# Panoramic Technique in the Video Monitoring System and Implementation

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***Abstract***

*Video surveillance [1] technology plays an important role in the security field, with its intuitive, convenient and abundant information and is widely used in city traffic, civil security and other various fields especially in the important safety departments or major events. In this paper, according to the video surveillance system features and functional requirements, we use embedded system, OMAP4460 and Android operating system on the basis of the panoramic [2] technology to realize vertical 180 degrees horizontal 360-degree panoramic video surveillance. In the paper we profoundly analyze and discuss the embedded panoramic video surveillance system mainly from the hardware platform structures, the design of the peripheral circuit and the panorama function implement.*

*Keywords: OMAP4460, Android, panoramic, technology*

## 1. Introduction

With the rapid development of digital video technology and network technology, video surveillance technology becomes more and more digital, intelligent and networked. The Intelligent surveillance technology includes moving target detection, tracking, target classification and behavior understanding, etc .At the bottom of the entire visual system, moving target detection and tracking are not only the basis and key of follow-up high-level processing such as target classification, behavior  understanding but also have a  pivotal role in the direction of the automatic navigation and the robot target acquisition, so they have aroused extensive research and discussion. With the embedded technology and wireless communication technology continue to mature, the use of mobile devices for remote surveillance has become the hot area of the surveillance research. Remote video surveillance is an important part of the smart home. When there is a particular need to focus on objects and venues in the family, the master of the family can install cameras, observe their conditions in their environment through the network and monitor the progress of events when the accident happens. Therefore we take the video surveillance as cut-in point to realize a mobile video surveillance system integrated the panoramic technology through the embedded system.

## 2. System Requirements and Hardware Design and Implementation
### 2.1.The Whole Structure of the System

The panoramic video surveillance system can achieve on-site real-time surveillance and data transmission functions through a wireless network and human-computer interaction module. The users can control the camera directly through the interface or operating system configuration. The system itself has higher requirements on the definition, real-time and maneuverability so it integrates video collection and processing module, man-machine interaction module and remote monitoring module. The overall system framework shown in Figure 1. Image definition and real-time are critical to the video surveillance system so the video collection and processing module applies a video capture chip DM642 and a number of IP cameras.

DM642 can well finish the video data compression, transmission and synchronization. In order to realize real-time we use IP camera which transmits 30 image signal flow per second via a standard Web browser in real-time and continuously fitted with a fisheye lens to realize panoramic snapshot. The man-machine interaction module consists of the capacitive touch screen and its driving circuit. Touch screen device requires high-speed real-time response and has a higher demand on the transmission speed when the hardware supports multi-touch, so the host computer and the touch screen module take use of SPI interface to communicate, the current speed can reach 960KH.
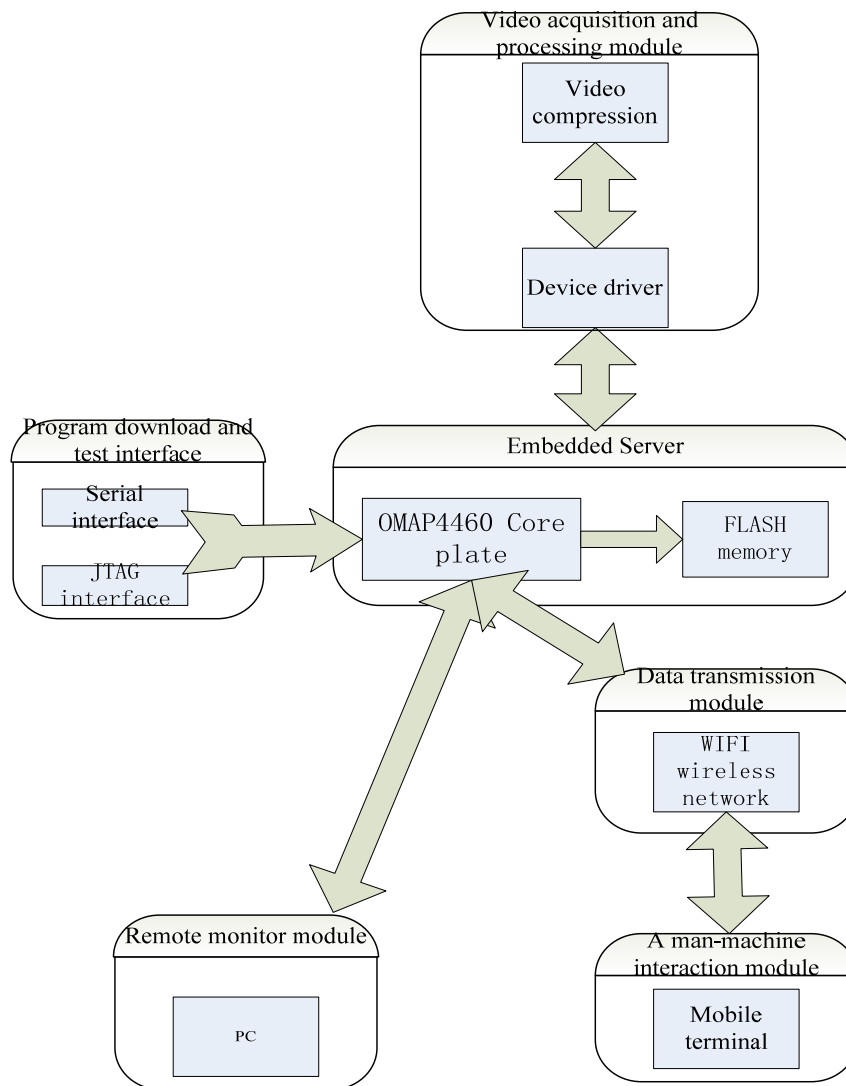
Figure 1. The overall system framework

## 2.2. The Video Collection Module

The video collection module is a DM642, it has three video port peripherals (VP0, VP1, VP2)and can be configured as a video capture port, video display port or transport stream interface collection port (TSI). The port consists of two parts- Channel A and Channel B. The port structure shown in Figure 2.
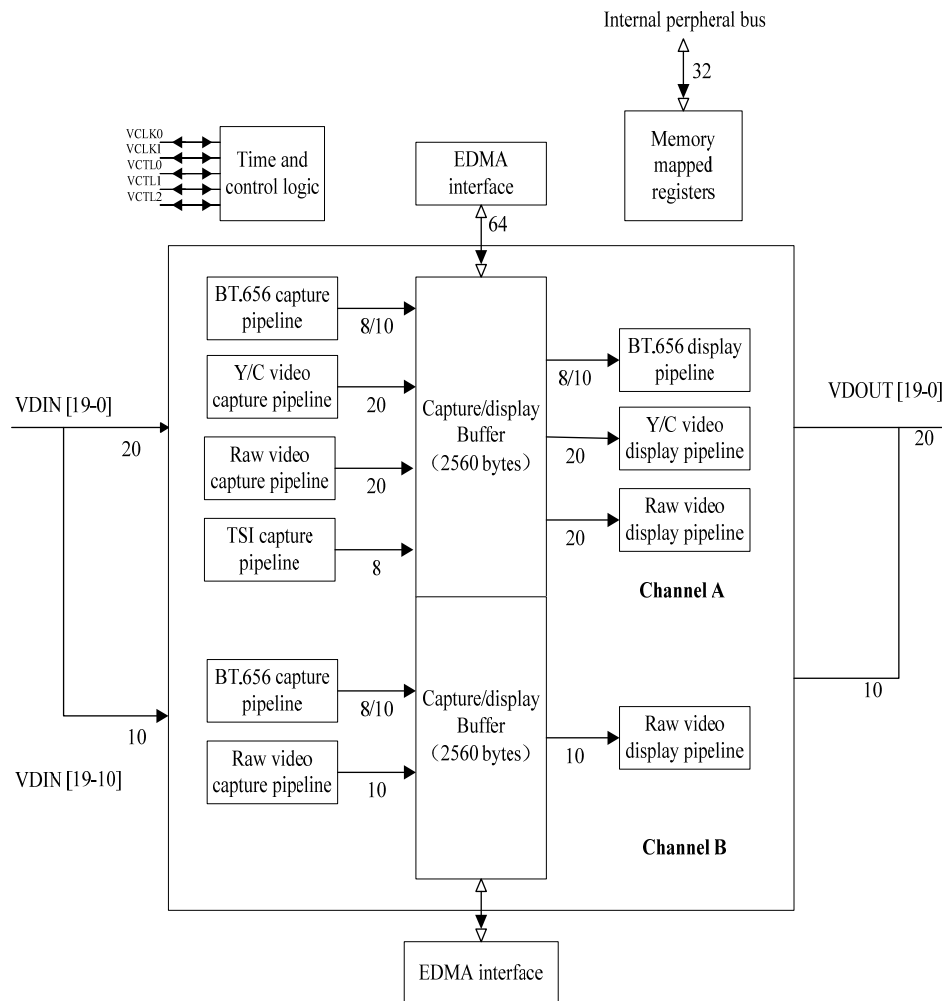
Figure 2.  The Port Structure

DM6423 Video Interface supports a seamless connection with a variety of video codec chips. Each video interface is composed of 20bit data line, and two input / output channels (A and B), two 2560-byte input / output cache control signal (VCTL0 VCTL1 and VCTL2) and clock signal (VCLK0, VCLK1). The control signal is used for video source sync signal (video capture enabled, the line synchronization, frame synchronization, field marks, etc.) input or output, clock signal for the clock signal input or output for video source. When we take the video interface as the video input port, the sampling frequency up to 80MHz and can be configured for the AB two 10bit or 8bit video input channels, a 16bit or 20bit Y/C image data input channel, a 20bit/10bit/8bit of the original video data input channel. When the algorithm code is implanted into the DM642 by CCS, the CPU can carry out these video data for a predetermined algorithm (such as negation, edge extraction, target orientation and the like) processing to achieve the right video processing functions.

## 3. Panoramic Technology
### 3.1. Panoramic summary
Panoramic technology [2] is developed rapidly in the global range and becomes gradually a kind of popular visual technology, because the visual panorama technology can bring people a new real sense of the scene and interactive experience. Panoramic technology also plays an important role in surveillance field. This paper establishes a complete set of video surveillance system based on the panoramic technique.

### 3.2. Panorama image stitching

In this paper, we use a method called "fish-eye" special lens for panoramic photography [3]. This lens in any direction is not less than 180 degree field angle and can cover the space of the scene of the entire hemisphere. Theoretically using this lens two times can complete the record of the whole scene. Obtained by calculating this panorama, you can get the disparity map of the whole scene, thus achieve splicing.



Figure 3. The fisheye panorama photo

Figure 3 shows the fisheye panorama [4] [5] photo. Panoramic image stitching [6] method includes full circle panorama stitching and the cyclotomic panorama stitching two. The cyclotomic panoramic image stitching generally requires four pictures in order to meet the requirements of 360 degrees in the horizontal direction, and each image has overlapping part, which is not conducive to the application of automatic mosaic algorithm, hence the paper take use of full panorama stitching method. After getting one pair of panoramic photos, firstly, circular fish-eye photo is logically divided in a uniform arc length for the longitude and latitude region and then each region is gradually subdivided to less than the pixel size, late the region in accordance with the angle is mapped to a regular rectangle region so that to complete the conversion by circular photos to panorama. Finally, two circular photos conversion of panorama are butt joint together to form the whole scene level 360 degree, 180 degree panoramic pictures.

A latitude of Fish-eye photo is actually a circular arc section ,the radius is $r$ ,we take a bit of $P$ (x,y) in the vertical line in the panorama at random ,then we need to calculate the corresponding arc location on $P^{'}$ ( $x^{'}$ , $y^{'}$ ).

First, calculate the arc radius:

$$r = (\frac{R^2}{x} + x)/2$$

Then, calculate the angle of arc and P point in the curve of angle:

$$\theta = \arcsin(\frac{R}{r})$$

$$\alpha = \frac{y}{R}\theta$$

Last, calculate the point coordinate in the mapped according to the trigonometry:

$x' = x - (1 - \cos(\alpha))r$

$y' = r\sin(\alpha)$

Figure 4 shows a panorama picture stitching formed by circular photos.

Figure 4.  Panorama picture stitching formed by two circular photos

## 4. System software implementation

The system is based on Android4.0 platform, therefore the picture display upregulation have used Android own surface class, to complete the picture display, after fully consider the process of adaptive we decided to application of automatic acquisition resolution method. Part of the code list is as follows:

```
import android.content.Context;
import android.graphics.Bitmap;
import android.graphics.BitmapFactory;
import android.graphics.Canvas;
import android.graphics.Color;
import android.graphics.Paint;
import android.graphics.Rect;
import android.util.Log;
import android.view.SurfaceHolder;
import android.view.SurfaceView;
import android.view.SurfaceHolder.Callback;
import android.view.WindowManager;

public class WelcomeView extends SurfaceView implements Callback {
        MainActivity activity;
        Paint paint;// Paint brush
        int currentAlpha;// The opacity value

        int screenWidth;// Screen width
        int screenHeight;// Screen height
        boolean mBTFlag = true;

        Bitmap[] logos = new Bitmap[5];// logoImage array
        Bitmap currentLogo;// Current logo image Quote
        int currentX;
        int currentY;
        public WelcomeView(Context context) {
                super(context);
                Log.d("MainActivity", "new WelcomeView()");
                this.activity = (MainActivity) context;
                // Set the callback
                this.getHolder().addCallback(this);
                this.paint = new Paint();
                // Load picture
```

```
logos[0] = BitmapFactory.decodeResource(activity.getResources(),
                    R.drawable.logo1);
logos[1] = BitmapFactory.decodeResource(activity.getResources(),
                    R.drawable.logo2);
logos[2] = BitmapFactory.decodeResource(activity.getResources(),
                    R.drawable.logo3);
logos[3] = BitmapFactory.decodeResource(activity.getResources(),
                    R.drawable.logo4);
logos[4] = BitmapFactory.decodeResource(activity.getResources(),
                    R.drawable.logo5);

// Made screen length and width
WindowManager
WM=(WindowManager)activity.getSystemService(Context.WINDOW_SERVICE);
        this.screenHeight=WM.getDefaultDisplay().getHeight();
        this.screenWidth=WM.getDefaultDisplay().getWidth();
}

public void onDraw(Canvas canvas) {
        Log.d("MainActivity", "onDraw()");
        paint.setColor(Color.BLACK);
        paint.setAlpha(255);
        canvas.drawRect(0, 0, screenWidth, screenHeight, paint);
        Log.d("MainActivity", "screenWidth:"+screenWidth);
        Log.d("MainActivity", "screenHeight:"+screenHeight);
        if (currentLogo == null)
                return;
        //canvas.drawBitmap(currentLogo, currentX, currentY, paint);
        canvas.drawBitmap(currentLogo, null, new Rect(0, 0, screenWidth,
screenHeight), paint);

};
```

## 5. Conclusion
This paper establishes a complete set of video surveillance system based on the panoramic technology. Testing proved that the system running smoothly, the testing results are satisfactory.

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