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HOME SURVEILLANCE SYSTEM DESIGN AND IMPLEMENTATION TOWARDS IOT ENVIRONMENT

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ABSTRACT

A personal home surveillance system is a low cost technology based on internet of things technology (IOT) that makes it possible for users to monitor the events that is happening in their homes remotely. There are multiple challenges in home surveillance systems such as picture is unclear, oddity cannot be specified automatically, motion sensors limitations, in addition to high cost of storage space. The trend of this paper, is to design and achieve moving objects extraction based home surveillance system with low cost, functional, and suitable solution within IOT context. The communication process is achieved essentially using Rasberry-Pi microcontroller device which enables a streaming of real time video along with capturing a snapshot images. In addition, a modified approach for moving objects detection in video sequences is presented in this paper based on the results of motion detection approach. The key result of the proposed moving object detection is represented by retaining the moving parts only in the video sequences captured by Pi camera in order to decrease the duration time of video frames, storage space required, in addition to minimize the reviewing time of the recording video. Furthermore, a real time stream video can be viewed from any web browser or mobile platform in term of surveillance system. The moving parts extraction process is achieved using the statistical information of the sequence frames within a modified motion detection algorithm. To analyze and evaluate the proposed motion detection algorithm results, we have attended our own video dataset that compose of three video files with different motion situations. The experimental result of the proposed moving objects detection based home surveillance system outperforms a remote surveillance of home integrity with efficient availability, reliability and high rate detection of moving objects in the captured video sequences .

Keywords: *Surveillance system, cloud server, motion detection, Internet of things, Background Model*

1. INTRODUCTION

Recently, the Internet of things (IoT) is qualified by the modern developments in RFID, smart and intelligent sensors, and communication tools. The elementary idea is to have intelligent devices work together without human connection to convey a new application. The modern technology in internet field, mobile revolution, telecommunication systems, and machine-to-machine skills represent the first point of the IoT. Recently and future years, the IoT is estimated to association diverse skills to enable novel presentations and applications by joining the physical objects by self-possessed in funding of smart decision creation [1].

Internet of things (IoT) is extensive set of technologies and uses several stages that has undefined and single definition. Another view the IoT uses network-connected strategies, fixed in the physical situation to recover some present procedure or to qualify a novel state not before conceivable. Several devices are connected to the system or net to deliver data by several sensor systems to let other structures to act on the domain by actuators. The principle of IoT is to connect many devices and sensors to convert appreciated data from the actual domain into digital information that offers amplified reflectivity into how the operators interact with the products or applications [2].Currently, various smart applications with numerous purposes are becoming part of human everyday lives due to the progresses in networking systems and communications skills

2. RELATED WORK

The Closed-Circuit Television (CCTV) system is widely used for surveillance application which based on video cameras to transmit and received a signal to a specific location of user with limited number of monitors. It requires a command and control center to control all the functions using cameras. In these kinds of surveillance systems, the person who is stationary and is located in that specific area can only view what is happening in that place. This type of system is considered as costly system; in addition it does not provides a real time information for the user when any disorder happens [1]. The authors in [2] presented a security system based on Global system of mobile communication GSM and Programmable Logic Controller (PLC). The proposed system used infrared sensor IR for motion detection purpose (which is caused a limitation in motion detection accuracy). The surveillance system in [3] is based on Arduino microcontroller (less memory storage, less functionality, more complexity in internet connection compared to raspberry Pi microcontroller). The presented system provide the monitoring ability to the users via alert them by SMS and photo captured based on plug and play system. The surveillance system workflow of the proposed work in [4] is based on the assumption; when there is an infringement. endeavor to the home, the owner will be cautioned via e-mail and alarm message is sent to the owner immediately. However, there is a lack of function camera capturing application and motion detection. The presented work in paper [5], the authors proposed two methods to design and implement home security system. The first method based on web camera to capture the motion video sequence, it provides a security alarm in terms of sound and send e-mail to the owner. The second method sends SMS message based on GSM- GPS Module and At mega 644p microcontroller, motion sensors, relays and buzzers. The presented work in [6] designed a video surveillance system based on motion detection. This system involves a Raspberry Pi, GSM and PIR motion sensor to detect objects motion with limited distance (up to 3 meter) and constrained to objects temperature. The presented work of home security system in [7] was designed and implemented using two Arduino controller and GSM module along with two PIR sensors to detect the moving objects in surrounding area up to 3 meters. The authors in [8] were presented home monitoring system based on an implanted system with various ultrasonic sensor to improve the system's consistency. Each sensor contains a Tx and Rx sited in a line route. The ultrasonic sensor will spread at a narrow angle. Multiple ultrasonic Rx sensor to receive the data, the ultrasonic transmission will be jammed by the body. The Rx system will not obtain any spread signal from the transmitter, the receiver will get information when somebody is passing through the monitoring field. The Majority Voting Mechanism is used for a group of transmitter.

In this paper, we present the design and implementation of home surveillance system based on personal cloud server (nimbus cloud) and Raspberrypi microcontroller in order to detect the moving objects in video sequences within IOT environment. The classical methods used for motion detection purpose are essentially based on optical flow method [9], Gaussian Mixture Model GMM [10], kernel Density Estimation KDE [11]. Basically, these methods are required an abundant calculation time for multiple parameters identification such as motion vectors of each pixel and probability density function of each pixel. Furthermore, these methods are constrained to the speed of moving objects. Therefore, a modified motion detection algorithm is proposed in this research to extract the moving objects in the video sequences instead of using PIR sensors in addition to overcome the slow motion of objects with drop of computation time processing.

3. PROBLEM DEFINITION

Recently, video surveillance system has been developed vastly due to its critical issue for computer vision field within security manner of indoor and outdoor environments. Practically, the conventional video surveillance systems can attain nearby distance surveillance based on PIR sensor and PC as a monitor host with connected camera to acquire video and images. There are different defects in the video surveillance systems based on PIR sensor for motion detection purposes such as; PIR sensor reveals motion by measuring variations in the infrared (temperature) levels emitted by the closer objects which is caused insensitivity to higher temperature above (35°). Furthermore, PIR sensor is insensitive to slow motion and less effectiveness with static objects. from other hand, lot of storage space is required to save the surveillance information with higher cost. Therefore, a real time moving object detection approach based on modified motion detection algorithm within low cost home surveillance system is presented in this paper towards IoT environment.

4. SYSTEM ARCHITECTURE OVERVIEW

The framework of the presented surveillance system involves two major parts: the hardware configuration part and software

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implementation part. The hardware configuration part is dedicated to control and monitor all the information captured by PI camera. Practically, the raspberry pi interacts with two prime components simultaneously; the web application that operates from any browser and the nimbus cloud server from other side as illustrated in Figure 1. The software implementation part is designed to control, monitor and analyze the activities such as capturing images, streaming live video and detection the moving object in the live video via a new motion detection algorithm. The workflow of motion detection algorithm is devoted to record video frames data when motion is detected, then store these captured frames automatically in the SD card memory storage device and upload it to the nimbus cloud concurrently. The streaming live video is additional option in this software in order to provide the user a real time accessing of the surveillance environment through a web browser remotely. When cloud is not available then the data stored locally on the raspberry pi and sent when the connection restarts. The essential step of monitoring process is represented by checking if there is a new video file every 30 minutes in order to send it to the nimbus cloud server otherwise no change occurs in the processing procedure.

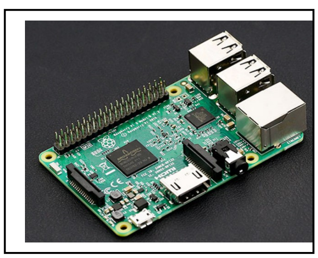

Figure 2: The diagram of the proposed home surveillance system.

to prepare the hardware requirements of the current home surveillance system which is composed of Raspberry Pi microcontroller, Pi camera, personal cloud server and SD card memory storage.

Raspberry Pi Controller: Raspberry PI 3(Pi) is a Hand computer with dimension (85,60 × 53,98× 17) mm in term of nano computer. Figure 2 shows a clear description of Pi3 used in this research. The operating system operates on raspberry Pi is OS .Raspbian. The installation process is conducted with assist of NOOBS web page.

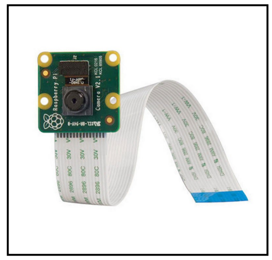

Figure 2: Raspberry Pi 3. and Camera Raspberry

Camera Raspberry Pi module (v.2): The second main component in the hardware devices is Camera Raspberry Pi module (v.2) which is has good resolution and superior than USB camera. This type of camera is common used on the home surveillance systems due to several technical specifications. Figure (2), illustrates a clear description of Pi camera module (v.2).

Nimbus Personal Cloud: In order to provide an adequate security, privacy and more storage space for uploading and downloading files, nimbus personal cloud [12] is utilized in this research. Nimbus personal cloud is planned to run on nothing but an external hard drive and Raspberry Pi. Nimbus is low-cost, informal to use private cloud. The main characteristics of Nimbus cloud is represented by high storage and provide sharing and streaming files anywhere with free paying which contributes to provide the security of files. In this work, only home owner and authorized people will access to Nimbus cloud which is enabled to access to Raspberry PI remotely with a predefined user name and password. The external hard (nimbus cloud server) could plugs into the owner router and access it remotely or unplug the external hard to make the owner data as a portable data with him.

B. Software Implementation Part

In this part, a software application system is designed and implemented in order to provide the owner (user) the ability for managing his/her home security remotely. The software application involves four main components; first, a secure web application has been designed to control the hardware devices and achieve the internet connection between the user and his/her home. Second, an authentication procedure based on hash function SH5 has been implemented in order to perform the security and authority for the web application. Third, a real time stream video is provided to perform the surveillance process remotely by user through accessing to the raspberry

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Pi camera connected with Raspberry Pi. Meanwhile, a snapshot images can be obtained to specify capturing multiple images during the streaming video. Finally, a modified motion detection algorithm is presented and implemented to detect and extract the moving objects in the stream video. Subsequently, the moving objects frames are stored as a new data video file in SD card memory device and nimbus cloud server simultaneously in order to review these parts of videos later by owner. Figure 4, illustrates these main options embedded in the designed web application.

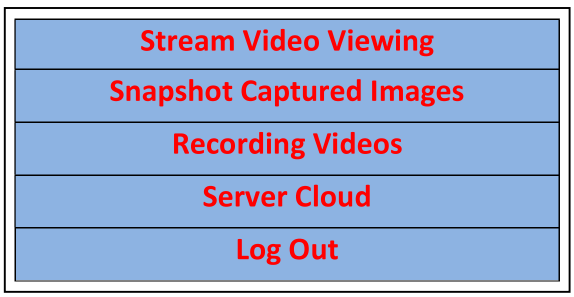

Figure 4: an illustration of web application options.

Web Application Design

In order to make the raspberry PI works as a web server, Apache server application is installed in Raspberry PI and adopted in this work to ensure the wireless connection between the client (home owner) and the server (the Raspberry PI and its connected devices placed at home network). The installation process is achieved by writing the following instruction in the command line:

sudo apt-get install apache -y

For the purpose of accessing to the Raspberry PI web server , the IP address of Raspberry PI should be determined previously. The Raspberry PI IP address is determined using the following instruction in the command line:

ifconfig

In this way, the hosting process of Raspberry Pi to the designed web page is conducted and subsequently received any requests or information published by the web page.

Authentication Procedure

The web application software involves an authentication process to guarantee and allow the authorized persons accessing to home surveillance system and prevents unauthorized persons from accessing. In this research, SH5 hash function [13] has been adopted to perform the authentication issue as illustrated in Fig. 5. SH5 hash function requires a predefined user name and password to get the permission of entering the surveillance system.

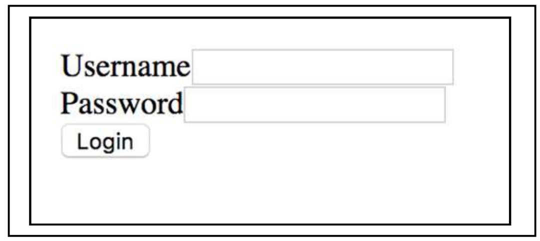

Figure 5: Log in web page.

Streaming video sequences:

In this paper, the raspberry pi camera has been adopted and utilized to acquire the indoor video sequences in real time and send these sequences to raspberry pi microcontroller in order to analyze and extract the moving objects from the captured video using the proposed motion detection algorithm. Subsequently, the video sequences are send to web application URl address through the internet network and according to user request in the web application to IP address of raspberry PI. In this work, the IP address of raspberry PI is stand to static status through the initialization process in order to ensure the connectivity from any browser

Moving Objects Extraction

Significantly, the moving objects detection process plays the key point of the surveillance system applications. The essential step of the proposed home surveillance system is based on extracting the moving objects from the captured video sequence. In this paper, the moving objects detection process is achieved based on modified motion detection algorithm named MOSI. The framework of the proposed motion detection algorithm MOSI composes of four major parts; background model construction, key frames detection, motion detection decision and finally the post processing part. Essentially, MOSI algorithm is devoted to retain video frames (key frames) only when motion is detected, then store these key

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frames automatically in the memory storage device and nimbus cloud server to review or uploaded later. Here, the standard deviation measure is utilized as a benchmark of the interaction(change detection) between any two sequenced frames in the captured video. In the following sections, an illustration of the proposed motion detection algorithm and its main steps are presented in details.

5. BACKGROUND MODEL ONSTRUCTION

In order to detect the moving objects in live video, a background model construction is required to conduct the difference process between the background frame and current frame for all video sequences. Therefore, the background frame should be updated and modeled in a successive manner to avoid the background changing in the captured video stream. The background frame is modeled according to Eq. (1) stated in [14]:

$$B^t = (1 \quad \delta) B^{t-1} \mid \delta F^t \qquad (1)$$

Where B^t, F^t are current background and current frame at time t respectively, B^{t-1} is background at time t-1 and δ is alterable parameter in the range [0,1]. In this work, the background model construction is updated and conducted at each three frames in order to reduce the computation time and storage space needed to maintain the frames of moving objects only. The binary mask procedure is achieved after background extraction. The moving objects regions at each frame (including humans) are extracted based on the absolute difference between the frame F^i and the background frame B^i. These differences are indicated as Bnr^i which calculated according to the following equation:

$$Bnr^i = \begin{cases} 1 & if \left|B^i - F^i\right| > \epsilon \\ 0 & if \left|B^i - F^i\right| < \epsilon \end{cases} \qquad (2)$$

Where $^{\varepsilon}$ is determined from the experiments. The workflow of the proposed motion detection algorithm MOSI is illustrated in Figure 6.

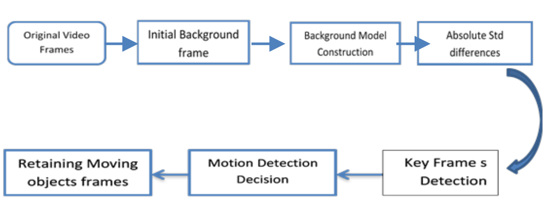

Figure 6: The workflow of the proposed motion detection algorithm MOSI.

It is worth mentioning, in this work the background frame construction is updated at each three sequence frames which leads to avoid the static objects in the scene and minimize the processing time. An illustration of sample original video frames and their binary mask frame extraction is demonstrated in Fig, (7).

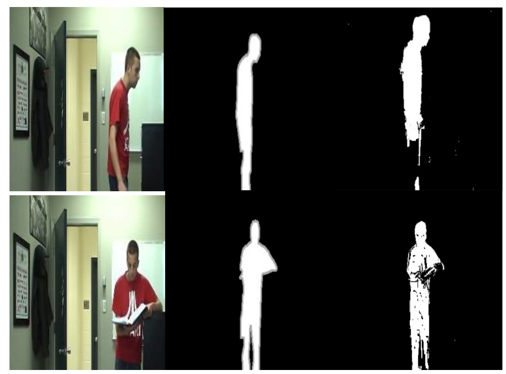

***Figure** 7 : The qualitative results of binary mask process for two sample frames of video (office) with sequence(665, 1091), from left to right : first column represents the original frame, the second column represents the ground truth and the third column is*

6. Key Frames Extraction

In order to reduce the search space O(N)[2] adopted in traditional motion detection methods which is based essentially on motion vectors calculation and probability density function of each pixel in the frame, we present a modified algorithm for motion detection for stream video based on statistical information of the detected key frames. In this research, the key frames detection process is represented by obtaining the moving parts only in the video sequences. The main contribution of key frames detection based MOSI algorithm is represented by adapting non overlapped block-based matching technique between the sequence frames instead of pixel-based matching technique. The statistical information is utilized to perform the key frame detection process which is characterized by standard deviation statistical measures. The workflow of key frame detection process is based on statistical measure and performed over a delicate level. Its include dividing each frame in the video sequence into set of r blocks with equal size in order to drop the run time and minimize the frame representation to a single dimension (r) instead of (W×H) dimension, where W is the frame width and H is the frame high. The average of the first N

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frames from the input video sequence is assumed to be the initial background frame according to Eq.(3).

$$B^1 = \frac{1}{N}\sum_{i=1}^{N} F^i \quad , i = 1, \ldots \ldots N \qquad (3)$$

Algorithm 3.1 : Statistical Information Extraction (SIE)

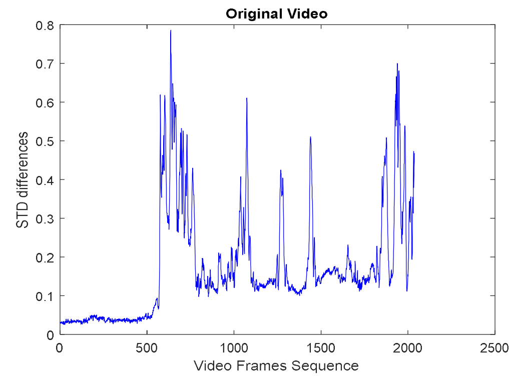
```
Input: Ft, Bt , bs, W, H  //  Ft, Bt are the current
frame and background frame respectively,  bs is
window size, W is frame width, H is frame high
Output:  :   one dimension array
Step 1:  read Ft, Bt frames
Step2 : cont=1
Step 2: convert Ft, Bt frames into gray scale
mode.
Step 3: For i=1 to H mode bs ; step bs
                For j=1 to W mode bs ; step bs
                        row1= i
                        row2= i + (bs-1)
                        col1=j
                        col2= j+ (bs-1)
                        St1=  Ft (row1:row2,
col1:col2)
                        St2= Bt ( row1:row2,
col1:col2)

                        cont=cont+1
                 End For
           End For
 Step 5: End
```

Furthermore, the average differences AD for the first N frames is calculated in order to use later as a threshold value in key frame extraction process and background frame model updating. The background frame construction model is achieved at each three frames to avoid the static objects in the captured scene and reduce the processing time of motion detection procedure. Each frame is splits into non-overlapping (equal sized) blocks using rectangular window and calculate the standard deviation for each block in both (background frame Bt and current frame Ft). Then, the absolute differences between the corresponding blocks for both background frame Bt and current frame Ft are calculated and stacks into one dimension buffer (feature vector).

Afterwards, we calculate the sum of all standard deviation differences blocks in order to get the weigh change at each frame and formulate this change as single statistical feature. The demonstration of key frame extraction based MOSI algorithm is presented in Fig. (8), where x-axis represents the frame indexes and y-axis represents the weighted sum of the standard deviation differences between two sequence frames.

The workflow of statistical information extraction process is described in terms of an algorithm steps in Algorithm (1) with current frame Ft , current background frame Bt , window size bs . frame resolution high H , width W respectively as input and return array of standard deviation difference between two sequence frames as output.



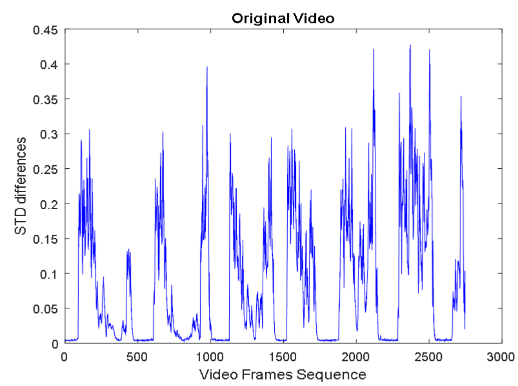


***Figure 8** :Two Samples demonstrate the standard deviation frames differences of two original video files (office and sofa).*

Afterword's, the key frames detection is specified for each three frames *fi, fi+1, fi+2* according to the following condition:

*If mean (di, di+1, di+2) > S * AD*

Where di, di+1, di+2 are the statistical difference features of the ith sequence frames, S is an integer scalar determined from the experiments and AD is the average differences of the first N frames. Obviously, there is no need to determine a threshold value of key frames beforehand, because it is determined dynamically through the implementation of the above condition.

7. Motion Detection Decision

In this stage, the motion detection decision between two sequences frames has been taken based on two main conditions; the first condition is dedicated to identify the key frames as illustrated above in section 5. The second condition is stand to identify peaks value along video frames. In this work, we assumed that peak value is identified for each three frames *fi, fi+1, fi+2* along the video frames according to the following condition:

If di < di+1> di+2 then

peak value = di+1

Where *di* is the single statistical spatial feature represents the sum of the standard deviation difference values between two sequence frames obtained from algorithm (1). The second condition is deployed to minimize and filter the false key frames that obtained from the first condition. In this way, only the movement frames are retained when there is any movement in the captured scene as shown in Fig. (9). An illustration of the proposed Motion detection algorithm is stated in Algorithm (2).

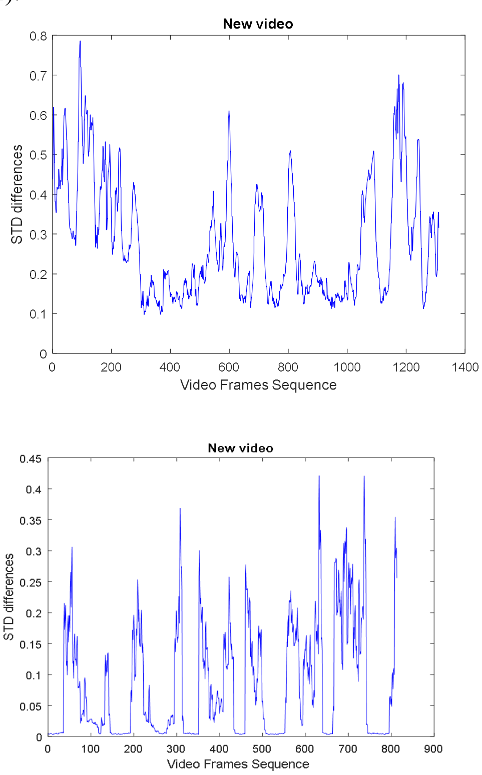


Figure 9 : Two Samples demonstrate the standard deviation frames differences of the two new video files (office and sofa).

8. Post Processing

In this stage, the key frames of moving objects in the video sequences extracted from the previous stages are retaining as a new video file opened for writing purpose. The proposed home surveillance system is designed to execute the duration time of this process at 30 minutes. In this way, if there is any movement in the captured video, a new video file is created which is composed of moving objects only. The new video file is stored in the SD card memory storage device and upload it to the nimbus cloud server concurrently.

This process represents the essential step in the monitoring process which is achieved at each 30 minutes during the processing procedure of the current surveillance system.

9. EXPERIMENTAL RESULTS

The performance evaluation of the proposed moving object detection algorithm has been tested over two dataset, the first one downloaded from [15] and the second database is collected based on our efforts. The first dataset consists of two global videos (office, sofa). The second database has been achieved and attended for experiments purpose and involved an indoor scenes with different actions. The video dataset was prepared to involve indoor scenes that demonstrate paradigm cases in video surveillance. The experimental videos consist of static background under motion scenes with different motion situation. The motion scenes are in term of walking one person from right to left then return from left to right, hand gesture, walking then stopping then walking through video sequence, walking two persons sequentially. The video dataset is composed of three video sequences captured by Samsung camera, 21x optical zoom with 30 frame per second frame rate, 24 bit per pixel, width is 1280, high is 720 and mp4 video file format under different duration time. We conducted the experiments on a HB laptop operating Windows 8 with a 2.20-GHz Intel Core i7 CPU and 6-GB RAM. The implementation of the MOSI algorithm has been conducted in Python 3.7 platform. In this work, the optimal value of δ is stand to 0.2, the value of ε is stand to 0.08, 21 pixels is stand to window size bs, S threshold value is 3.

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A. Evaluation Metrics

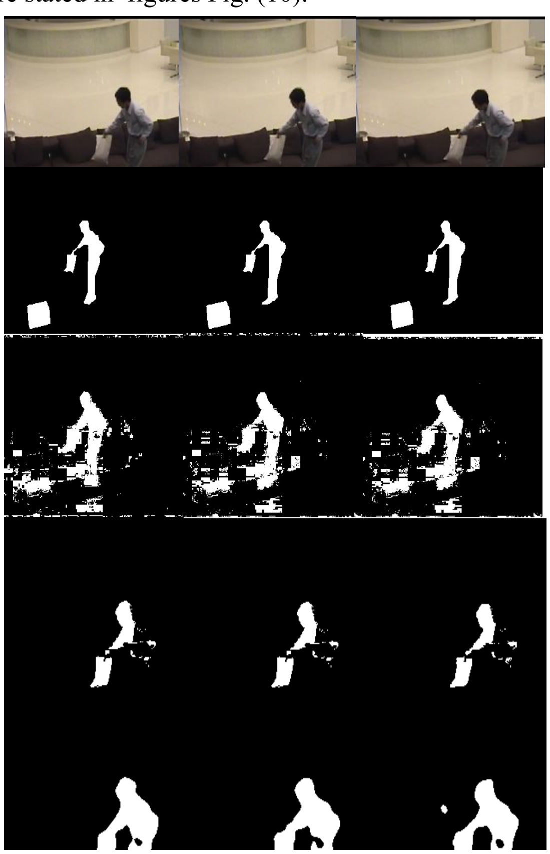
The experimental results of this research is conducted using quantitative measurements in order to evaluate the performance of the proposed motion detection algorithm. These measurements are represented by true positive rate (TPR) or (Recall), false positive rate (FPR) or (Precision), Similarity and F-measure and defined as follows:

$$TPR = \frac{TP}{TP+FN}\ , \quad FPR = \frac{FP}{TP+FP}$$

$$Similarity = \frac{TP}{TP+FP+FN}$$

$$F\_Measure = 2.\frac{Precision * Recall}{Precision + Recall}$$

Where TP is the true positive , FN is false negative , and FN refers to false negative. Essentially, the evaluation metric involves a comparison process between the ground truth results with the obtained results. Furthermore, a comparison process between the proposed algorithm MOSI results and two prior methods such as KDE and MMG algorithm is presented. The visual output results of background subtraction and foreground subtraction algorithms are stated in figures Fig. (10).



Algorithm 2 : Motion Detection Algorithm

Input : Sequence frames , W, H, bs (window size)
Output: new video file
Step1 : B^1=
Step2 : Bcont = 1
Step3 : Open newvideofile for writing
Step4 : While ~Eof(videoreader)
i = 1;

Step5 : [Bnr^i , Ons]= BinaryMask(B^i, F^i)
Step6 : ***stdubuf*** = SIE(B^i, F^i, bs, H, W)
Motion_ID (i) ← Sum (***stdbuff***)
Step7: // motion decision
For each three frames *fi, fi+1, fi+2*
Index frames = Key Frame Extraction (*di, di+1, di+2*)
if (Index frames)
if (Peak_detection(*fi, fi+1, fi+2*))
write(newvideofile **,** *fi+2*)
write(newvideofile **,** *fi+3*)
end if
end if
end for
Step 8:*// Background Model Construction*
if Bcont = = 3
B^i ← BackgroundModel($\boldsymbol{F^i}$, $\boldsymbol{B^{i-1}}$)
Bcont ← 0
end if
i← i+1
Bcont← Bcont+1
End *while*
Step 10 : close newvideofile
Step 11 : End

Figure 10 *:the qualitative resultes of background subtraction algorithm compaired with KDE, GMM methods for office video.*

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Fig. (10) demonstrates the experimental results of sofa video file with three sequenced frames indexed by (675, 676, 677). The first row represents the three frames sequence of sofa video file, the second row represents the standard case of foreground and background (ground truth), the third row represent the KDE Algorithm output result, forth row represents the output results of MMG algorithm and the five raw illustrates the visual output results of the proposed work. The qualitative results (F-measurements, Similarity) for five video sequences are stated in table (1).

Table 1 : The qualitative results of each method

Method	Evaluation	office	sofa	V1	V2	V3
KDE	F-measure Similarity	0.754 0.719	0.722 0.735	-	-	-
GMM	F-measure Similarity	0.671 0.658	0.667 0.589	-	-	-
Propose work	F-measure Similarity	0.813 0.792	0.833 0.881	0.857 0.878	0.811 0.842	0.786 0.779

B. Moving Objects Detection Assessment

The main contribution of key frames detection based motion detection MOSI algorithm is represented by adapting the corresponding comparison technique between the sequence frames instead of pixel by pixel comparison technique. Furthermore, the standard deviation measure that adopted in the comparison technique exhibits an accurate results for moving parts detection process. Table 2 illustrates the experimental results of the proposed motion detection algorithm based on statistical information MOSI. Its described the decreasing of storage space in megabyte (MB) and time duration of the new video files when motion detection process is applied over the stream video. The quantitative results of moving objects detection for several video files are demonstrated in Fig. (11). These quantitative results are acquired by plotting the standard deviation differences in (y-axis) for all video frames (x-axis). The first column represents the frames differences along the original video, the second column represents the frame differences along the new video file (after applying moving objects extraction algorithm). From the experience, we notice that new video file composed of the moving objects only which is caused a drop in the storage space of the captured videos.

Table 2: The qualitative results of motion detection algorithm for each video file

Video	Original video size (MB)	New video size (MB)	Original video Number (frame)	New video Number (frame)	Original video duration(sec)	New video duration(sec)
V1	73.3	32.1	1960	540	61	17
V2	35.2	12.5	921	352	30	7
V3	46.6	20.9	1233	580	41	10
sofa	**604**	**3.2**	**2750**	**814**	**134**	**9**
office	**506**	**6.17**	**2050**	**703**	**102**	**15**

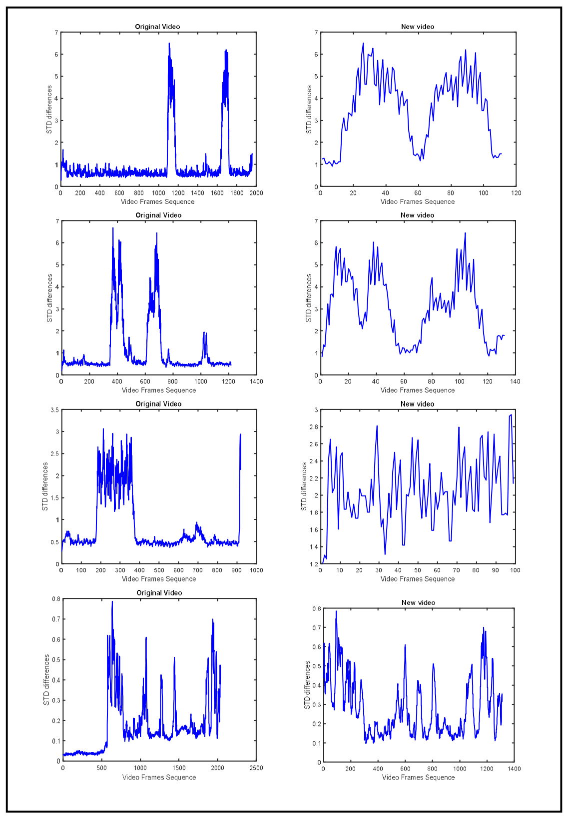

Figure 11: *The qualitative results of the proposed motion detection algorithm based on standard deviation, each raw represent a video sample, the first column represent the original video, the second column represent the new video file after detecting motion and extract the key frames.*

10. CONCLUSION AND DISCUSSION

The assumption implicit in this paper was to develop a home surveillance system in order to assist the user surveillance his/her home remotely with low cost components. The presented home surveillance system based essentially on moving objects detection and extraction from real time video to store these moving regions only in SD card memory device and nimbus cloud server at the same time in order to minimize the storage space needed. From the experiments, the presented surveillance system exhibits a satisfactory performance with comparatively low cost. A modified solution for moving objects extraction based on motion detection in the video sequences is being intended and implemented for real time surveillance system instead of using motion sensors or build in motion library. The proposed home surveillance system consist of multiple module written in Html, Python and Matlab programming languages. We have employed a statistical information to detect the differences between the sequence frames. The motion detection decision is based essentially on key frame extraction technique. The obtained results related to motion detection procedure proved a fast and accurate indication of occurring motion through the video sequences. Moreover, we have adopted a background frame model that integrate the current frame and previous background frame in term of linear equation. The background model construction is updated and conducted at each three frames in order to minimize the computation time and avoid the static objects in the captured scene. The main contribution of MOSI algorithm is characterized by adapting non-overlapped block matching technique instead of pixel based matching techniques in order to retain the moving parts only of the sequence video and reduce the storage space, processing time. The obtained results proved the effectiveness of the presented approach in extracting the moving parts only with less storage space and processing time than the existing motion detection methods.

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