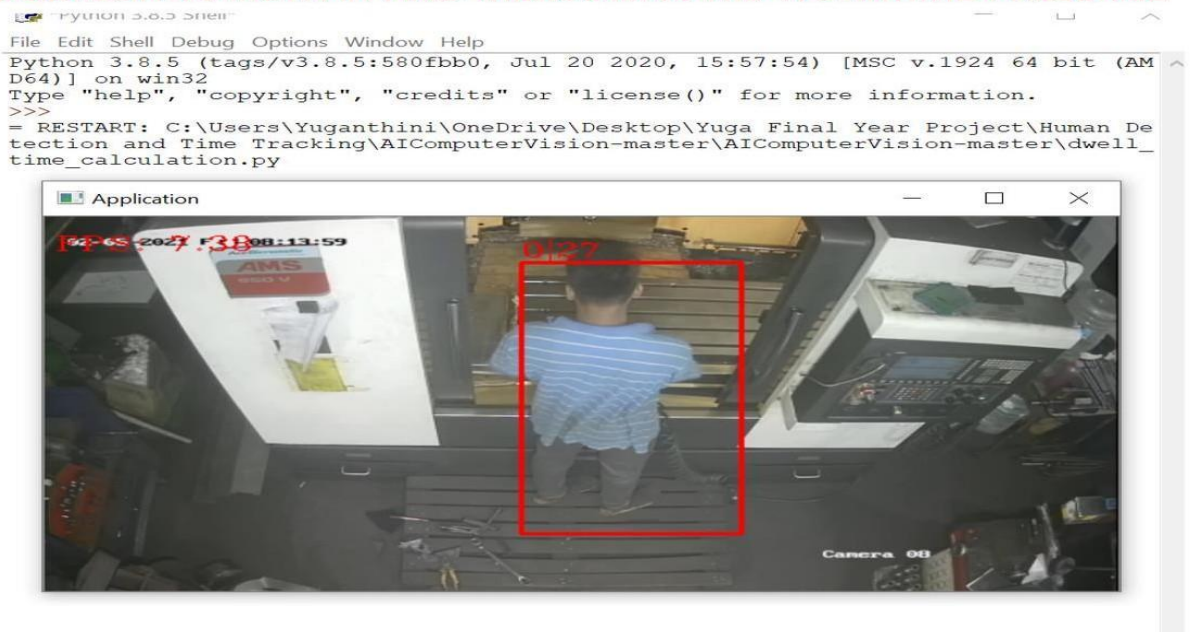


FIG 5.2 DETECTING EMPLOYEE AT AN INDUSTRIAL WORKING ENVIRONMENT

3.DETECTING HUMAN AND MEASURING HIS WORKTIME PRESENCE AT A PARTICULAR REGION



FIG 5.3 TIME TRACKING EMPLOYEE AT SPECIFIED REGION

CHAPTER 6

CONCLUSION AND FUTURE WORK

CONCLUSION

Human resource management is an essential part in every organization. This project would provide a solution for the problem faced in the real-world industrial working environment to supervise and monitor work efficiency of the employee. We focus on detecting the worker within the certain defined region and extract the time he/she has spent in that certain region and compare it with the existing biometric attendance system and calculate the actual effective working hours of the employee. The existing works which are mentioned below in the reference section deals about human detection, counting heads, attendance monitoring like face detection, finger prints, etc., The existing works doesn't support something where the employee are detected in a particular working region with the help of surveillance camera and calculates the efficient time spent by the employee with respect to the check in and check out time as recorded in the biometric system. So, this provides validation for the existing system and it is also used to monitor activities.

LIMITATIONS AND FUTURE WORK

The proposed work falls short when it must focus many people in a single frame as it becomes difficult to monitor the activity and calculate the timings. So, it requires surveillance camera which focuses certain specific region where it isn't crowded.

This project can be further developed and used in different applications. This project focuses on monitoring and efficiency calculation of an employee at workplace. It can further be used in security alarming systems which could track unauthorized activities at certain restricted areas.

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APPENDIX

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Technical comments

Decision: Revision

Title: Activity Tracking of Employees in Industries using Computer Vision

Review comments – 1

1. Activity tracking of employees in industries using computer vision is the proposed title.
2. Concept is good. However, novelty should be strongly emphasized by authors. Similar works exist in literature.
3. Figure IV comparing biometric time versus measured time should be revised. Section 4 related works should be improved with more elaboration and illustrations.
4. Schematics should be clearly projected on a plain background to give more clarity to underlying words
5. Section V should start with explanation and then followed by illustrations.
6. Figures are not captioned. Paper is very poorly organized. Figure 1 is not relevant to the topic proposed.
7. Conclusion should be well written summarizing the merits and limitations of various methods.
8. A note on future works and limitations of proposed work should be included in discussion.
9. Authors to revise based on comments provided.
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Yours' Sincerely

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B. PLAGIARISM REPORT

Analysis Result

Page 1 of 6

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Abstract

Human resource management is integral to every organization. Its employees are managed based on various aspects such as time management and efficiency monitoring which never goes out of scope at every level in an organization. Many strategies and methods have been proposed and used by the human resource department as a routine to monitor employees to effectively utilize the employees's man-hours and promptly train those who lack certain efficient working skills. This paper discusses effective monitoring of employees in the workplaces through computer vision.

C. JOURNAL PAPER

Activity Tracking of Employees in Industries using Computer Vision

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Abstract—Human resource management is integral to every organization. Its employees are managed based on various aspects such as time management and efficiency monitoring which never goes out of scope at every level in an organization. Many strategies and methods have been proposed and used by the human resource department as a routine to monitor employees to effectively utilize the employee's man-hours and properly train those who lack certain efficient working skills. This paper discusses effective monitoring of employees in the workplace through computer vision technology using CCTV cameras in an organization. The employees are detected within their work region and the effective time spent within are mapped against their efficiency of work completed within the stipulated time. In this proposed method, the effective working hours of an employee are consolidated where the cost of implementation is much simpler than existing strategies and methods used in employee monitoring.

Keywords—Computer Vision; OpenCV; Human detection; Employee monitoring; Efficiency tracking; Human Resource Management

I. INTRODUCTION

A. Computer Vision

It's a field of artificial intelligence where the computers are trained to decode and apprehend the visual world. Digital images and Videos from Surveillance cameras are used with Convolutional Neural Network models that facilitate the machines and they can precisely identify and distinguish objects. Computer vision plays a vital role in the problems it could

solve by enabling the interaction between the digital world and the physical world. Computer vision facilitates various applications such as object detection, human tracking, image processing, video processing, colour detection, autonomous vehicles.

B. Human Detection

Human detection is an application of computer vision which widely monitors the human activities movements and positions in a frame and executes a set of responses based on desired condition [3]. The widely used human detection is the human motion detection in highly restricted areas [2]. Slowly the Human detection technology is replacing the security professionals sitting in front of several surveillance monitors to suspect any suspicious activities [14].

In the attendance system the human detection and tracking technology is majorly used in head counting, crowd management in commercial spaces [16], emergency evacuations, face detections, crowd classification, etc.

C. Attendance Systems

Attendance is a mandatory factor that plays an important role in any field of work. This ensures the organization's discipline and smooth functioning. Its sole purpose is to maintain the track of entry and exit time of employees at an organization. There are several methods to time-track employees at an organization.

II. EXISTING ATTENDANCE SYSTEM

A. Biometric Attendance system

Biometric attendance system is used to scan the fingerprint of an employee into a device which in turn stores it into a database as unique Id. [17],[18] So, the next time the employee places his finger to scan, it recognises the fingerprint that is stored in the database and confirms their presence with the in-clock time. The same happens while they exit out.

B. *Facial Recognition attendance system*

Facial recognition involves capturing features of a human face to identify them and classify to mark their attendance. Facial recognition system uses image processing as its backbone to classify and abstract features of images as well as live camera inputs. [13] discusses the recognition and detection eye and contours in a human's face. It compares the skin tone to extract and match with the existing database.[8] states about the effective recognition which is then stored with the time stamp in an excel sheet for further processing of attendance.

C. *GPS based attendance system*

GPS attendance system is a mobile based application which helps in managing employees' attendance with their check in and check out time along with their location data. The location data is acquired with every check in and check out and it then gets validated with the list of allowed locations to be clocked in [20]. It is used mainly for remote workforce and comes handy with their hand-held devices and the cost of implementation is lesser when compared to biometrics which in turn requires certain sophisticated hardware and systems to implement it.

D. *RFID based attendance system*

Radio Frequency Identification is a attendance system which works on proximity based passive radio frequency identification which could be made as a ID card to simply monitor the check in and check out. It is also used in replacement to those long tiring processes of attendances in schools and colleges [19]. This attendance system is much like the biometric system, just the recognition is much faster compared to the traditional fingerprint systems.

E. *Comparing existing system with our system* Our method focuses on the key factor of human detection within a work region with existing surveillance cameras to monitor the time spent within the region from his total work time in the office. Our method acts as an add on to the existing attendance system to facilitate the precise efficiency of the worker in a workplace against the work output throughout that day. It is also used to validate the existing attendance system as they check only the check in and check out time [17],[18].

In this paper we provide a validation for the existing system as well as provide the total efficient working hours of an employee. We use this with the existing biometric system to avoid proxy attendance [8] and to facilitate within workplace monitoring of employees. By our method we get the benefit of the location tracking from a GPS based system as well as the biometric system. We in turn calculate the work efficiency and ideal time spent by each employee in a workplace.

III. RELATED WORKS

Jianpeng Zhou, Jack Hoang [4] has developed Real-Time Robust Human Detection and Tracking System by this method and they tried to detect and track them and it involves false object Identification. Many approaches have failed because it fails to distinguish between human motion with other movements like trees, vehicles on the road and some shadow motions so they overcome these defects with the process of false object detection by using the colour histogram. Colour histogram mainly focuses on the various types of colour on the input may be an image or a frame from a video instead of the spatial location of the colours and the foreground and background distribution are in a different distribution. This task is performed by calculating pixel count for every 256 scales with some colour spaces like RGB or HSV. It also performs colour quantization in which the images are divided into small intervals which are called a bin in case of large images by keeping this as a prerequisites steps for classification and to track the individual they have used the method which is purely dependent on colour irrespective of its shape and appearance and it fails to distinguish a two different object with same structure for (e.g.) It unable to differentiate white and red cap and its high noise interference sensitive these are two drawbacks of colour histogram methodology.

Pedro Simao, Jose Fonseca, Vasco Santos [10] has introduced a new solution for an attendance management system which is high time-consuming but a necessary process in almost every organization.

Equal priority should be given in terms of security. They have used the wireless Zigbee Technique which is most popular in security than others. It is a protocol with low-cost, low-power, wireless

mesh characteristics, it includes many cyber models like cryptographic keys, ciphering frames to provide better security. They can be implemented in various types such as Zigbee coordinator, Zigbee router, Zigbee end device over network and application protocols layer successfully. This technology is provided with C, C++ simulation by which user can perform modification and make the system more effective the biometrics along with fingerprint detection was used. This system is designed in such a way that it automatically records the attendance based on fingerprint matching. This is achieved using Zigbee technology which requires high maintenance and low network stability.

Changyan Li, Lijun Guo, Yichen Hu [2] have introduced a new method to monitor the individuals and to track them in a video with a methodology called Kalman filter. This filter integrated with a dynamic model which can act as a control system to the systems and it can also provide the measurement in multiple sequential ways. It was more popular because of its efficient recursive attribute. The estimation of systems internal state can be done very accurately, sometimes it can be worked with the combination of a linear belief function and belief filter to state the equation by using evidential updates. The observation and process model is referred to as a complex system categorize as a non-linear filter to work with those non-linear systems we can use either extended or unscented Kalman filter. This technique was used to improve human detection accuracy and to reduce the search time they implemented their research as a two- modules first they tried to get the human features from the depiction. Second, the Kalman filter plays a role to predict human movement in the next frame. Although the technique was efficient it fails to detect multiple humans in a video.

Swapnil V. Tathe, Sandipan P. Narote [4] has proposed the system to find the movement of human detection and their activities by extracting the biometric feature from an image like face and eyes. Face detection is done using a Skin color-based method especially they used the YCbCr color model and the Projection Function method was also used to

detect the eye region and also non-parametric feature space analysis technique which is called as Mean shift algorithm using this method the maximum density function can be located it has many applications among those in tracking it plays a vital role using this method confidence map can be drawn in a new image by assigning a probability on each pixel of the new image which is the probability of the pixel color occurring of the previous image objects. This algorithm is preferred as it is an independent tool and it does not rely on predefined shapes on data clusters. it can and the Kalman filter is used to improve efficiency. Although it has many advantages it was not preferable due to the lack of robustness.

Yuqing Chen, Yang Xue [15] has designed a system through which we can find the activity of an individual like jumping, walking quickly, walking upstairs and, apart from just pointing the presence of an individual using a single accelerometer they tried to overcome the drawback of FFT which is a DFT signal used for the computation of the Discrete Fourier Transform of sequences different frequency component DFT signals are generated with the distribution of value and DCT coefficient method is used to compress the image by reducing the pixel value this method provides us a high compression without loss of data which can be transmitted over the networking which extraction can be performed only in the same axis rather than the different axis but this system was restricted with a limited number of activities as it can detect only a few ventures.

NazareKancahn Jayant, Surekha Borra [8] has developed an Attendance Management system that uses Hybrid Face Recognition Techniques In this system camera was used to monitor attendance. In this method, the image which was captured at present is compared with the image which is stored in the Database. If a match occurs then the student will be marked as present else he/she will be considered absent. The Object detection Viola-Jones algorithm was

used which is the most popular framework. It is mostly used to detect a particular object in a frame. It proceeds with four different stages such as Haar Feature selection, creating an integral image, Adaboost Training, cascading

classifiers. It can also work with the KLT algorithm to detect an object in a video when they are in movement along with the salient features. It also indicates the motion by drawing bounding boxes. It has high demand because of its Robust, impressive speed property. which is highly luminous sensitive was used, so it fails in some cases where it needs to detect faces in various lighting conditions.

NarraDhanalakshmi, Saketi Goutham Kumar [9] has introduced a different Attendance management system and new concept by including various technology like Fingerprint, Aadhaar Based Biometric observation. This system has introduced an alternate way in case of failure where first they tried to record an attendance based on fingerprint but it fails to recognize, then they tried to extract the biometric feature such as fingerprint from the Aadhaar number which is unique and includes all the details of a person. It was not reliable and we have to get proper permission and details from UIDAI for using CIDR which is not practical for all the organization.

Vis`12akha K, Sidharth S Prakash [14] has developed a technique to monitor the sensitive area by detecting and tracking the movement and activity of an individual by using one of the most trending technologies Computer vision which includes many useful concepts and methodology to bring a great revolution in image advancing field. By this method, it reduces the manual effort which needs to be put into securing or monitoring a particular region using Haar Classifier is used to focus on a specific position in a detected window and pixel intensities can be calculated in every region based on the computed value it categorizes the subsections of an image it always works with cascade classifier to become more effective. It is highly preferable because of its computational speed irrespective of the size of an image it will take constant time for all sizes of the computationally expensive frame.

Dima MaharikaDinama, QurrotaA'Yun [3] has designed an application to detect and to track the motion from surveillance using recognition and classification procedure to detect an

object in a video Footage or live which is possible using one of the most neural networks Convolutional neural Networks. They are made up with learnable weights and biases neurons by passing through an activation function. In this approach, the image to pass through a convolution layer which is the topmost layer in neural networks then it moves along the source image known as a filter. This filtering task is used to accumulate the original pixel value this network is mixed with a nonlinear and pooling layer by using this method they detect a human in a video and track them by drawing rectangular contour over them to improve efficiency. It uses some filters like spatial correlation to remove blur, background noise and to move a filter over the image.

Karthikeyan B, Kabilan M [5] has developed the technique which uses laser point to perform human detection and tracking efficiently even when there are many traditional methods to detect and effectively track the human, it fails to give the accurate result when they are out of focus. To overcome this drawback, they introduced the Raspberry Pi technique through a laser which can be used as an indicator in the camera through which it can rotate itself to 360° so that it can cover the entire focus of an individual but it is not compatible with all the environment.

IV. INFERENCE FROM THE LITERATURE

We have come across many methods which are reducing manual effort by making the process automatic like automatic attendance management, library management, speech recognition, capturing gesture, tracking activities and so on. Through this project we try to do something unique way of monitoring and to improve the efficiency of existing methods. There is a technology to automate and validate the attendance system in the existing methods they have used highly reliable and low power consuming method like Zigbee wireless technology to record attendance using fingerprint and Viola-Jones object detection framework, biometric technologies which are known for

its high security, convenience, uniqueness,
and assurance characteristics but it is not

preferable to use because of its cost, bias, and inaccuracy. Detection and activities of humans are tracked by utilizing various algorithms like Kalman, Mean shift algorithm, Colour histogram method, Hog, Haar classifier. Where the Kalman filter is used to predict the future scenario in an image or video frame. It was included in many projects as it has the capacity to produce accurate results with low memory consumption and has high computing speed. Hog is mainly used for its easy and accurate way of extraction of features from image or video. Mean shift algorithm provides a solution for other machine learning algorithms like K-means, Gaussian mixture; it does not rely on assumption; it is not necessary to make any assumption model. Haar cascade classifiers are unique for their high-speed computational power. Although many methods have been introduced efficiently the attendance system checks the presence of an individual in a specific area. In this paper we provide a validation for the existing system as well as provide the total efficient working hours of an employee. We use this with the existing biometric system to avoid proxy attendance [8] and to facilitate within workplace monitoring of employees. By our method we get the benefit of the location tracking from a GPS based system as well as the biometric system. We in turn calculate the work efficiency and ideal time spent by each employee in a workplace.

V. PROPOSED METHOD

Any process that involves processing of images should come across a feature descriptor in order to identify the type of object in the given frame and extract the necessary features from it. There are several feature extraction algorithms

- HOG: Histogram of Oriented Gradients
- SIFT: Scale Invariant Feature Transform
- SURF: Speeded-Up Robust Feature

In which HOG algorithm is the most utilized and it is highly reliable for detecting humans in a precise manner.

HOG - Histogram of Oriented Gradients. This algorithm mainly extracts the structure and features of an object [2]. It is also used to detect the edges and definitions using its

gradient and orientation abstraction.

Caffe model is a convolutional architecture for fast feature embedding used for detecting the objects and person in a frame with more accuracy at a rate of 92% and it is much faster compared to other CNN models for feature detection.

The person detection is carried out by existing algorithms which were used widely in the field of human detection and tracking such as HOG with Kalman filter, Caffe model, CNN, RCNN and certain other deep learning methodologies.

In this paper, all static surveillance camera feeds will be acquired from a workplace and the desired work regions of every employee will be plotted within the feed. While the employee enters the office premises which is confirmed by the biometrics at the entry the feed starts to monitor the specified region for the detection of the person.

In our method, the person in our field of view is detected using both the above algorithm and a rectangular contour is mapped inscribing the person in it. The centroid of the rectangular contour is mapped as points by the centroid tracker which finds the centroid of any given dynamic moving contour within a frame precisely and yields a value as a coordinate. Our pre-mapped specific work regions will then be plotted against it to identify whether the centroid of the contour is lying within the specified mapped work region.

Once our condition satisfies the timer counts the time spent by the specific person inside a specific work region. Whenever the person leaves the specific mapped region, the timer holds and resumes after the person enters the region again. The cumulative time of the person spending inside and outside the region is summed up. This total time spent within the region is then compared with the biometric time which is the clock in time to the clock out time by excluding other constrained leisure hours allotted to each of the employees. From this we could arrive at the total efficient working hours of an employee by the ratio of the total time spent within the region to the total biometric time of the employee on that day.

VI. WORKFLOW

The footage from the surveillance camera is processed frame by frame and specific regions are discretized and the employees are detected in those regions and the total

time spent by an employee when he or she is inside the region is calculated by the in-frame time. The below given workflow represents the stepwise process.

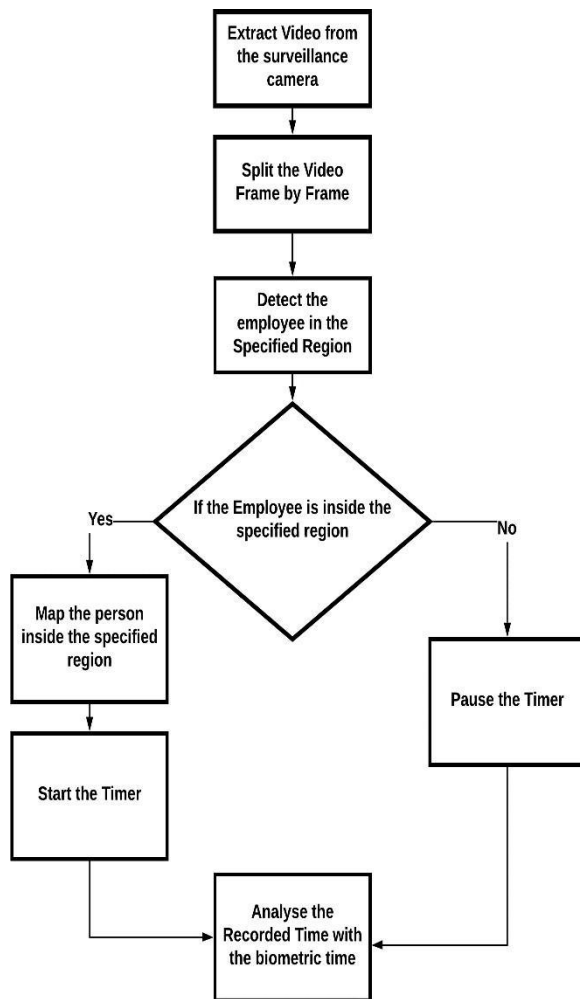


Figure 1. Workflow

VII. COMPARING BIOMETRIC TIME VS MEASURED TIME

Employees	Biometric Time			Our Measured Time		Efficiency %
	In Time	Out Time	Effective Working Hrs	Secs	Hrs: mins	
1	09:05	17:35	08:00	24300	06:45	84
2	09:15	17:45	08:00	27900	07:45	97
3	09:10	17:10	07:30	25200	07:00	93
4	10:00	17:30	07:00	24900	06:55	98

Figure 2. Graphical Representation of Biometric time Vs Measured time

The above graph shows us the representation of the time in which each employee has spent in the organization. We are comparing the biometric time versus the time measured by the surveillance camera. We could clearly see that Employee 1 has given his biometric check in and check out which is denoted in blue color, whereas his presence at his actual workplace is very less compared to his biometric time. Similarly, we have calculated the same for employee 2, employee 3 and employee 4. Finally, we could come up with a conclusion that employee 4 has spent efficient working hours at the organization when compared to other employees. Proceeding to employee 2, who has also spent some efficient hours at the workplace. We could know that an employee is efficient when he/she matches the biometric working hours with that of the measured working hours through the surveillance camera. So, if an employee marks his presence only in the biometric system but not inside his working region for more than the specified amount of time interval then the employee is considered as not so efficient.

From the above case we could come up with a conclusion that, EMPLOYEE 4 > EMPLOYEE 2 > EMPLOYEE 3 > EMPLOYEE 1.

The efficiency of employee 4 is greater than compared to the rest of the three employees.

VIII. EFFICIENCY CALCULATION

The efficiency of an employee can be calculated by the total time measured in the specific region to the time measured using the biometric system.

Efficiency of an Employee (%) =

$$\frac{\text{Total Time Measured in the Specified Region} \times 100}{\text{Total Time measured using the Biometric System}}$$

This will give us the efficiency percentage of each employee.

IX. EXPERIMENTAL OUTPUT

The below output snap shots were taken from the video footage recorded by the surveillance camera installed in a small-scale industry and tested for monitoring its employees and validating with their existing biometric fingerprint system by our code. Firstly, the surveillance camera was automated in order to get the contours of the employees in frame then the time frame of each contours in a specified region is calculated in seconds when the employee is in frame. The desired region is mapped based on their specific requirement and the employees were mapped and detected within that specific region.



Figure 3. *Detecting employee at workplace*

Similarly, we tried mapping each employee in that company by mapping their employees with their existing CCTV cameras. The main intention behind implementing this method of monitoring were to track the employees in a wider work space where number of supervisors were need to monitor each one of them. Many will roam around the cafeteria and other non-work-related areas by punching their biometric. As intent to reduce the effort on supervisors this method of monitoring is developed and implemented.

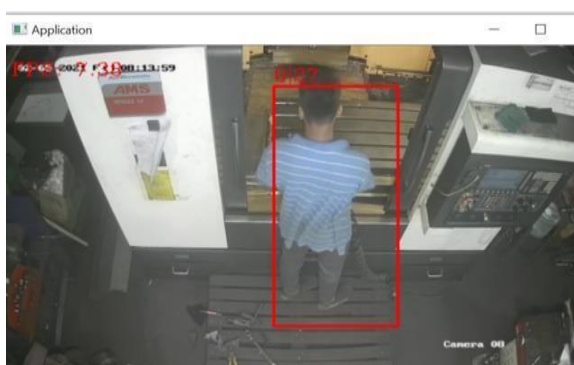


Figure 4. *Detecting employee at an industrial working environment*



Figure 5. *Time tracking employee at specified region*

X. CONCLUSION

Human resource management is an essential part in every organization. This project would provide a solution for the problem faced in the real-world industrial working environment to supervise and monitor work efficiency of the employee. We focus on detecting the worker within the certain defined region and extract the time he/she has spent in that certain region and compare it with the existing biometric attendance system and calculate the actual effective working hours of the employee. The existing works which are mentioned below in the reference section deals about human detection, counting heads, attendance monitoring like face detection, finger prints, etc., The existing works doesn't support something where the employee are detected in a particular working region with the help of surveillance camera and calculates the efficient time spent by the employee with respect to the check in and check out time as recorded in the biometric system. So, this provides validation for the existing system and it is also used to monitor activities.

XI. LIMITATIONS AND FUTURE SCOPE

The proposed work falls short when it must focus many people in a single frame as it becomes difficult to monitor the activity and calculate the timings. So, it requires surveillance camera which focuses certain specific region where it isn't crowded.

This project can be further developed and used in different applications. This project focuses on monitoring and efficiency calculation of an employee at workplace. It can further be used in security alarming systems which could track unauthorized

activities at

certain restricted areas.

XII. REFERENCES

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D.SOURCE CODE

```
import cv2
import datetime
import imutils
import numpy as np
import time

from centroidtracker import CentroidTracker

protopath = "MobileNetSSD_deploy.prototxt"
modelpath = "MobileNetSSD_deploy.caffemodel"
detector = cv2.dnn.readNetFromCaffe(prototxt=protopath,
caffeModel=modelpath)

# Only enable it if you are using OpenVino environment
#detector.setPreferableBackend(cv2.dnn.DNN_BACKEND_INFERENCE_ENGINE)

# detector.setPreferableTarget(cv2.dnn.DNN_TARGET_CPU)

CLASSES = ["background", "aeroplane", "bicycle", "bird", "boat",
            "bottle", "bus", "car", "cat", "chair", "cow", "diningtable", "dog",
            "horse", "motorbike", "person"]

tracker = CentroidTracker(maxDisappeared=80, maxDistance=90)

def non_max_suppression_fast(boxes, overlapThresh):
    try:
        if len(boxes) == 0:
            return []

        if boxes.dtype.kind == "i": boxes
            = boxes.astype("float")
```

pick = []

```

x1 = boxes[:, 0]
y1 = boxes[:, 1]
x2 = boxes[:, 2]
y2 = boxes[:, 3]

area = (x2 - x1 + 1) * (y2 - y1 + 1)
idxs = np.argsort(y2)

while len(idxs) > 0:
    last = len(idxs) - 1
    i = idxs[last]
    pick.append(i)

    xx1 = np.maximum(x1[i], x1[idxs[:last]])
    yy1 = np.maximum(y1[i], y1[idxs[:last]])
    xx2 = np.minimum(x2[i], x2[idxs[:last]])
    yy2 = np.minimum(y2[i], y2[idxs[:last]])

    w = np.maximum(0, xx2 - xx1 + 1)
    h = np.maximum(0, yy2 - yy1 + 1)

    overlap = (w * h) / area[idxs[:last]]

    idxs = np.delete(idxs, np.concatenate(([last],
                                           np.where(overlap > overlapThresh)[0])))

return boxes[pick].astype("int")
except Exception as e:
    print("Exception occurred in non_max_suppression : {}".format(e))
def main():
    cap = cv2.VideoCapture('CNC2.mp4')
    fps_start_time = datetime.datetime.now()

```

fps = 0

```

total_frames = 0
object_id_list = []
#dtime = dict()
#dwell_time = dict()
dw = 1

while True:
    ret, frame = cap.read()
    frame = imutils.resize(frame, width=1000)
    total_frames = total_frames + 1

    cv2.rectangle(frame, (350,35), (750,550), (0,0,255), 3)
    cv2.line(frame, (550,35), (550,550), (0,0,255), 1)
    cv2.line(frame, (350,310), (750,310), (0,0,255), 1)
    cv2.putText(frame, 'Detection Region', (350,20),
cv2.FONT_HERSHEY_SIMPLEX, (0.5, (255,255,255)), 1, cv2.LINE_AA))

    (H, W) = frame.shape[:2]

    blob = cv2.dnn.blobFromImage(frame, 0.007843, (W, H), 127.5)

    detector.setInput(blob)
    person_detections = detector.forward()
    rects = []
    for i in np.arange(0, person_detections.shape[2]):
        confidence = person_detections[0, 0, i, 2]
        if confidence > 0.5:
            idx = int(person_detections[0, 0, i, 1])

            if CLASSES[idx] != "person":
                continue

```

```
person_box = person_detections[0, 0, i, 3:7] * np.array([W, H, W, H])
```

```

(startX, startY, endX, endY) = person_box.astype("int")
rects.append(person_box)

boundingboxes = np.array(rects)
boundingboxes = boundingboxes.astype(int)
rects = non_max_suppression_fast(boundingboxes, 0.3)

objects = tracker.update(rects)
for (objectId, bbox) in objects.items():
    x1, y1, x2, y2 = bbox
    x1 = int(x1)
    y1 = int(y1)
    x2 = int(x2)
    y2 = int(y2)
    xmid = int(x1+((x2-x1)/2))
    ymid = int(y1+((y2-y1)/2))
    xm = xmid
    ym = ymid

    if dw == 1:
        dtime = datetime.datetime.now()
        dwell_time = 0
        dw = 0
        calculated_time = 1

    if ((xmid < 750) & (xmid > 350)): if
        ((ymid < 550) & (ymid > 35)):
            #curr_time = datetime.datetime.now() #old_time
            = dtime
            #time_diff = curr_time - old_time
            #dtime = datetime.datetime.now()
            #sec = time_diff.total_seconds()

```

```
#dwell_time += sec
```

```
time.sleep(0.9)
dwell_time += 1
```

```
calculated_time += dwell_time
dwell_time = 0
```

```
cv2.rectangle(frame, (x1, y1), (x2, y2), (0, 255, 0), 2)
text = "{}|{}".format("Measured Time", int(calculated_time))
cv2.putText(frame, text, (525, 20)
cv2.FONT_HERSHEY_COMPLEX_SMALL, 1, (0, 0, 255), 1)
#cv2.line(frame, (x1,y2), (xmid,ymid), (0,0,255), 1)
cv2.circle(frame, (xm,ym), 2, (0,255,0), 3)
```

```
fps_end_time = datetime.datetime.now()
time_diff = fps_end_time - fps_start_time
if time_diff.seconds == 0:
    fps = 0.0
else:
    fps = (total_frames / time_diff.seconds)
```

```
fps_text = "FPS: {:.2f}".format(fps)
```

```
cv2.putText(frame, fps_text, (5, 30),
cv2.FONT_HERSHEY_COMPLEX_SMALL, 1, (0, 0, 255), 1)
```

```
cv2.imshow("Application", frame)
key = cv2.waitKey(1)
if key == ord('q'):
    break
cv2.destroyAllWindows()
```