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Intelligent system for storage optimization of video surveillance using in-camera processing

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ABSTRACT

Closed-circuit television (CCTV) is a useful technology that is mainly used for security purposes. Closed-circuit cameras are used in public and private locations. Video captured by cameras is stored in the back-end on secondary storage devices such as hard drives, pen drives, and so on. Every day, a large amount of data captured by cameras is stored, but sometimes these data may be useless. For example, no activity is performed in private places at night, and since no activity is performed, installed CCTV cameras record video frames that are similar to each other (as the camera is not active) to record still images. For this reason, a large amount of storage space is wasted. To reduce archiving, we are developing an intelligent system that will compare video frames after a regular period of time. Frames will be compared to the side of the camera (a chip consisting of the algorithm to compare the frames will be integrated into the camera) and if the frames are not similar, they will be stored in the secondary storage device.

Keywords: Adjacent frames, CCTV camera, Image processing, Network bandwidth, Storage optimization.

I. INTRODUCTION

A storage management system optimized for video surveillance improves short and long term performance by eliminating unwanted data (video frames), minimizing the security of bandwidth accounting and providing flexibility and expandability to adapt to changes and to growth Our project is to design and implement an intelligent system that accepts inputs as video sequences that will be subdivided into frames. This information will then be used to analyze the frames and to discover the differences between the adjacent frames and then the system will only store the frames on the server that are not similar to each other. Using a step-by-step decision-making process, the system will be designed and implemented.

Image processing

Image processing is basically a method of converting an image digitally and performing certain operations on it, extracting information from it or obtaining an improved image. It is a type of signal delivery where the input is an image, such as a video or photo frame, and output can be an image or functions associated with that image. In general, the image processing system includes image processing as two-dimensional signals while applying a signal processing method already configured. Today it is one of the fastest growing technologies, with its applications in various aspects of a company. Image processing is also part of the central research area within the engineering and information technology disciplines.

The image processing consists of the following three steps.

- Import the image with digital photography or optical scanner.
- Manipulation and analysis of images that includes data compression and optimization of images and detection patterns that is not for human eyes, such as satellite images.
- The last stage is the result where the result can be a modified image or an image analysis report

II. LITERATURE SURVEY

At this time, the use of heterogeneous training data and more data is explored to improve its detection rate in closed-circuit camera scenarios. In addition, it is proposed to use the transformation parameters of the object space to automatically model and predict the evolution of the intrinsic parameters of the camera and, therefore, to adjust the detector for better performance. The proposed approaches are tested on publicly available data sets and real CCTV videos [1].

This work aims to exploit the CCTV security system to allow advanced services not only for surveillance, but also for security, automatic air conditioning, and electronic ticketing. The new system has minimal installation and hardware costs, as it uses CCTV cameras already installed. In addition, an integrated EAP (acquisition and processing) node is used for each wagon, consisting of a video multiplexer and a digital signal processor that implements advanced service algorithms such as: smoke detection, to provide timely alarm in case of fire, or detecting people for people counting or fatigue detection for the driver. The information is transmitted by each EAP node to the train information system. Final terminals can be tablets for train personnel and / or display screens in each car in case of fire alarm for passengers [2].

The investigated operators are key components of a Closed Circuit Television (CCTV) system, which is the link between system technology and its effective use. Operator performance will largely determine the level of service provided by the system. There have been few studies demonstrating the performance of the operator, while much work has been done to test the performance of the technology. Previous work on CCCC operators performed by the HOSDB (Home Office Scientific Development Branch) used video and subjects that knew they were tested, which means that subjects will most likely concentrate more on good performance [3].

In this document, a closed-circuit digital transmission (CCTV) system called high-definition serial interface (ER-SDI) is proposed to improve transmission distance and maintain quality. The current HD-serial digital interface (HD-SDI) has a maximum transmission distance of 200 m. The proposed ER-SDI provides a

transmission distance of 518 m using multilevel constellations and a channel code for a transmission speed of 1.5 Gaps. Its required bandwidth is only 337.5 MHz for coaxial cables [4].

From this document, they refer to the attraction of automatic real-time surveillance is obvious: it maximizes the efficiency and effectiveness of security personnel and resources while increasing the likelihood of preventing a serious security breach. Artificial vision solutions have the potential for very discriminative detection and very low false alarms. The conclusion is that the applied computational vision has the potential to get the best return on investment (ROI) both short and long term [5]. In our project we propose to monitor the CCTV footage. First we will break the captured CCTV footage into frames and will then compare the adjacent frames over a particular time difference. If frames are identical then those frames will not considered and only the frames which are not identical to each other will be sending to the server. This entire computation will be carried out with the help of Raspberry Pi which will be mounted on or inside the CCTV camera.

III. HARDWARE INTERFACES

CCTV (Closed-Circuit Television):

TV (closed circuit television) is a television system in which signals are not distributed publicly, but are monitored, mainly for surveillance and security purposes. CCTV is based on the strategic positioning of the cameras and the observation of the camera's input on monitors somewhere. As camcorders communicate with monitors and / or video recorders via private coaxial cable routes or wireless communication connections, they obtain the designation "closed loop" to indicate that access to their content is limited to the design only for those who can see it Older CCTV systems used low-resolution black and white monitors with no interactive functions. Modern CCTV screens can be in color, on a high resolution screen and can include the ability to enlarge an image or trace something (or someone) among its features. Talk CCTV allows a supervisor to talk to people within range of the camera's associated speakers.

CCTV is commonly used for a variety of purposes, including:

- Maintaining perimeter security in medium- to high-secure areas and installations.
- Observing behavior of incarcerated inmates and potentially dangerous patients in medical facilities.
- Traffic monitoring.
- Overseeing locations that would be hazardous to a human, for example, highly radioactive or toxic industrial environments.
- Building and grounds security.

Applications of CCTV

Probably the most widely known use of CCTV is in security systems and such applications as retail shops, banks, government establishments, etc. The true scope for applications is almost unlimited. Some examples are listed below.

- Monitoring traffic on a bridge.
- Recording the inside of a baking oven to find the cause of problems.
- A temporary system to carry out a traffic survey in a town centre.
- Hidden in buses to control vandalism.
- Recording the birth of a gorilla at a zoo.
- Making a wildlife program using a large model helicopter.
- Reproducing the infrared vision of a goldfish!
- Aerial photography from a hot air balloon.
- Production control in a factory.

Raspberry Pi

The Raspberry Pi is a mini computer that was specifically created to make tech learning easier. It has a lot of components for computer-based projects, like USB ports, an Ethernet port, an SD card slot, Wi-Fi antenna ports, and more. It does not come with peripherals, like cables, a keyboard, a mouse, or a monitor. It is a great for learning program languages, like Python, Scratch, and Wolfram. Most Raspberry Pi enthusiasts like making single-process builds to show o their do-it-yourself talents. There are four different models of Raspberry Pi. The Pi 2 Model B or Pi 1 Model B+ are ideal for beginner projects because they are the most versatile and have the widest range of capabilities. The Pi 2 Model B has the added bonus of having a quad-core processor and 1 GB of RAM so it supports heavier operating systems, like Ubuntu and Microsoft 10.

Technical Specifications of the Raspberry Pi:

- Broad-com BCM2837 64bit ARMv7 Quad Core Processor powered Single Board Computer running at 1.2GHz
- 1GB RAM
- BCM43143 Wi-Fi on board
- Bluetooth Low Energy (BLE) on board 4 x USB 2 ports
- 4 pole Stereo output and Composite video port Full size HDMI
- CSI camera port for connecting the Raspberry Pi camera
- DSI display port for connecting the Raspberry Pi touch screen display Micro SD port for loading your operating system and storing data
- Upgraded switched Micro USB power source (now supports up to 2.4 Amps

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IV. FIGURES

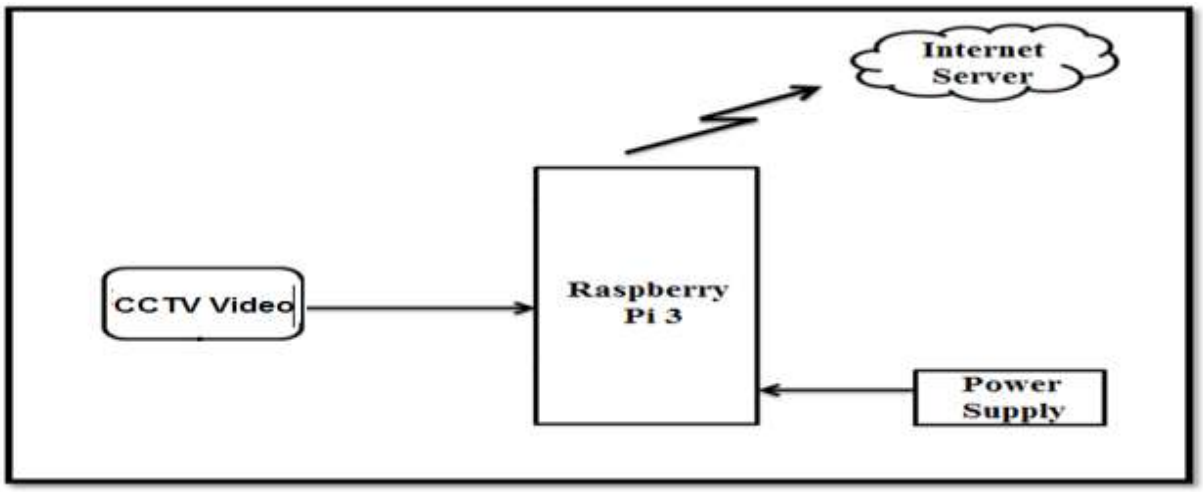

Fig 1: System Architecture

Fig. 2: CCTV camera

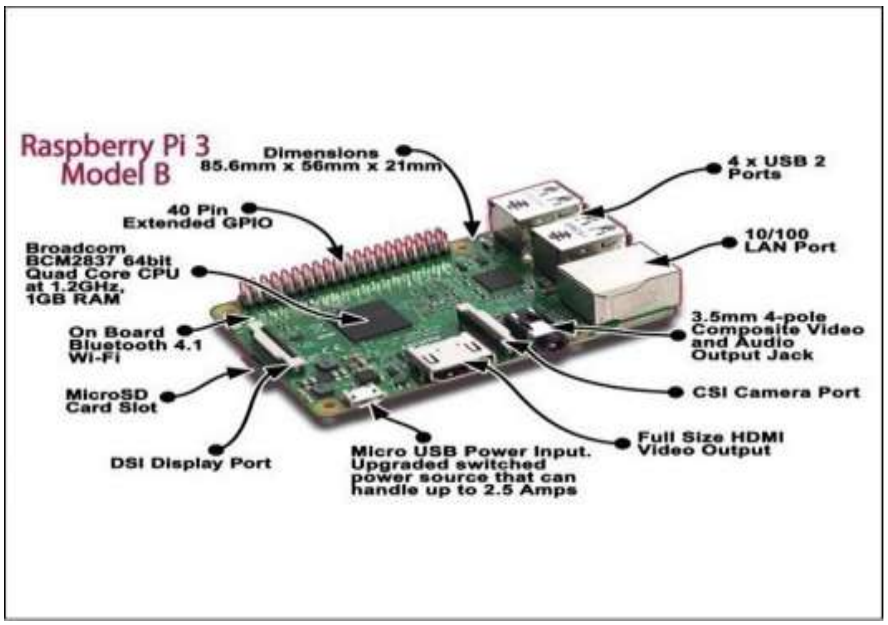

Fig. 3: Raspberry Pi 3 board

V. CONCLUSION

The project is intended to reduce storage space required to store CCTV footage, which consumes large amount of memory and also intends to reduce the bandwidth utilization for storing this frames on the network. Unnecessary frames are being removed to optimize the system storage. This approach will optimize the storage while maintaining the information as well as quality of the video clip.

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