Implementation of A Low Cost Motion Detection System Based On Embedded Linux

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Abstract: **In the world of computing, resources utilization along with flexibility, scalability, robustness and security are the important issues as with cost and maintenance. Motion detection system is developed towards for intelligence, minimize the system and reduce the cast of equipment. That makes it possible that motion detection system becomes smaller. As a result, the efficiency of motion detection is better and workloads are reduced greatly. Here how to build up the hardware and software platform and to integrate the hardware module and software module by using Linux operating system and to improve the exits system performance by algorithm optimizing techniques.**

The embedded Linux is a kind of miniature operating system, which is designed for the demand of the embedded OS. It has some advantages such as small code amount, fast running speed, and strong stability.

Keywords: *Image processing; Embedded Linux; Open CV library; Detection algorithm.*

I.INTRODUCTION

Motion detection [1] system is implemented Due to the current rise of crime rates, surveillance alarm and security systems are in demand. There are immediate needs for more reliable surveillance systems in commercial, law enforcement and military applications to enforce extra security measures. Video surveillance has been one of the most important security equipment and the most common device being used. However there are limitations as in what the today systems will be able to provide.

Implementation for the embedded-motion detection system involves various such as the selection of the hardware platform, embedded operating system and suitable algorithms. Hardware platform it's a combination of S3C24100A Processor device is developed by Samsung Corporation and CMOS camera device interface through USB port in the board. Two modes are there in ARM9 board, one is NOR mode and second is NAND mode, operating system run on NOR mode and Application's are run on NAND mode.

In this paper three modules are used one is video capture module, second is video processing module and third is data transmission module. The CMOS camera can be interfaced to S3C24100A ARM9 microprocessor through the USB port and continuously captures the video and transmits bit-stream to video processing module. The video processing module, it checks the video streams and it also compares the two frames according to the suitable detection algorithm. It is the hardcore of the entire system. When surveillance scene is changed, it will make alarm to rise. The data transmission module, data monitoring on host system or internet can be done.

II. HARDWARE AND SOFTWARE DESIGN

In this paper we used Samsung S3C24100A microprocessor as the hardware

platform. In this board start up codes, OS kernel and users application programs are together stored in a NAND FASH.application programs run in 64MB SDRAM [2], which can also be used as programs the room of various data and the task. A CMOS camera capturing videos is connected to a USB interface in the board. After that captured video is processed by the detection module. That is transmitted to local host or monitoring area.

The embedded Linux 2.6.12 is a mini operating system the advantage is it is only designed for embedded applications. it has some advantages, such as small code, running speed .strong stability and so on. This OS cuts from normal Linux. So it is the ideal soft ware platform for embedded application program. The ARM9 Block diagram shown in below fig [1]

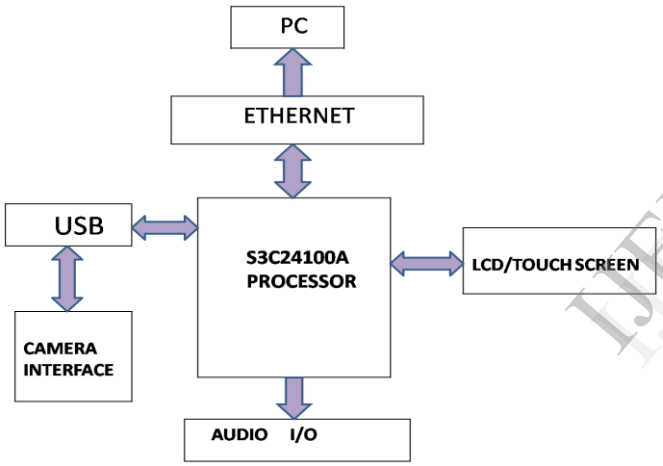


Fig.1.Block diagram.

III.RELEVENT WORK FOR PROCESSING FRAME WORK

In this we are mainly involving the two modules namely system layer and application layer [2]. The main work of system layer involves start-up programs of Linux and low level drivers in the development board like camera, data cards, and USB interface. The module names like.

1. System Layer.
2. Application layer.

The application layer mainly contains three modules those are

1. Video capture module.
2. Video processing module.
3. Data transmission module.

1). Video capture module receives the video stream from camera and transmits to the video processing module.

2). Video processing module processes the images in video according to the motion detection algorithm. This is the heart of the project.

3). Data transmission module transmits the output result from network interface to monitoring center.

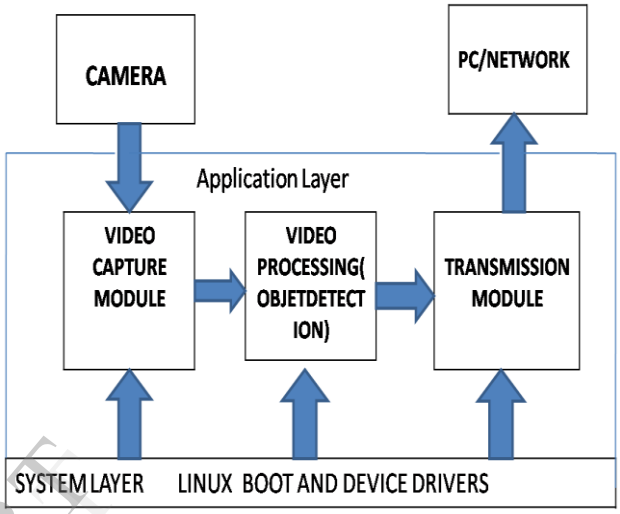


Fig. 2.System Processing framework

IV. OPEN CV (OPEN SOURCE COMPUTER VISION)

Open CV is a library programming mainly aimed at real time applications. It is a collection of c functions and c++class. The main advantage of the open cv, it is a open source. Here some modules are used those are:

cv--Computer vision algorithms.
cvaux--Experimental open CV functions.
highgui--Image and video I/O and GUI functions.

IV.1) Features of open CV

1. Cv.lib
   - i).Basic image processing.
   - ii).Structural analysis.
   - iii).Camera calibration.
   - iv).Motion analysis.
   - v).Object recognition.
2. Highgui.lib
   - i).Basic GUI.
   - ii).Image and video I/O.

iii).Image labeling.

IV.2) OPERATIONS ON IMAGES

1. Allocate and releasing images.
2. Reading and writing images from files.
3. Image conversation.
4. Access image elements.
5. Drawing commands.

V.MOTION DETECTION SYSTEM

Intelligent visual surveillance system can be used many different methods for detection of moving targets, a typical method such as background subtraction method, frame betweens method. The process flow of motion detection system is shown in below fig3.

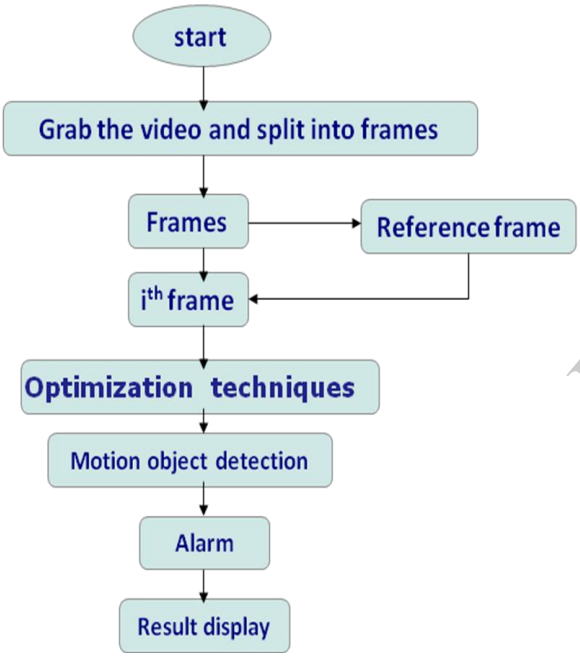


Fig3.Flow chart for motion detection system

V).1.BACKGROUND SUBTRACTION ALGORITHM

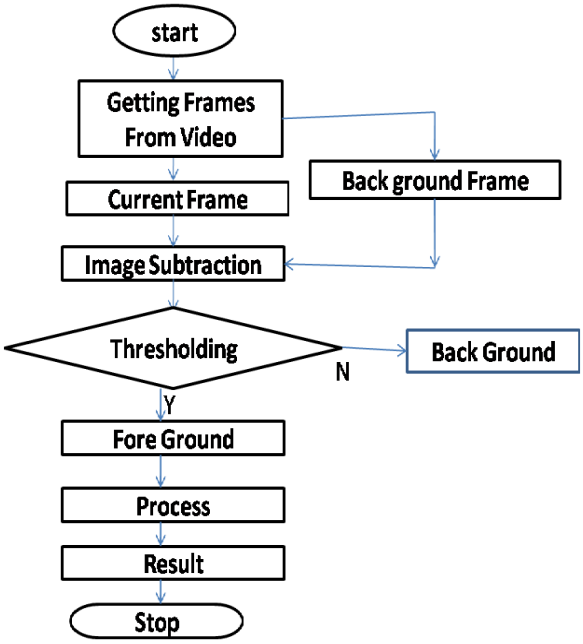


Fig4.Background subtraction algorithm

The basic idea of the first frame image taken as reference image. Then the current frame image f(x, y) with the reference image h(x, y) subtraction, and if the pixel difference is greater than the certain threshold, then it determines that the pixel to pixel on the moving target, or as the background pixel. The choice of threshold of the background subtraction to achieve the success of motion detection is very important. The threshold value is too small will produce a lot of false change points, the threshold choice is too large will reduce the scope of changes in movement. The appropriate threshold request be adapt with the impact which be had by scenes and camera on the wavelength of the color, the changes of light conditions, so the choice of the threshold should be selected the method formula is shown as.

$$g(x, y) = f(x, y) - h(x, y)$$

Here g(x, y) = foreground image.
f(x, y) = current image.
h(x,y) = reference image

a. Input image

b). Motion object (difference)

From the above screenshot we can see that the advantages of difference method is the computation of small, fast, simple, low complexity of program design. It is only sensitive to the movement of objects. In fact, only detect relative motion of the object. Because there is a very short time interval between the two images, and the impact of the differential image by changes in light is small. So it is very suitable for detecting the motion objects.

VI. ALGORITHEM OPTIMIZATION

Back ground subtraction algorithm works well in static or variable scenes. It has been widely applied due to less calculations and quick speed in real time application processing. But it sometimes the algorithm may fall in malfunction and the detection result may be unreliable yet.

1) If motion object move slowly, the changes of two images can be very little as a result, motion objects may not be detected.
2) In image, the segmented area is usually bigger than the real objects. So this may result to locate motion object in the inaccurate position.

A). Image noise removing and morphology.

There is so much space-relatively among the adjacent pixels, where as the image noise is statistically independence. So such average grey level of pixel neighborhood can substitute the original value in the noise region. This method can remove noise effectively.

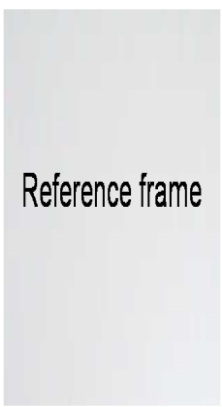
Next the image is going to be processed by morphology method. Some isolated points in the processed images are removed by the opening operation. And some small bulges in the difference image should be removed still. By the closing operation.

B).Adaptive thresholding technique**.**

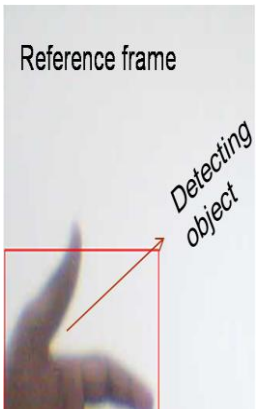
The key factor is the threshold t, which can be determining pixel attribute, namely, earthier motion object or background. The proposed coefficient between the motion object and the background is added to our improved method. When the co-efficient is less than 0.05, the probability of the occurrence of motion object will have been kept a constant value, namely properly increasing motion objects proportion to the image when their size become small.

VII. EXPERIMENTAL RESULT.

To improve the actual effect, a lot of tests have been done for our motion detection system. Here the background image is initially inputted to the system model. If a motion objects brakes the surveillance scene the detection system will subtract the current frame. If the object is detected an alarm are quickly sent our monitoring area.



a).input .



b). Output (motion object)

VIII.CONCLUSION

According to test result the motion object detection system is improved by the above techniques, however to design the perfect intelligent visual surveillance system. Our motion detection system increases the probability of sending reliable alarms and achieves the expected result effects.

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