International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-3, September 2019

Embedded Video Surveillance Based Moving Object Detection and Tracking

Dhaya Chinnathambi, Poonkavithai Kalamegam

Abstract: ***Background reckoning and the foreground, play prominent roles in the tasks of visual detection and tracking of objects. Moving Object Detection has been widely used in sundry discipline such as intelligent systems, security systems, video monitoring systems, banking places, provisionary systems, and so on. In this paper proposes moving objects detection and tracking method based on Embedded Video Surveillance. The method is based on using lines computed by a gradient-based optical flow and an edge detector gradient-based optical flow and edges are well matched for accurate computation of velocity, not much attention is paid to creating systems for tracking objects using this feature. The proposed method is compared with a recent work, proving its superior performance and when we want to represent high quality videos and images with, lower bit rate, and also suitable for real-world live video applications. This method reduces influences of foreground objects to the background model. The simulation results show that the background image can be obtained precisely and the moving objects recognition is achieved effectively.***

Keywords: ***Object Detection and Tracking, EVS, Edge Localization, Embedded Software***

I. INTRODUCTION

Moving object detection in real time is a hardening task in visual surveillance systems. It often acts an initial step for further processing such as classification of the detected moving object. In order to perform more refined operations such as categorization, we need to first develop an efficient and accurate method for detecting moving objects. A typical moving object detection method has the following features: evaluation of the stationary part of the observed scene (background) and obtaining its statistical character tics, obtaining difference images of frames taken at different times and different images of the sequence with the image of the stationary part of the scene, favoritism of regions belonging to objects, recognition of these objects, determining the trajectory of motion of these objects, and their classification, alteration of the stationary part of the background for changing detection conditions and for changing the content of the scene, registration of situations and obligatory messages. One of the simplest and popular method for moving object detection is a background calculation method which often uses background modeling, but it takes long time to detect moving objects. Temporal difference method is very simple and it can detect objects in real time, but it does not provide robustness against elucidation change.

Real-time Moving object detection is important to many vision applications such as visual surveillance, intelligent behavior recognition [10], and motion tracking. These applications affirm heavily on the accuracy of moving object detection. However, they have several drawbacks that complicate the tracking stage [8]. The processing of a video stream for characterizing events of interest relies on the detection, in each frame, of the objects involved, and the temporal assimilation of this frame based information to model simple and complex behaviors. This high level depiction of a video stream relies on an accurate detection and tracking of the moving objects, and on the relationship of their trajectory of the scene.

Moving object detection is the basic step for further analysis of video. It handles segmentation of moving objects from stationary background objects. This not only creates a focus of attention for higher level processing but also decreases computation time noticeably. Commonly used techniques for object detection are background calculation, statistical models, temporal differencing and optical flow. Due to dynamic environmental conditions such as enlightenment changes, shadows and waving tree branches in the wind object segmentation [10] is a difficult and major problem that needs to be handled well for an embedded video surveillance system.

major problem that needs to be handled well for an embedded video surveillance system.

II. RELATED WORK

A. *Background Modeling-Edge Detection Method*

Edge detection is defined as to eradicate the unwanted information's and to save the memory space. It is the first step to recover information from images. Edges are the momentous local changes of intensity in an image. Edges classically occur on the boundary between two different regions in an image [1]. Edge also can be defined as discontinuities in image passion from one pixel to another. A typical edge detector has the following steps: it restrains noise as much as possible, without annihilating the true edges,

Manuscript published on 30 September 2019
* Correspondence Author
Dhaya Chinnathambi*, Professor, Department of Computer Science and Engineering, Adhiparasakthi Engineering College, Melmaruvathur
Poonkavithai Kalamegam, Associate Professor, Department of Computer Science and Engineering , Hindustan University of Science and Technology, Chennai

it applies a filter to enhance the quality of the edges in the image, it determines which should edge be preserved,

it determines the exact location of an edge. An optimal edge detector should satisfy the ensuing criteria: the most favorable detector must minimize the probability of false positives as well as that of false negatives for missing real edges, the edges detected must be as close as possible to the true edges, the detector must return one point only for each true edge point, that is, it minimizes the number of local maxima around the true edges created by noise.

Edges distinguish boundaries and are therefore a problem of fundamental consequence in image processing. Image Edge detection drastically reduces the amount of data and filters out useless information [2], while conserving the important structural properties in an image. Since edge detection is in the vanguard of image processing for object detection, it is crucial to have a good understanding of edge detection algorithms. Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of objects in a scene. There are an extremely large number of edge detection operators available, each designed to be sensitive to certain types of edges. For mainly four edge detection methods available there is Sobel operator, canny operator, Prewitt's operator, Robert's cross operator. In this paper we proposed edge detection method as canny edge detecting operator. Because this is very avow on digital videos in real-time systems. Basically, edge detection involving four important steps: Smoothing, suppress as much noise as possible, without destroying the true edges [6]. Enhancement, apply a filter to augment the quality of the edges in the image (sharpening).

B. *Prewitt Edge Detector*

A variety of Edge Detectors are offered for detecting the edges in digital images. However, each detector has its own advantages and disadvantages [2]. The basic idea following edge detection is to find places in an image where the intensity changes rapidly. Based on this idea, an edge detector may either be based on the technique of locating the places where the first derivative of the intensity is greater in magnitude than a specified threshold or it may be based on the criterion to find places where the second derivative of the intensity has a zero crossing.

The local edge orientation is anticipated with the direction of the kernel that yields the maximum response. Various kernels can be used for this operation. Two patterns out of the set of 8 are shown in Figure 1:

-1	0	+1
-1	0	+1
-1	0	+1

Gx

-1	0	+1
-1	0	+1
-1	0	+1

Gy

Figure 1: Masks for the Prewitt gradient edge detector

C. Canny Edge Detector

It is the very improved image processing tool to detect edges from original images. It probably has following steps: Gray scale conversion, noise reduction, gradient computation, non maxima inhibition, thresholding and masking. We discuss about one by one in below:

First, in photography and figuring a grayscale digital image is an image in which the value of each pixel is a single sample, it holds only enormity information. Convert any color to a grayscale illustration of its luminance, first one must obtain the values of its red, green, and blue (RGB) primaries in linear intensity encoding, by gamma extension. Images of this sort, also known as black and white, are composed exclusively of shades of gray, varying from black at the weakest passion to white at the strongest. Second, the canny edge detector uses a filter based on the first derivative of a Gaussian, because it is prone to noise exists in raw unprocessed image data [5]. Thus, at first the raw unprocessed image data. Thus, at first the raw image is convolved with a Gaussian filter. The result is a slightly blurred version of the original which is not affected by a single noisy pixel to any momentous degree. Third, an edge in an image may point in a variety of directions, thus the canny algorithm uses four filters to detect horizontal, vertical and diagonal edges in the blurred image. The edge detection operator returns a value for the first derivative in the horizontal direction (Gy) and the Vertical direction (Gx). From this the edge gradient and direction can be dogged by the following equations:

$$G = \sqrt{G^2{}_x + G^2{}_y} \qquad (1)$$

$$\theta = \arctan\left(\frac{G_y}{G_x}\right) \qquad (2)$$

The edge direction angle is smoothed to one of four angles representing vertical, horizontal, and the two diagonals.

Fourth, Non-maxima inhibition (NMI) can be positively formulated as a local maximum search, where a local maximum is greater than all its neighbors and without itself. For a given n, the locality of any pixel consists in the one dimensional case of the n pixels to its left and right side referred to as (2n+1) locality and in the two dimensional case of the quadratic (2n+1) * (2n+1) region centered around the pixel. The same value may appear several times in an image, thus the question arises, which pixel should be concealed in case of a tie. In practice, either all or all but one is concealed according to some ordering.

Fifth, It mainly having two threshold values: first one is high value and another is low value. Believe that important edges are incessant in the image which allows following a section of a given line and to abandon a few noisy pixels that do not represent a line but produced large gradients. Therefore, initially a high threshold value is considered to calculate the genuine edges. Starting from these, the directional information uses, edges can be traced through the image. While tracing an edge, a lower threshold value is applied which allows to trace pale sections of edges. A more refined approach is to create histogram of the image pixel intensities and use the valley point as the threshold. The histogram based thresholding approach considers an average value for the background and object pixels, but the actual pixel values have some deviation around the average values.

Retrieval Number: B2601078219/2019©BEIESP
DOI:10.35940/ijrte.B2601.098319
Journal Website: www.ijrte.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Conversely, this may be computationally expensive, and also image histograms do not have clearly defined valley points, resulting in difficulties to select an accurate threshold value.

Sixth, a given image is anticipated to be placed over a background when the translucent areas can be specified through a binary mask. Thus, for each intended image there are actually two bitmaps: the actual image, in which the unused areas are dispersed a pixel value with all bits set to 0's, an additional mask, in which the corresponding image areas are assigned a pixel value of all bits set to 0's and the surrounding areas are assigned a value of all bits set to 1's. For example, in an image, black pixels have all-zero bits and white pixels have all-one bits. This preserves the background pixels of the transparent areas while resets the bits of the pixels with zeros which will be obscured by the overlapped image. Then, the program renders the image pixel's bits by blending them with the background pixel's bits using the bitwise OR operation. For this method, the image pixels are appropriately placed while keeping the background pixels. The outcome is a perfect compound of the image over the background.

D. *Moving Object Detection and Tracking*

Moving object detection aims at mining moving objects that are of interest in video sequences with backgrounds which can be static or dynamic. Some examples of interesting objects include walking pedestrians and moving vehicles, but usually not waving tree leaves. The moving object detection problem can be devised as a change detection problem whereby regions in a frame that have not changed chronologically are labeled as background regions or background pixels and the changed regions are label as foreground regions. Changes can be detected using various approaches to background subtraction. Further analysis, such as object tracking, is then done on the foreground regions.

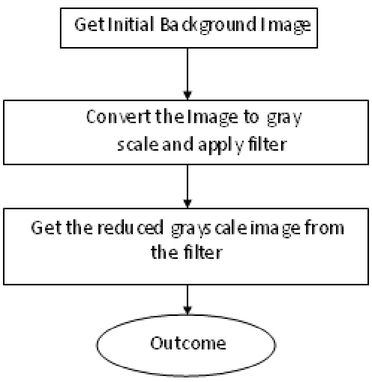

Figure 2: Locating the Primary Background Image

Figure 2 shows the locating primary background image. The harms with dynamic environmental conditions make moving object detection very demanding. Many methods for moving object detection have been proposed in the literature. A popular approach to foreground segmentation is background subtraction which has a very low computational cost. The goal here is to remove the background in a scene by describing an adequate model of the background; the outcome is that only appealing objects are left in the landscape for tracking and further analysis.

The aim of object tracking is to institute an association between objects or object parts in consecutive frames and to extract chronological information about objects such as path, posture, speed and direction. Tracking detected objects frame by frame in video is a momentous and difficult task. It is a crucial part of smart surveillance systems since without object tracking, the system could not mine unified temporal information about objects and higher level behavior analysis steps would not be possible. On the other hand, erroneous moving object segmentation due to shadows, reflectance and occlusions makes tracking a difficult research problem. We used an object level tracking algorithm in our system. That is, we do not track object parts, such as limbs of a human, but we track objects as a whole from frame to frame. The information extracted by this level of tracking is adequate for most of the smart surveillance applications.

III. PROPOSED METHOD

A background representation and low-level detection methods to create a foreground pixel map and extract object features at every video frame. Background models generally have two distinct stages in their process: initialization and update. Following sections describe the initialization and update mechanisms together with foreground region detection methods used in the three background models we tested in our system. And more, the remainders have become isolated points. A morphological operation is applied to remove the sprinkled error points and connect the foreground points. The remaining regions are extracted with small ones removed.

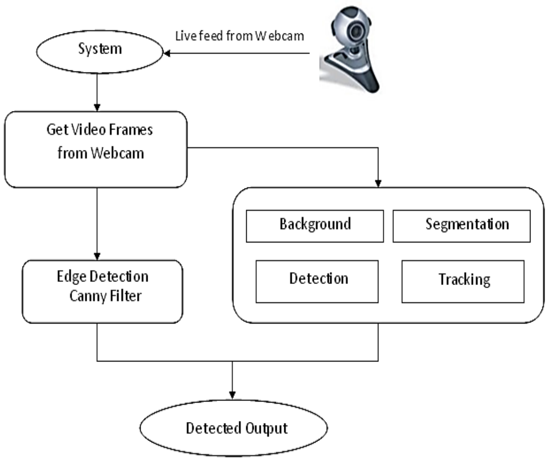

Figure 3: The Basic Block Diagram of MOD and Tracking

The segmented foreground objects form a binary output image. Segmentation of objects of interest from an image sequence is a primary and critical task in most intelligent surveillance applications such as object identification, tracking and analysis. Typical approach for segmentation of foreground objects from image sequences employ the idea of comparing each frame against a model of the background, followed by selecting the outliers. Figure 3 shows the block diagram of MOD and tracking.

Retrieval Number: B2601078219/2019©BEIESP
DOI:10.35940/ijrte.B2601.098319
Journal Website: www.ijrte.org

Published By:
Blue Eyes Intelligence Engineering & Sciences Publication

In general, the pixels are selected in one of two ways: pixel by pixel, where an independent decision is made for each pixel, possibly taking into account information from neighboring pixels, and region-based selection, where a decision is made on an entire group of spatially close pixels. For updated background model to obtain enclosing rectangle r(i,j,n) = 1, the remaining part is taken as moving objects by ignoring rectangle of space smaller as noise [7]. The figure 4 shows the proposed block diagram of MOD.

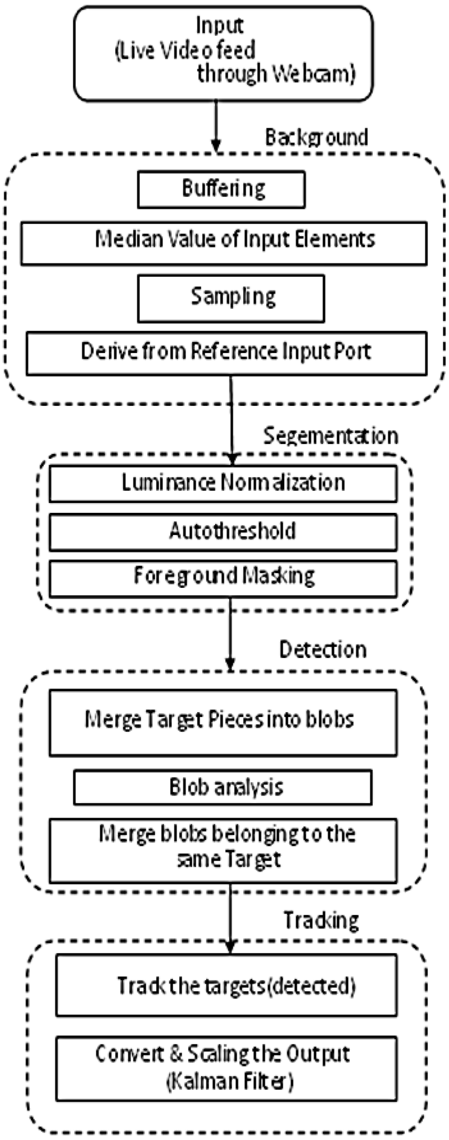

Figure 4: The Proposed Block Diagram of MOD Kalman Filtering

A Kalman Filter (KF) is applied to deduce the state of a linear system where the state is unsaid to be Gaussian distributed. This filter not only provides an efficient computational solution to sequential systems but also provides an optimal solution for the discrete data for linear filtering problem. On tracking objects from frame to frame in long sequences of images, the continuity of the motion of the observed scene, allows the prediction of the image, at any instant, based on their previous trajectories. Because the moving state changes little in the neighboringconsecutive frames, we model the system as linear Gaussian with the state parameters of Kalman Filter given by the object respectively. A discrete-time dynamic equation state is given by:

$$X(t+1) = \Phi t, Xt+st \quad (3)$$

where the state vector,

$$X = [x, y, u, v, w, \Delta t]^T, \Phi = \begin{pmatrix} 101000 \\ 010100 \\ 001000 \\ 000011 \\ 000001 \end{pmatrix} \quad (4)$$

X and y are the predicted coordinates of the object u and v are velocities in respective direction, ω represents the width of the object rectangle and Δt represents the change in time t.

st is the white Gaussian noise with zero means and covariance matrix Qt, That is st~N(0, Qt). The position obtained by 2DPCA-GMM algorithm will be the measurement vector Zt. The measurement model will then takes the form:

$$Z_t = H_t . X_t + q_t \quad (5)$$

The predicted coordinates (x, y) and dimensions ω of the rectangle are used to locate the object in the present frame. Where qt~N (0, Rt), qt is white Gaussian noise, Rt is covariance matrix and Ht is the design matrix such that:

$$H_t = \begin{pmatrix} 1 & 01 & 00 & 0 \\ 0 & 10 & 10 & 0 \\ 0 & 00 & 00 & 1 \end{pmatrix} \quad (6)$$

The corresponding covariance matrices Qt-1 and rt-1 are the inputs to the Kalman filter. In the sequential image, if the dynamics of the moving object is known, prediction can be made about the positions of the objects in the current image. The Kalman Filter state prediction $\bar{X}t$ and state covariance prediction $\bar{P}t$ are defined by:

$$\bar{X}_t = \Phi_{t-1} \hat{X}_{t-1} \quad (7)$$

$$\bar{P}_t = \Phi_{t-1} \bar{P}_{t-1} \Phi_{t-1} + Q_{t-1} \quad (8)$$

where $\hat{X}$ and $\hat{P}$ demotes the estimated state vector and error covariance matrix respectively at time t. Then the Kalman filter update steps are as follows:

$$K_t = \bar{P}_t H^T{}_t (H_t \bar{P}_t HT_t + R_t)^{-1} \quad (9)$$

$$\hat{X}_t = X_t + K_t (Z_t - H_t X_t) \quad (10)$$

$$\hat{P}_t = (I - K_t H_t) \bar{P}_t \quad (11)$$

KF algorithm starts with initial conditions with K0 and $\bar{P}_0$. Kt is the Kalman gain, which defines the updating weights between the new measurements and the predictions from the dynamic model.

Retrieval Number: B2601078219/2019©BEIESP
DOI:10.35940/ijrte.B2601.098319
Journal Website: www.ijrte.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

IV. EXPERIMENTAL RESULT

Figure 5 shows the original image which is used for imposed and figure 6 shows the conversion of original image into binary image. The figure 7 shows edge detection of binary image. Figure 8 shows the overlay image of binary image.

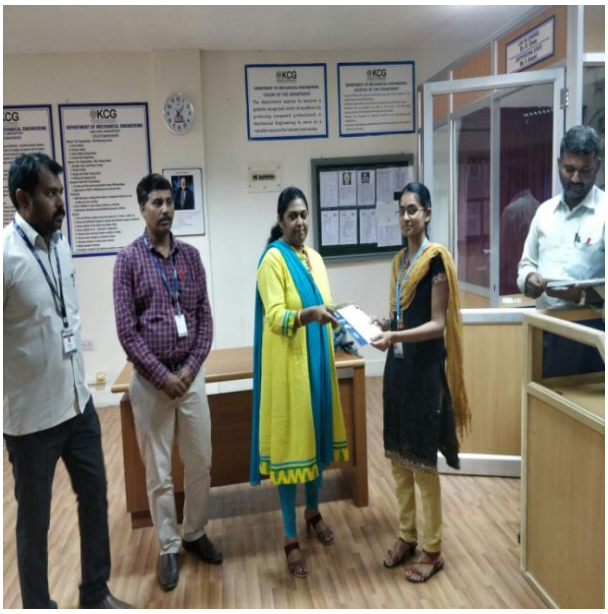

Figure 5: Original Image

Figure 6: Binary Image

Figure.7: Edge Detection

Figure 8: Overlay

V. CONCLUSION

The paper intended a Moving Object Detection System based on embedded video surveillance, which has strong, low price and low power consumption, etc., and can be applied in crowd monitoring, environmental monitoring, crisis monitoring and other applications fields. Moving objects detection takes full advantage of the interrelation between frame images in video, and purges an influence of complex background in the non-moving region. The detection result indicates that the method has the advantages of inter-frame difference; it is firmness in dynamic environment. In the mean time, because of combined with background difference, detected moving objects have relatively complete information. And also the simulation outcome shows the detection and tracking results for live videos feed through the webcam.

REFERENCES

1. .C. Shin, D.Goldg Of, And K. W. Bowyer .*"Comparison Of Edge Detector Performance Through Use In An Object Recognition Task"*.Computer Vision And Image Understanding, Vol. 84, No. 1, Pp. 160-178, Oct(2001).

2. MAMTAJUNEJA,PARVINDER SIN SANDHU," *PERFORMANCE EVALUATION OF EDGE DETECTION TECHNIQUES FOR IMAGES IN SPATIAL DOMAIN", INTERNATIONAL JOURNAL OF COMPUTER THEORY AND ENGINEERING*, VOL. 1, NO. 5, DECEMBER(2009).
3. LUSHENWU,ZHENLIU,YUWE SCHOOL OF MECHATRONIC ENGINEERING, NANCHANG UNIVERSITY NANCHANG ,CHINA. *" MOVING OBJECTS DETECTION BASED ON EMBEDDED VIDEO SURVEILLANCE*", INTERNATIONAL CONFERENCE ON SYSTEMS AND INFORMATICS (ICSAI 2012), 978-1-4673-0199-2/12
4. WEN-KAI TSAI, MING-HWA SHEU, & CHUNG-CHI LIN," *BLOCK-BASED MAJOR COLOR METHOD FOR FOREGROUND OBJECT DETECTION ON EMBEDDED SOC PLATFORMS*", IEEE EMBEDDED SYSTEMS LETTERS, VOL. 4, NO. 2,JUNE (2012).
5. PRANABKUMARDHAR, MOHAMMADIBRAHIMKHAN, ASHOKEKUMARSENGUPTA, D.M.H.HASAN AND JONG-MYONKIM,*"AN EFFICIENT REAL TIME MOVING OBJECT DETECTION METHOD FOR VIDEO SURVEILLANCE SYSTEM"*, INTERNATIONAL JOURNAL OF SIGNAL PROCESSING IMAGE PROCESSING AND PATTERN RECOGNITION VOL. 5, NO. 3, SEPTEMBER (2012).
6. WANG AND N.H.C. YUNG, *"EXTRACTION OF MOVING OBJECTS FROM THEIR BACKGROUND BASED ON MULTIPLE ADAPTIVE THEIR HOLDS AND BOUNDARY EVALUATION"*, IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION METHODS, VOL. 11, NO. 1,(2010), PP. 40-51.
7. P. DUNNE AND B.J. MATUSZEWSKI, "*HISTOGRAM BASED DETECTION OF MOVING OBJECTS FOR TRACKER INITIALIZATION IN SURVEILLANCE VIDEO*", INTERNATIONAL JOURNAL OF GRID AND DISTRIBUTED COMPUTING, VOL. 4, NO. 3,(2011), PP. 71-78.
8. D. SEN AND S.K. PAL, "*HISTOGRAM THRESHOLDING USING FUZZING AND ROUGH MEASURES OF ASSOCIATED ERROR*", IEEE TRANSACTION ON IMAGE PROCESSING, VOL. 18, NO. 4,(2009)APRIL, PP. 879-888.
9. OLUFADE, F.W. ONIFADE., OLADEJI, P. AKOMOLAFE&ADEMOLA, S. OLANIYI, DEPARTMENT OF COMPUTER SCIENCE, UNIVERSITY OF IBADAN,*"A MODEL FOR INTELLIGIENT MOTION DETECTION IN LIVE VIDEO STREAMING SYSTEMS*", AFRICAN JOURNAL OF COMPUTING & ICT, ISSN 2006-1781, VOL5. NO.3, MAY(2012).
10. BASTIAN LEIBE, KONRAD SCHINDLER, NICCORNELIS, AND LUC VAN GOOL,"*COUPLED OBJECT DETECTION AND TRACKING FROM STATIC CAMERAS AND MOVING VHICLES"*, IEEE PROC. COMPUTER VISION AND PATTERN RECOGNITION., JUN 23-25(1999).
11. KA KI NG, STUDENT MEMBER, IEEE AND EDWARD J. DELP, FELLOW, PURDUE UNIVERSITY, WEST LAFAYETTE, *"FAST AND ROBUST OBJECT DETECTION AND TRACKING FOR LIGHTWEIGHT VISUAL SURVEILLANCE SYSTEMS*", IEEE, DECEMBER 29 (2010).
12. W.HU, T. TAN, L. WANG, AND S. MAYBANK, *"A SURVEY ON VISUAL SURVEILLANCE OF OBJECT MOTION AND BEHAVIOURS*", IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS – PART C: APPLICATIONS AND REVIEWS, VOL. 34, NO.3, PP. 334-352, AUGUST(2004).
13. D. COMANICIU,V. RAMESH, AND P.MEER, "*KERNAL-BASED OBJECT TRACKING*, "IEEE TRANS. PATTERN ANAL. MACH. INTELL., VOL.25, NO.5, PP. 564-575, 2003.
14. NAN LU, JIHONG WANG, O.H. WU AND LI YANG IAENG," *AN IMPROVED MOTION DETECTION METHOD FOR REAL-TIME SURVEILLANCE*", INTERNATIONAL JOURNAL OF COMPUTER SCIENCE, 35:1, IJCS_35_1_16.
15. EMADEDEENNOURELDAIM, MOHAMED JEDRA AND NOUREDINE ZAHID LABORATORY OF CONCEPTION AND SYSTEMS, FACULTY OF SCIENCES," *TRACKING OF MOVING OBJECTS WITH 2DPCA-GMM METHOD AND KALMAN FILTERING*", INTERNATIONAL JOURNAL OF SIGNAL PROCESSING, IMAGE PROCESSING AND PATTERN RECONGINTION VOL. 5, NO.4, DECEMBER(2012).
16. M.SIVARATHINABALA, S.ABIRAMI," *AN INTELLIGENT VIDEO SURVEILLANCE FRAMEWORK FOR REMOTE MONITORING*", INTERNATIONAL JOURNAL OF ENGINEERING SCIENCE AND INNOVATIVE TECHNOLOGY (IJESIT) VOLUME 2, ISSUE 2, MARCH(2013).
17. OLUFADE, F.W. ONIFADE., OLADEJI, P. AKOMOLAFE&ADEMOLA, S. OLANIYI DEPARTMENT OF COMPUTER SCIENCE, UNIVERSITY OF IBADAN, IBADAN," *A MODEL FOR INTELLIGENT MOTION DETECTION IN LIVE VIDEO STREAMING SYSTEMS*", AFRICAN JOURNAL OF COMPUTING & ICT, VOL 5. NO. 3, MAY, (2012).
18. G. PRABHAKAR ASSISTANT PROFESSOR, B. RAMASUBRAMANIAN ASSISTANT PROFESSOR," *AN EFFICIENT APPROACH FOR REAL TIME TRACKING OF INTRUDER AND ABANDONED OBJECT IN VIDEO SURVEILLANCE SYSTEM*",. INTERNATIONAL JOURNAL OF COMPUTER APPLICATIONS (0975 – 8887) VOLUME 54– NO.17, SEPTEMBER(2012).
19. ABHISHEK KUMAR CHAUHAN, DEEP KUMAR "*STUDY OF MOVING OBJECT DETECTION AND TRACKING FOR VIDEO SURVEILLANCE*", INTERNATIONAL JOURNAL OF ADVANCED RESEARCH IN COMPUTER SCIENCE AND SOFTWARE ENGINEERING, VOLUME 3, ISSUE 4, APRIL(2013).