Design For Motion Detection System Based On Embedded Linux Using Arm

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Abstract: The design of motion detection system based on embedded Linux. The architecture and working of this system is introduced in details, and introduces the image processing, the conventional video detection system is improved. The motion detection system will make use any camera interfaces with ARM microcontroller. The main disadvantage of this type of systems is they will continuously capture or continuously record the video and it will not check whether any object or person or any other thing is present at that location or not. So it will cause wastage of power of the total motion detection system and at the same time wastage of the memory used to store the data base of the captured image or video. To overcome this we had designed. In this paper we are developing camera connected to a ARM. After the captured video is processed by the detection module, they are transmitted to a local host or the data is stored inside the pen drive connected to the USB port.

Keywords- Motion Detection; Image Processing, ARM, Embedded Linux

1. INTRODUCTION

Motion detection system [1] is being developed towards the trend of the intelligence and the miniaturization. Image processing technology plays a key role to support motion detection. On the other hand people have developed many portable and low -cost digital products on the development board. Which is capable of processing video image? That makes it Possible that motion detection system becomes smaller. As a result, the efficiency Of motion detection is better and people's workloads are reduced greatly.

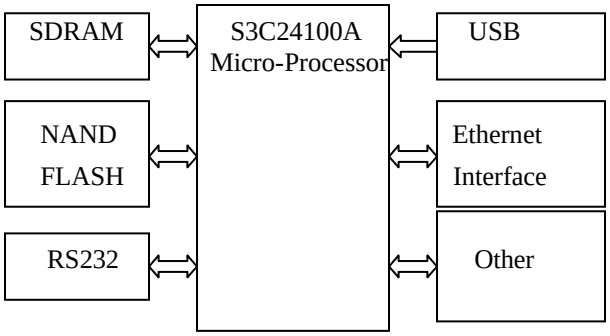
The design for the embedded-motion detection system involves various aspects such as the selection of the hardware platform and the embedded operating system. Besides these basic conditions, the motion detection algorithm as the brain of the whole system is vital yet. Once an unknown motion object invades the surveillance scene, the detection algorithm will run to analyze the captured image and estimate the unknown target. Based on that analysis, the system will make decision whether to send an alarm to monitoring center. In this paper, we will discuss how to build up the hardware and software platform based on embedded development. To improve the systemic performance, we will introduce not only how to select the detection algorithm, but also how to optimize it. By that, the detecting effect is expected to be promoted to a certain extend.

II. HARDWARE AND SOFTWARE PLATFORM

The development board with Samsung S3C2100A microprocessor [3] is selected as the hardware platform. CPU frequency is up to 203MHz in the board. Start-up codes, OS kernel and users' application programs are

together stored in a NAND FLASH whose capacity is 64MB. Application programs run in 64MB SDRAM, which can also be used as the room of various data and the stack A CMOS camera capturing videos is connected to a USB interface in the board. After the captured video is processed by the detection module they are transmitted to a local host or the remote monitoring center on Internet from a 10Mbps' Ethernet interface.

The embedded Linux2.6.12 is a kind of miniature operating system, which is designed for the demand of the embedded OS [4]. It has some advantages such as small code amount, fast running speed strong stability and so on. And this OS cuts out the normal Linux and becomes much smaller in size. It can even be solidified in a memory chip with a few KB or MB. The kernel of Linux2.6.12 can be customized by development engineers in terms of the actual demand. So it is regarded as the ideal software platform to develop embedded application programs



Hardware System Architecture

S3C2440A Processor (Friendly ARM9)

Today, the ARM family accounts for approximately 75% of all embedded 32-bit RISC CPUs making it the most widely used 32-bit architecture.S3C2440 is a Samsung company's microcontroller which is designed based on the structure of ARM 920T family. This microcontroller works for an voltage of +3.3V DC and at an operating frequency of 400 MHz The maximum frequency up to which this micro controller can work is 533 MHz We cannot get S3C2440 microcontroller individually. We will get it in the form of FRIENDLY ARM board otherwise we can call it as MINI 2440 board.

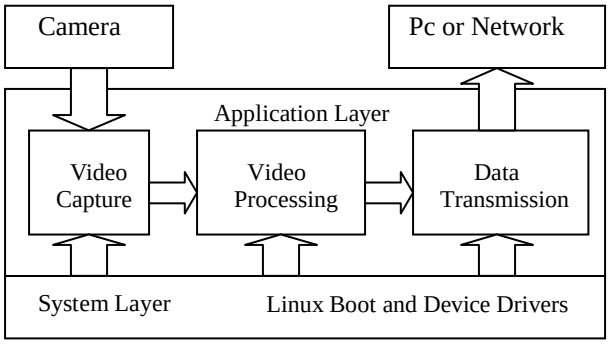
III.SYSTEM PROCESSING AND OPERATION

The software development mainly includes the system-layer and the application-layer two levels. The main duty of system-layer software involves start- up programs of Linux2.6.12 and low-level drivers for various devices in development board (e.g., camera, USB interface and network card). The design for application-layer software mainly includes three modules, namely, Video Capture Module, Video Processing Module and Data Transmission Module. The function of every module is as following.

1) Video Capture Module. Receive video streams from the camera and transmit this bit-stream to the Video Processing Module

2) Video Processing Module. Check up video streams and process images in video according to a detection algorithm. It is the hardcore of the entire system. When the surveillance scene is changed, it will decide to whether to send out an alarm. .

3) Data Transmission Module. Output the processed result from the network interface to a local host or monitoring center on Internet



System Processing Framework

Our software architecture is based on C/S mode. As the server, the detection system in the target board transmits video data to the client on Internet or local host. After a system-layer program is firstly loaded and starting application-layer programs will run to capture video images by camera. Having been processed, video images (sometimes with an alarm) will be transmitted to the client where watchers can observe the monitored images.

ALGORITHM:

1) Background Subtraction Algorithm. Build up an initial model of a static scene and make the current image in video subtract the static image in initial model. As a result, the background of the image is going to be eliminated, and then the motion object is going to be segmented and detected.

2) Optical Flow Algorithm. Segment motion objects in terms of the dispersion characteristics of optical Flow. The motion objects only exist in these places where the optical flows are a lot different from the other locations.

3) Image Difference Algorithm. Capture continuous images in video and have the current image subtract the next one. The places where the difference values of two images are beyond a critical number will be regarded as motion object's location

Image Difference Algorithm works well in many static or variable scenes. It has been widely applied due to less calculation and quick speed in real-time processing. But there still are some shortcomings with this algorithm. In the following situation, the algorithm may fall in malfunction and the detection result may be unreliable yet.

A) If motion objects move slowly, the changes of two images can be very little. As a result, motion objects may not be detected.

B) In image, the segmented area (regarded as motion objects) is usually bigger than the real object's. So this may result to locate motion object in the inaccurate position.

C) The algorithm is easily interfered with the image noise, which can bring errors and affect the Precision of the threshold value

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IV. RESULT ANALYSIS

They have lot of tests done for motion detection system. The test scene is located in the street and our system will keep monitoring a certain region of the street by camera. After all drivers and application programs are loaded to the target board, video data are successfully transmitted to our host screen from the Ethernet interface in that device.

The background image is initially inputted to the system model. If a motion object breaks in the surveillance region, the detection system will create the difference image, analyze the processed results and decide whether to send an alarm to the monitoring center.

(a) Background image

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B) Motion Object

The difference image is comparatively smooth owing to removing noise and morphology processing. An alarm is quickly sent out to our host.

V. CONCLUSION

This paper'' Design for motion detection system based on embedded Linux using ARM'' has been described. It has been eliminates the wastage of power motion detection system and the wastage of memory. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM9 board and with the help of growing technology the system can be successfully implemented. This system finds more applications in ATM, military & defense cell.

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