Background Modeling and Subtraction in Surveillance Application with Security

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***Abstract*- Intelligent video surveillance system deal's with the real-time monitoring of persistent and transient objects within a specific environment. In existing video surveillance using CCTV (close circuit television) works with binary segmentation algorithm and it had critical pre processing steps in various high level computer vision applications. This can be applied not only in security systems, but also uses in environmental surveillance. The basic principle of moving object detecting is given by the Background Subtraction algorithm. Then, a self-adaptive background model that can update automatically and timely to adapt to the slow and slight changes of natural environment is detailed. When the subtraction of the current captured image and the background reaches a certain threshold, a moving object is considered to be in the current view, and the mobile phone will automatically notify the central control unit and automatic alerting system alert the authorized user through SMS and user can view the detected image by GPRS enabled mobile devices.**

***Index Terms*- Background Modeling and Subtraction, GPRS, SMS, surveillance, WebLogic Server, GSM SIM900A, Mobile device.**

1. INTRODUCTION

Identifying moving objects from a video sequence is a fundamental and critical task in video surveillance, traffic monitoring and analysis, human detection and tracking, and gesture recognition in human-machine interface. A common approach to identifying the moving objects is background subtraction, where each video frame is compared against a reference or background model. Pixels in the current frame that deviate significantly from the background are considered to be moving objects. These foreground pixels are further processed for object localization and tracking.

Since background subtraction is often the first step in many computer vision applications, it is important that the extracted foreground pixels accurately correspond to the moving objects of interest. Even though many background subtraction algorithms have been proposed in the literature, the problem of identifying moving objects in complex environment is still far from being completely solved. There are several problems that a good background subtraction algorithm must solve correctly. Consider a video sequence from a stationary camera overlooking a traffic intersection. As subtraction algorithms have been proposed in the literature, the problem of identifying moving objects in complex environment is still far from being completely solved. There are several problems that a good background subtraction algorithm must solve correctly. Consider a video sequence from a stationary camera overlooking a traffic intersection. As it is an outdoor environment, a background subtraction algorithm should adapt to various levels of illumination at different times of the day and handle adverse weather condition such as fog or snow that modifies the background. Changing shadow, cast by moving objects, should be removed so that consistent features can be extracted from the objects in subsequent processing.

The complex traffic flow at the intersection also poses challenges to a background subtraction algorithm. The vehicles move at a normal speed when the light is green, but come to a stop when it turns red. The vehicles then remain stationary until the light turns green again. A good background subtraction algorithm must handle the moving objects that first merge into the background and then become foreground at a later time. In addition, to accommodate the real-time needs of many applications, a background subtraction algorithm must be computationally inexpensive and have low memory requirements, while still being able to accurately identify moving objects in the video. Even though many background

2. RELATED WORKS

Video surveillance takes place normally by using CCTV cameras (Closed Circuit Television) for monitoring or

surveillance for intruder detection in case of emergencies in hospitals, shopping maal, banking sectors, and personal purpose automation and so on, Later Video fusion approach also used for monitoring such systems. These systems are designed in such a way that monitoring images are stored and there is a need for human to interact for knowing about the changes in the current surveillance systems and then they will intimate to the concerned organization. Hence this is not a fast secured monitored due to the time delay taken for human interaction.

Due to time delay, we cannot get the update information for every minute or second and so it is not possible to detect the intruder in an appropriate time. This system uses the moving average algorithm to store the monitored images. Also this system lack the computation capability for surveillance meant for security

Various background modeling and subtraction algorithms have been proposed [1], [2], [3], [4], [5] which are mostly focused on modeling methodologies, but potential visual features for effective modeling have received relatively little attention. The study of new features for background modeling may overcome or reduce the limitations of typically used features, and the combination of several heterogeneous features can improve performance, especially when they are complementary and uncorrelated. There have been several studies for using texture for background modeling to handle spatial variations in the scenes; they employ filter responses, whose computation is typically very costly. Instead of complex filters, we select efficient Haar-like features [6] and gradient features to alleviate potential errors in background subtraction caused by shadow, illumination changes, and spatial and structural variations. Model-based approaches involving probability density function are common in background modeling and subtraction, and we employ Kernel Density Approximation (KDA) [3], [7],

3. PROPOSED MOVING OBJECT DETECTION FRAME WORK WITH ALERTING SYSTEM

In this paper, to design a new detection framework that preserves the advantages of the existing works and avoids their drawbacks. For overcoming the drawbacks here K-means and Canny Edge Detection combined for edge detection [9]. This system provides a low-cost intelligent mobile phone-based video surveillance solution using moving object recognition technology. The basic principle of moving object detecting is given by the Background Subtraction algorithm. Then, a self-adaptive background model that can update automatically and timely to adapt the slow and slight changes of natural environment is detailed. Every captured frame that can compared with background frame based on threshold value, if the image reaches certain threshold value then moving object is considered to be in the current view or current frame and stores in the server i.e. WebLogic server, the mobile phone will automatically notify the central control unit or the user through SMS. Then user can view the captured image present in server using GPRS in remote location.

3.1 Multiple Feature Combination

The most popular features for background modeling and subtraction are probably pixelwise colour (or intensity) since they are directly available from images and reasonably is criminative. Although it is natural to monitor colour variations at each pixel for

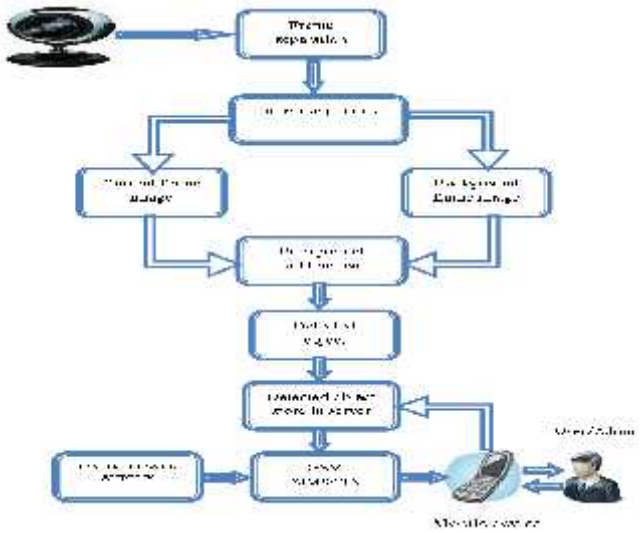


Fig 1 overall structure of high level computer vision application

3.2 Feature Analysis

In feature analysis the characteristics of individual features and the performance of multiple feature integration. After the correlation between every pair of features, RGB colors and three Harr-like features are significantly correlated; I propose a pixel wise background modelling and subtraction technique using k-mean clustering algorithm, where generative and discriminative techniques are combined for classification. The feature improves background/foreground classification performance.

In this module, extract the feature from the image frame, Edge Detection, Corner Detection, color Transformation and color classification.

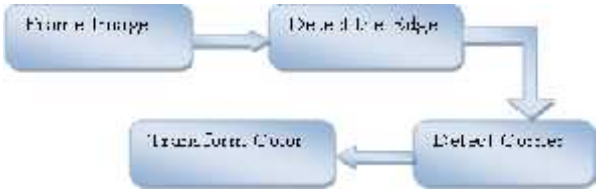


Fig 2 Feature Analysis

3.3 Classification

After background modelling, each pixel is associated with k 1DGaussian mixtures, where k is the number of features integrated. Background/foreground classification for a new frame is performed using these distributions. The background probability of a feature value is computed by (2), and k probability values are obtained from each pixel, which are represented by a k-dimensional vector. Such k-dimensional vectors are collected from annotated foreground and background pixels, and they denote them by y_j (j ¼ 1; . . .; N), where N is the number of data points. In most density-based background subtraction algorithms, the probabilities associated with each pixel are combined in a straightforward way, either by computing the average probability or by voting for the classification.

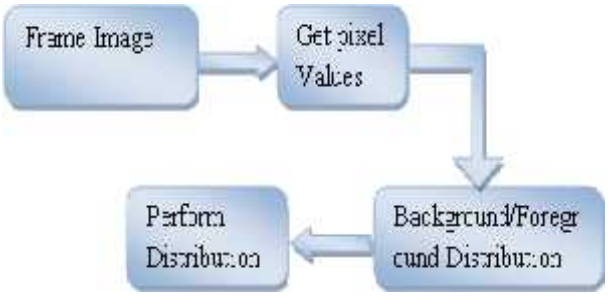


Fig 3 Classification

3.4 Background Detection

K-means clustering is a method of cluster analysis which aims to partition observations into k clusters in which each observation belongs to the cluster with the nearest mean. The problem is computationally difficult; however there are efficient heuristic algorithms that are commonly employed that converge fast to a local optimum. These are usually similar to the expectation-maximization algorithm for mixtures of Gaussian distributions via an iterative refinement approach employed by both algorithms. Additionally, they both use cluster centers to model the data, however k-means clustering tends to find clusters of comparable spatial extend, while the expectation-maximization mechanism allows clusters to have different shapes.

3.5 WebLogic Server

EA Systems' WebLogic is a server software application that runs on a middle tier, between back-end databases and related applications and browser-based thin clients. WebLogic is a leading e-commerce online transaction processing (OLTP) platform, developed to connect users in a distributed computing environment and to facilitate the integration of mainframe applications with distributed corporate data and applications.

WebLogic server is based on Java 2 Platform, Enterprise Edition (J2EE), the standard platform used to create Java-based multi-tier enterprise applications. J2EE platform technologies were developed through the efforts of BEA Systems and other vendors in collaboration with the main developer, Sun Microsystems. Because J2EE applications are standardized modules, WebLogic can automate many system-level tasks that would otherwise have demanded programming time.

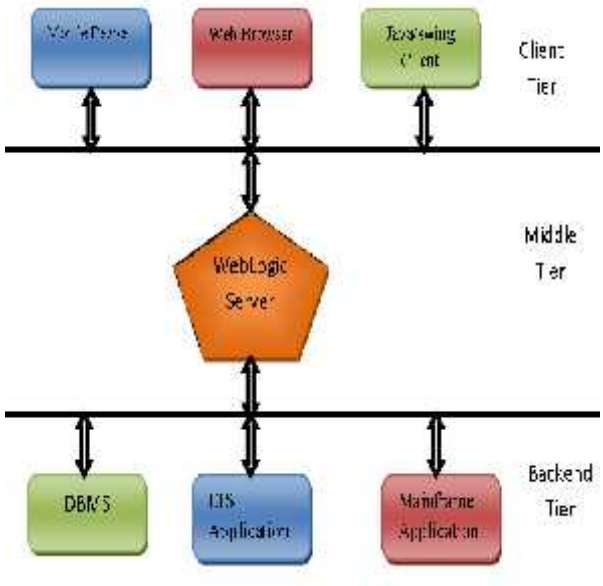


Fig 4 Three-Tier Architecture of web logic server

The main features of Web Logic server include connectors that make it possible for any legacy application on any client to interoperate with server applications, Enterprise Java Bean (EJB) components, resource pooling, and connection sharing that make applications very scalable. An administration console with a user interface makes management tasks more efficient and features such as Secure Sockets Layer (SSL) support for the encryption of data transmissions, as well as authentication and authorization mechanisms make applications and transactions secure [12].

3.6 GSM Module

SIM900 is a quad band modem being able to operate in 850, 900, 1800, 1900 MHz bands and offers improved GPRS functionalities useful in web enabled applications. AT commands used for Call/SMS in SIM300 can be used with the SIM900 modem. GSM/GPRS Modem-RS232 is built with Dual

Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz the Modem is coming with RS232 interface [13].

Fig 5 GSM SIM900A

This allows you connect PC as well as microcontroller with RS232. The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply.

Using this GSM SIM900A modem, we can make audio calls, SMS, Read SMS, attend the incoming calls and internet through simple AT commends [11].

3.6.1 Testing of GSM modem using HyperTerminal

1. Connect the GSM Modem to a PC COM Port
2. Create a HyperTerminal (Windows tool for serial port communications) window with Baudrate 9600 and connect it to the COM Port to which GSM is connected.
3. Type any AT command in the HyperTerminal window and you could see the modem responding by sending "OK".

TABLE 1

Basic AT Command with SMS text mode

Commands	Description
AT	Checking communication between the module and computer.
AT+CMGF	Message format
AT+CMGR	Read message
AT+CMGS	Send message

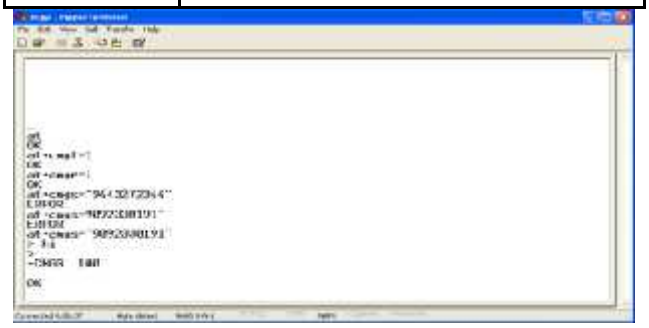


Fig 6 Testing Of AT Commands in Hiper Terminal

3.7 User Viewer Module

After getting the alert SMS from GSM SIM900 modem to the administrator/user. Can View the detected images from our prohibited area through GPRS enabled mobile devices with the IP address and port number of the web logic server

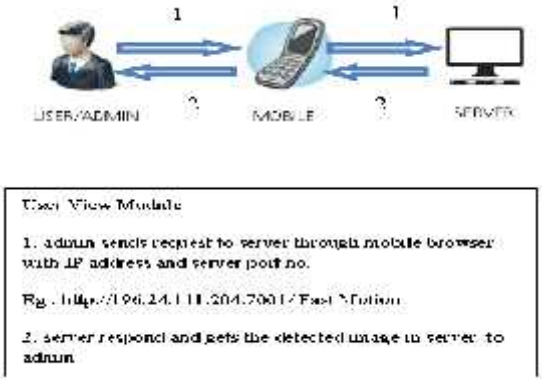


Fig 7 User view module

4. EXPERIMENTS

We present the performance of our background modeling and subtraction algorithm using real videos. Each sequence involves challenges such as significant pixelwise noises (subway), dynamic background of a water fountain (fountain), and reflections and shadow in wide area.

4.1 Image capturing using Webcam

In this module we are capturing the video from webcam using Java Media Framework (JMF) API. JMF is a framework for handling streaming media in Java programs. JMF is an optional package of Java 2 standard platform. JMF provides a unified architecture and messaging protocol for managing the

acquisition, processing and delivery of time-based media. JMF enables Java programs to get the video image from web camera

Fig 8 Camera Control For Fast Motion Detection

4.2 Background Detection

K-means clustering is a method of cluster analysis which aims to partition observations into k clusters in which each observation belongs to the cluster with the nearest mean. The problem is computationally difficult; however there are efficient heuristic algorithms that are commonly employed that converge fast to a local optimum. These are usually similar to the expectation-maximization algorithm for mixtures of Gaussian distributions via an

4.3 Images Stores in Server

After the background template has been constructed, the background image can be subtracted from the observed image. The result is foreground (moving objects). Actually, the background is timely updated. To classify a new pixel value with respect to its immediate neighborhood in the chosen color space, so as to avoid the effect of any outliers. This motivates us to model each background pixel with a set of samples instead of with an explicit pixel model. So the current value of the pixel is compared to its closest samples within the collection of samples.

In case of some random disturbances, each pixel will fluctuate in a small range even there is no expected moving objects in the scene. So there must be a strategy to judge it. A threshold is defined in the system. If the difference of one pixel between real time frame and template is more than 10, then add 1 to the threshold. When differences of all pixels in the frame are all calculated, moving objects is thought to appear if the threshold is more than 3 percent of the total number of pixels in the frame.

Fig 9 Motion Detected Images Stores in Server

4.4 Alerting System

After detecting the changes in video frames, we are alerting the central control unit or the user through SMS using the GSM Modem. A GSM SIM900A modem is a wireless modem that works s with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

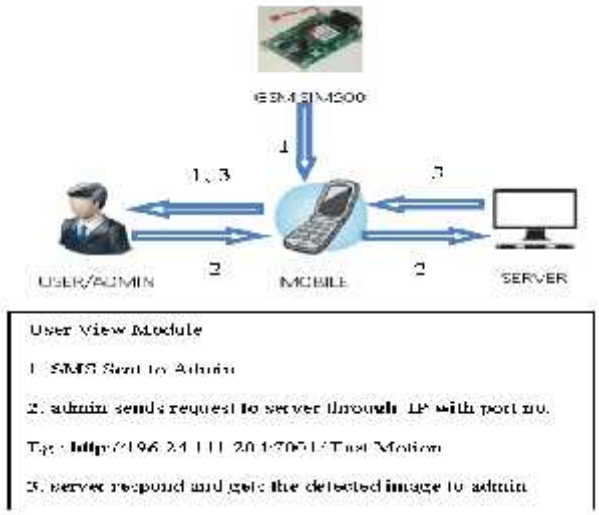


Fig 10 Alerting System

After the receiving of SMS by an authorized user, they can view the detected image by GPRS enabled mobile devices.

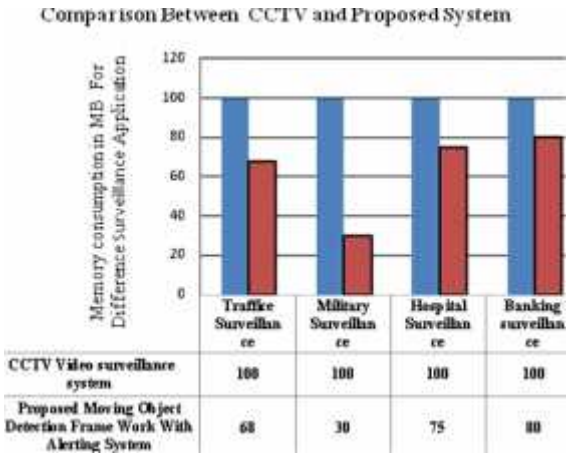
Fig 11 Image Viewed in Mobile Device

TABLE 2

Comparison between High Level Computer Vision Application with Security and CCTV Video surveillance system

Features	*CCTV Video Surveillance System*	*Proposed Moving Object Detection Frame Work With Alerting System*
Memory Consumptions	Store's continuously	When object detect in current frame
Human Interaction	Needed	Not needed
Alerting Features	Not applicable	Applicable by sending SMS by SIM900A GSM modem
Remote Monitoring	Not applicable	Applicable by using GPRS enabled mobile devices

Fig 12 Memory Consumption between CCTV and Proposed Video surveillance system in many app



5. CONCLUSION

We have introduced a multiple feature integration algorithm for background modeling and subtraction, where the background is modelled with a generative method and background and foreground are classified by a discriminative technique. Here we can use background subtraction in many high level computer vision applications, some of the security features enclosed, like SMS generation and remote monitoring using a GPRS enabled mobile phone devices. Our algorithm demonstrates better performance and less storage space than CCTV video surveillance system and the performance is tested quantitatively and qualitatively using a variety of indoor and outdoor video applications.

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