# Research of UAV Video Compression System based on DM6467

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## Abstract

**UAV is a kind of forward-looking low-cost,highly flexible platform,which has already been universally applied in domains such as television film shooting and disaster relief work.In order to encode and transmit its huge real time video data,this paper focuses on design of UAV video compression system based on H.264 and a high performance video compression equipment implementation based on Davinci platform.According to the characteristics of UAV video,the system chooses H.264 encoding algorithm,an algorithm which has a high compression ratio and capability of inhibiting errors,and it can well meet these requirements. The experimental results show that H.264 has obvious advantages over H.263 and MPEG4 in terms of compression performance and encoding speed.**

## Keywords

**UAV, H.264, DM6467, Video Compression.**

## 1. Introduction

Unmanned Aerial Vehicle (UAV),as a low-cost,highly flexible application platform,is widely used in plant protection [1],military navigation [2],film [3],aerial imaging [4] The UAV in a certain height and speed circumstances,the implementation of tasks,and video image capture. Video image information has a huge amount of data,in order to improve the ground observer recognition and transmission efficiency,the need for a high resolution and reduce the error of the video compression algorithm.As showed in Fig.1,when the flight speed of 300m / s,video frame rate of 25fps,PTZ camera angle of 5º,height is 300m,then the frame before and after the repeat range is about 50% [5].

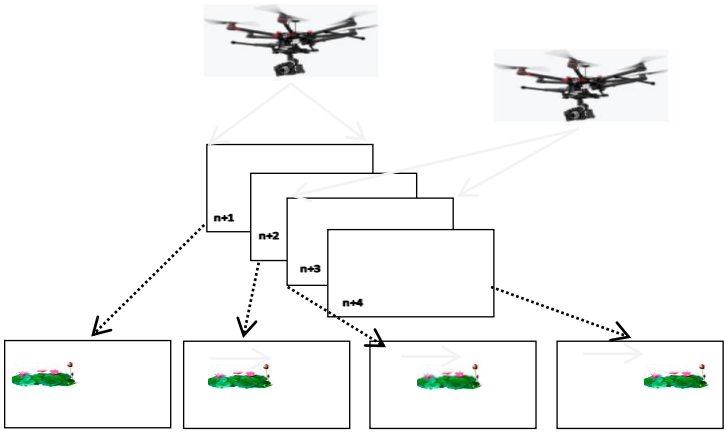


Fig. 1 System hardware design

## 2. Organization of the Text

### 2.1 H.264 Encoding.

H.264 gets a new generation of video coding algorithm, compared with the previous standard has a higher compression ratio and better image quality, can meet the UAV video compression system requirements[6].H.264 uses conversions and prediction of mixed coding, compared to H.263 or

MPEG4, when using the same bit rate, you can get a higher SNR, the rate down to 50%. Using a more accurate motion estimation and prediction algorithm, H.264 minimizes residual data by motion compensation and reduces entropy coding data to improve coding efficiency.

### 2.2 MPEG4 Encoding .

MPEG4 encoding is built on the object, that is, VOP (video object plane), which contains the shape information, texture information and motion information 3 kinds of information. MPEG4 on the VOP code is actually the VOP of the three kinds of information encoding, and the results of the synthesis of bit stream output [7].

It has the advantage that it makes it possible for the control object and the operation object to be possible, enabling content-based interaction (editing, operation, access, etc.), and the conventional encoding is frame-based, and it is clear that the object cannot be manipulated. Two can be used according to the importance of the object of a different compression ratio, in order to achieve efficient compression.

### 2.3 H.263 Encoding

The H.263 video coding standard is a low bit rate image compression standard intended for high quality motion image compression. H.263 uses the coding method common in motion video coding, and divides the coding process into two parts: intra-frame coding and inter-coding. I frame using improved DCT transform and quantization, in the frame between the use of 1/2 pixel motion vector prediction compensation technology to make the motion compensation more accurate, quantified after the application of improved variable length coding table (VLC) quantitative data entropy coding, Get the final coding coefficient [8].

It has the advantage of high compression rate, CIF format full real-time mode single occupancy bandwidth is generally around a few hundred, the specific occupation of bandwidth as the amount of movement on the screen and how much different. The disadvantage is the case that the quality is relatively poor, occupying the bandwidth with the complexity of the screen movement and greatly change.

## 3. System Hardware Design

We designed the UAV video compression system structure shown in Fig.2. Its function can be divided into the following sections [9,10]:

(1) video input processor: use the TVP5158 chip to receive image data from the camera,and then convert the analog signal to a digital video signal according to ITU.1120.

(2) core processor: This part of the choice of TMS320DM6467 processor,C64 work in 594MHz,ARM926EJ-S work in 297MHz. The core processor receives data from the video input processor,converts the data into a standard H.264 stream by using a H.264 encoder,and then saves it to the storage module.

(3) data storage module: it integrates in the DM6467 kernel SATA port,the various types of data written to a solid state disk (Solid State Drives,SSD).

(4) clock module: clock module using CDCE949 chip,according to the system configuration to provide the smallest clock unit for data storage module time reference.

(5) power module: select TPS54331D and TPS40192D two chips for voltage conversion circuit design. This module provides sufficient power for each module.

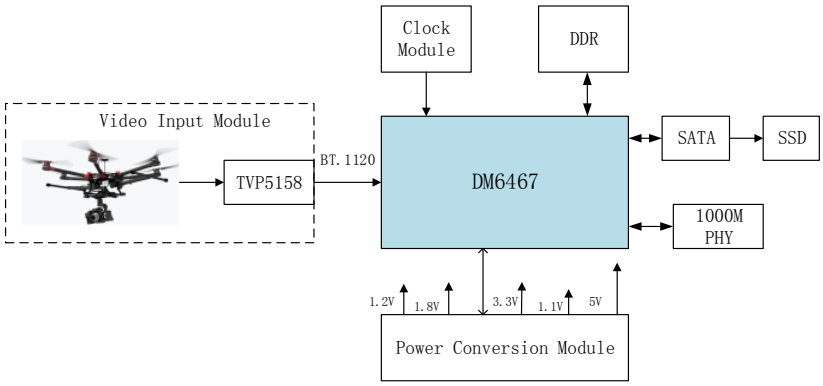


Fig. 2 System hardware design

## 4. System Software Design

The software design and development process based on the Davinci platform consists of four steps [11]: algorithm design, server, and codec engine and application design. The system uses DSP / BIOS for DSP to support the operation of audio and video algorithms, and uses MontaVista Linux (MV) on ARM to support its management of peripherals. The ARM-side program executes the codec algorithm on the DSP side through the VISA (Video, Image, Speech, Audio) API interface call provided by Codec Engine and returns the result of the algorithm execution to the ARM-side program via the VISA API interface. Fig.3 displays the VISA API during operation [12].

Applications include ARM and DSP-side software. ARM is responsible for VxWorks platform device driver, load DSP program and DSP interrupt handling. DSP is in charge of implementing the video coding algorithm.

(1) ARM-side call Engine_Open function, the executable program will be loaded to the DSP side, open a Codec Engine instance.

(2) The ARM side calls VISA Create, creates a Codec algorithm instance corresponding to the Codec Engine instance, and returns a pointer to the Codec Engine API call.

(3) SAF7113 output BT.1120 digital video, as the DM6467 VPORT input, VPORT convert it to YUV format, sent to the DSP side for encoding.

(4) DSP calls the H.264 algorithm to encode the input image data.

(5) DSP to the ARM side to send an interrupt, and the data stream encoding to the ARM side.

(6) ARM side to receive and save the data flow, check all coding tasks have been completed, and then notify the DSP.

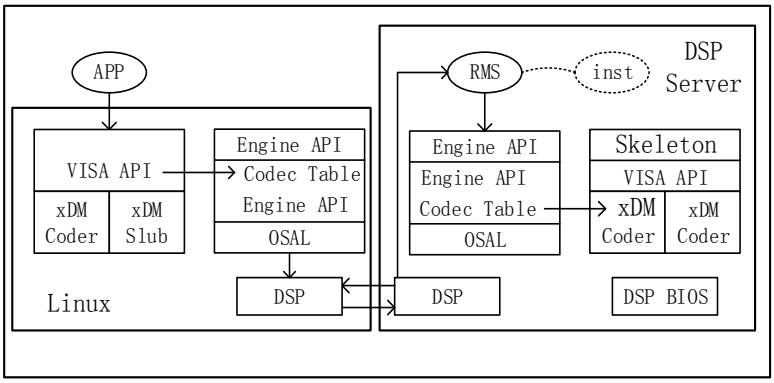


Fig.3 Dual - core Communication Flow Chart

# 5. Experiment and Analysis

## 5.1 Compression Performance Comparison

In this experiment, http://meru.cecs.missouri.edu/free_download/videos/, mother_ daughter_ qcif. y4m video is selected with a resolution, and H.263,MPEG4 and H.264 encoders are used to compress the video sequence. The PSNR (peak signal to noise ratio) at different bit rates is shown in Fig.4.

The experimental data show that at the same bit rate, H.264 PSNR is 2dB higher than MPEG-4 average, 3dB higher than H.263 average; 40% lower than MPEG4 at the same PSNR, average low 48%. So H.264 compression performance is better than MPEG4 and H.263.

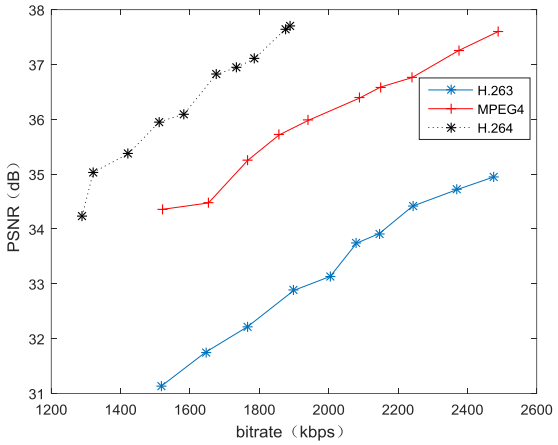


Fig. 4 PSNR comparison at different bit rates

## 5.2 Coding Speed

We encode the coding speed test sequence [13], the results shown in Fig.5. The results show that the encoding speed is not very different at the low speed, but when the rate increases, the H.264 algorithm is the most advanced, and the MPEG-4 and H.263 algorithms are basically the same.

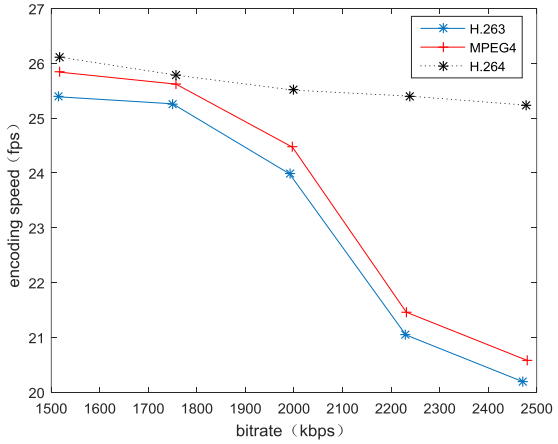


Fig. 5 Encoding speed comparison at different bit rates

# 6. Conclusion

In this paper, we completed the design of UAV video compression system based on H.264 video coding standard and Davinci platform, and realized high performance video compression equipment with 25fps at 1080p resolution. It is well suited to meet the requirements of UAV video capture on board, such as high compression ratio, high video resolution and reasonable embedded resource consumption.

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