Optimization of Surveillance Camera for Low Cost Storage Device

M. Porpavai[1], S. Ramya[2], V. Rajesh[3], Ms. R. Birundha[4]

[1,2,3]*Student ,Final Year B.E- ECE, Valliammai Engineering College, Tamilnadu, India.*

[4]*Assistant Professor, Dept. of ECE, Valliammai Engineering College, Tamilnadu, India.*

ABSTRACT - *In surveillance, CCTV camera is more costly because of the use of computer. It reserves too much space for continues recording and also require manpower to detect the unauthorized Activity. By comparing to the existing system Raspberry pi system is much cheaper with better resolution and low power consumption feature. Here Motion Detection Library is used as a simple but powerful people presence triggers. This system is only suitable for small personal area surveillance such as personal office cabin, bank locker room and parking entrance. Whenever the motion is detected through Motion Detected inside the room the image is captured through camera and temporarily stored in the raspberry pi module. Application under IOT (Internet of Things) can be used remotely to view the activity and get notifications when motion is detected. System works standalone without the PC once programmed. One Internet browsers is used to get the notification on motion detection.*

***Key Words*: Storage optimization, Raspberry Pi, USB Camera, CCTV, Redundant frames.**

1. INTRODUCTION

Surveillance cameras are the basic requirements for the security of any place. After certain period of time, the memory space should be upgraded which leads to high maintenance cost. Hence the video size is optimized by removing unwanted video frames. Our project is to design and implement an intelligent system that accepts input as a video sequences. The video sequences are subdivided into the frames. The adjacent frames are compared then they will store the frames that are not similar to each other. This approach will optimize the storage as well as maintain the information quality. Whenever the motion sensor detect an image then the camera will turn on, take the image using the surveillance camera by image processing technique.

Image processing is basic methods of converting image into digital form. Digital capturing is more popular because of the captured video by digital surveillance cameras is very easy to track and analyze with object detection and content analysis tools. The captured video is sent to the server for further processes.

2. LITERATURE REVIEW

In literature [6] IOT based system, its advantages, uses, email notification are discussed and cloud is used to store data in image processing, literature [7] discusses about image data transfer to the android device with limited distance constraint.

According to survey on video surveillance and storage by HIS technologies [5], there are 245 million CCTV cameras installed all over the world in 2014. Out of which 71% are from Asia. A CCTV camera generates a video at its low quality is generally recorded at 352X240 resolution and 30fps occupies 10GBs of storage in 1 day which leads to 1TB of storage in 138 days. In 2012, Seagate [4] submitted a technical review paper, where compression techniques are done to store the CCTV footage which results in loss of quality and does not affect much on size. So, they suggested using backup plus option by Seagate. In closed circuit camera the use of heterogeneous training data and more data is explored to use the transformation parameter in object space to automatically model and predict the evolution of intrinsic parameter of the cameras. Therefore, to adjust the detector for better performance [3].In recent researches done on this topic, cloud storage is suggested for CCTV camera. But it requires fast internet connection in every CCTV cameras.

In literature [8] the continuous monitoring of the videos is not required for surveillance camera where video frames are compared to each other. This requires fast object detection and identification of unusual activities. While comparing if any intrusion is detected then the authorized person is notified. Due to the general stationary characteristics of surveillance video data, motion detection has been widely used where the motion fields and motion vectors are extracted from the data and the statistics is analyzed to detect unusual objects and activities. After identifying the objects, the system can track the objects using trained statistical models. Tracking across frame involves matching the objects characteristics along the sequences. Kalman filters and HMM (Hidden Markov Model) filters have been proposed for tracking purpose. The behavior of tracking system is able to analyze and understand the behavior of objects and send real time alert. Hence the captured videos have been transmitted, in real time and reliably, over wired or wireless network, which possess an even big challenge than the storage issues. The transmission of surveillance video by reducing the size of the video with small quality losses, improves the accuracy and efficiency of the surveillance system. And literature [11] suggests email alerts to the in charge person with short message service using e-mail.

3. PROPOSED METHODOLOGY

The aim is to make smart motion surveillance system which can be monitored by owner remotely through android applications. As it is connected with the system, the system will send push notifications to android device when an intrusion is detected. It is necessary to develop and implement an affordable low cost web-camera based surveillance system for remote security monitoring. An authorized user can access to their monitoring system remotely through internet with the use of a mobile phone and monitor the situation. This entire work is done by using Raspberry Pi with Raspbian operating system.

The main objective is to propose a system to optimize the storage and as well as to maintain the information quality. The camera will continuously capture the images. The video sequences are divided into subsequent frames. The adjacent frames of the video sequence are compared. Then the system will store the frames that are not similar to the adjacent frames. In this work, Python is used as the platform for implementing the various image processing and computer vision techniques.

4. BLOCK DIAGRAM

4.1 Transmitter

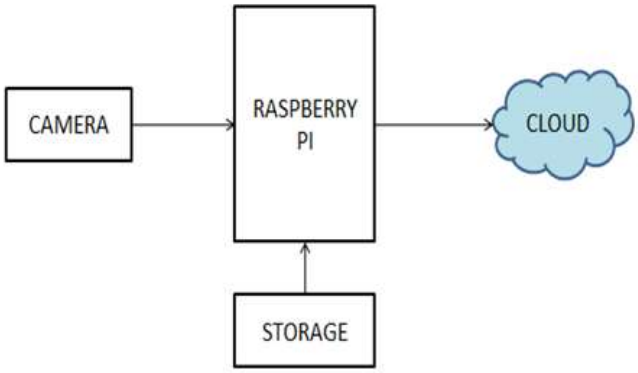

Fig 1: Block diagram of Transmitter

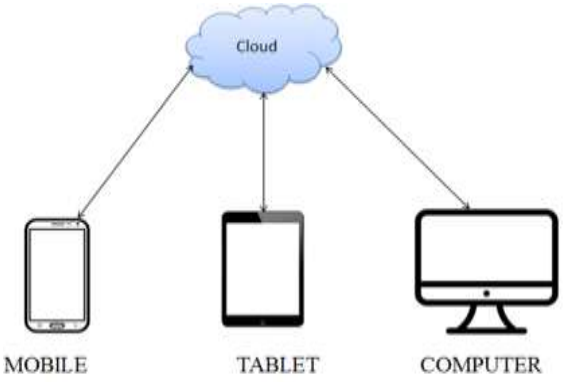

Fig 2: Block diagram of Receiver

5. WORKING PRINCIPLE

This project consists of four modules. They are

- Extraction of the frames from the video sequence.
- Comparison of the adjacent frames of video sequence.
- Combining the non-similar frames of the video sequence.
- Sending an alert mail to the receiver regarding the motion detection.

The project implementation includes the following steps

Step 1: Setting up of the Raspberry Pi

After getting the Raspberry Pi, SD Card is written with its OS. Then the Micro USB Power Cable is attached along with the Raspberry Pi with monitor through HBMI cable. Then the keyboard and mouse are connected with it.

Step 2: Making the Raspberry Pi operate without monitor, keyboard and mouse.

The Raspberry Pi is made to be connected with internet without any PC. Through Putty the system works in standalone mode, this helps to access the command window of Pi.

Step 3: Installation of the VNC Viewer

The VNC Viewer is installed in the system. After installation, the IP address of Raspberry Pi is dynamically entered to operate the Pi through PC.

Step 4: Running the VNC Viewer

It is necessary to ensure that the VNC starts automatically, as it enables the working of the system remotely with GUI display of Pi.

Final Process is as follows

- **Motion Detection**: The Python helps to find the difference between the last frame and the present frame.

- **Sending Notification**: When the motion is detected, it will send the notification to the receiver by means of alert mail, along with the motion detection video.

6. HARDWARE DESCRIPTION

6.1. Raspberry Pi

The Raspberry Pi is a **credit-card sized computer** that plugs into a computer monitor, and uses a standard

keyboard and mouse. It is a very cheap computer that uses Linux, but it also provides a set of GPIO (general purpose input/output) pins that allows us to control electronic components. It is a capable little device that enables people to explore computing, and to learn how to program in languages. It has the ability to interact with the outside world, and it can be used in a wide array of digital marker projects.

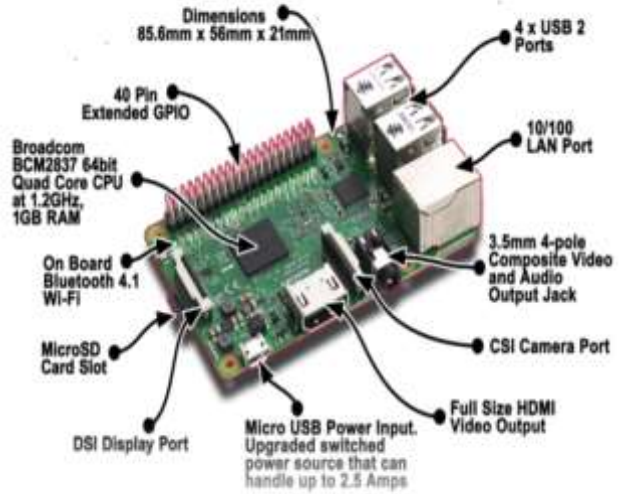

Fig 3: Raspberry Pi 3 Model B+

6.2. USB Camera

We use a normal standard USB webcam to take the pictures and video on the Raspberry Pi. The quality and the configurability of the camera module is highly superior to a standard USB webcam. We can also use "IR camera" instead of USB camera for "Night Vision".

Fig 4: USB Camera

7. SOFTWARE DESCRIPTION

Python is an interpreter, high level, general purpose programming language. Python's elegant syntax and dynamic typing, along with its interpreted nature, makes it an ideal language for the rapid application development in most platforms. It is the Raspberry Pi's recommended programming language. Linux is one of the open source software. It is the Raspberry Pi's recommended operating system; it is also based on Linux Kernel. Every flavor of the Raspberry Pi uses Raspbian. Raspbian is the Debi an-based computer operating system for Raspberry Pi.

FLOW CHART

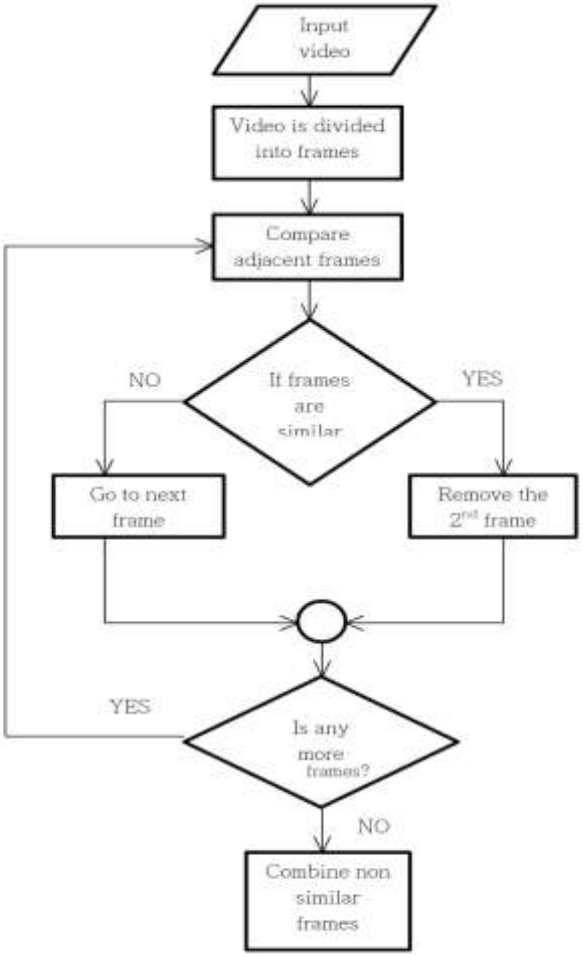

Fig 5: Flow Chart of the video recording

8. EXPERIMENTAL RESULTS

The main objective is to minimize or optimize the storage space occupied by the CCTV footage based on the redundancy of the adjacent frames.

The compression is done by deleting the non-similar frames from the input video sequence. After the compression techniques are applied, the output video is of shorter duration. Due to compression the duration of the video is reduced to about 60%. The alert mail is sent to the

receiver, regarding the motion detection.

- Normal camera - 24/7- activity 30% - 1GB
- Time camera - 12/7- activity 30% - 500MB
- Motion detection by Frame comparison

-24/7- activity 30% - 300MB

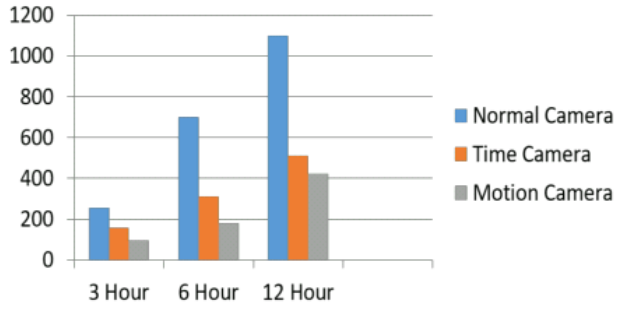

Fig 4: Comparison of the memory storage of various cameras.

9. ADVANTAGES

- Increase cyber security by using Linux based software.
- Core level image processing by raspberry pi will increase quality and security in recording.
- Reduce memory space with increased quality of camera view.

10. APPLICATIONS

- It can be used in small personal area surveillance. I.e. Personal office cabin, Bank locker room, Parking entrance, etc.
- It can also be used in Army surveillance, Space research.
- It can also be used in high dense areas. E.g.: Mall, Traffic signals.

11. CONCLUSION

It is designed in such a way that the CCTV surveillance system can fulfill the needs of the user. It is designed mainly to optimize the storage for Closed-Circuit Television (CCTV) because the storage is a real challenge with increasing market demand. The system has countless applications and they can be used in different environments and scenarios.

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