Design of Video Sensor Based on Wireless Sensor Networks

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Abstract. Introduces a wireless video sensor, which is based on wireless sensor networks technique. It can be widely used including battlefield intelligence, security monitoring, and environmental tracking. The Zigbee communication protocols is based on the IEEE 802.15.4-2003 standard. With JPEG compression, the video can be transmitted through the low rate wireless network. Wireless video sensor nodes form mesh networks, and transmit video information to coordinator. The coordinator connects to monitor station, and the monitor software display the video from the nodes in the wireless networks.

Introduction

Wireless sensor networks (WSNs) is a massive deployment self-organizing network. Ultimately, the people and the physical world information interaction significantly expanded the scope of human perception. In wireless sensor networks based on video surveillance system that enables the client can obtain the remote sensor network perimeter of real-time image, understanding of wireless sensor networks. Image sensor nodes can also work together with other nodes that satisfy different needs. Wireless sensor networks for energy and resource-constrained and multimedia integration in many areas are worthy of study. How sensor network multimedia data transfers to reduce transfer times, lower energy consumption, as well as service quality assurance became the focus of the study now WSN. Of these, image compression, multimedia data network processing, effective energy-saving routing mechanism in multimedia sensor networks have made some progress. On the other hand, the more traditional video surveillance system is based on the analog cable transmission and monitoring range limited extensibility. And image acquisition value[1].

ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for wireless home area networks (WHANs), such as wireless light switches with lamps, electrical meters with in-home-displays, consumer electronics equipment via short-range radio. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking.

System Constitute

Wireless video sensor network system is shown in Figure 1, the system is composed of wireless video sensor nodes, coordinators and monitor station. Wireless video sensor nodes form self-organize mesh networks, and shoot video, compress the video into JPEG format. After compression the wireless video sensor node transmits the video information into the wireless networks, and the coordinator to node is responsible for collection video images, and multiple video collection node mesh network, formed by routing nodes, will capture the image information is transferred to the coordinator, coordinator and connected to the computer, in the host computer via video display software, enables live video viewing, provide a basis for analysis and decision-making. [2]
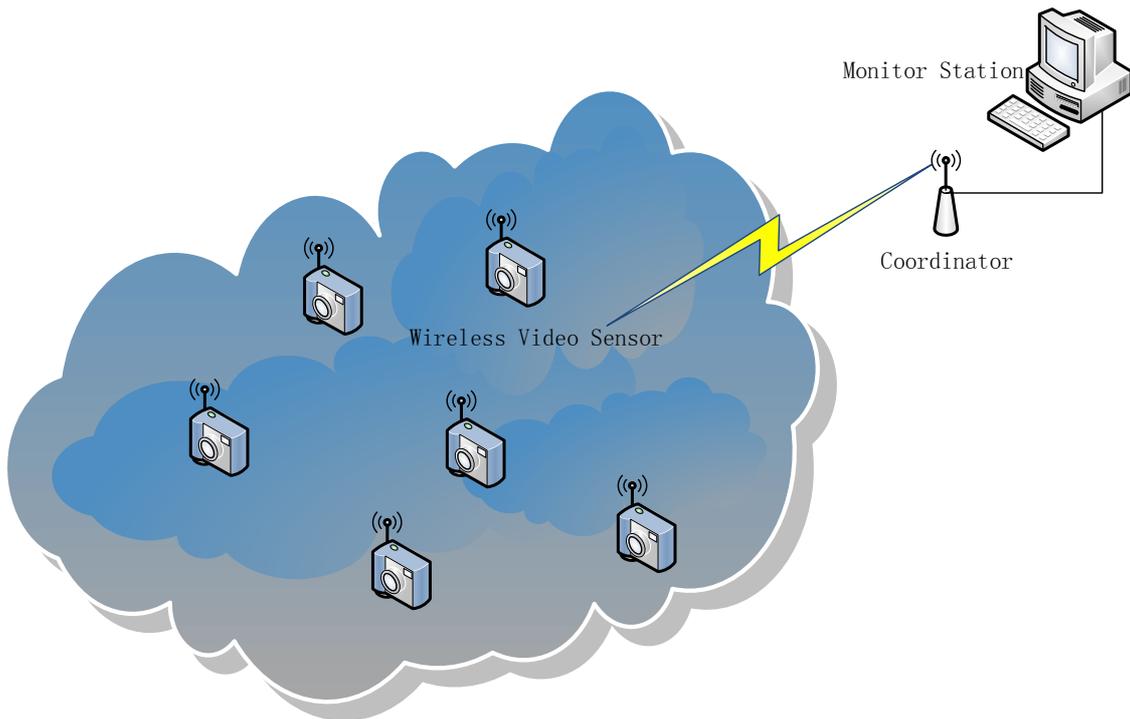
Fig.1 wireless video sensor networks system structure

Wireless Video Sensor Networks Node

Wireless video sensor node consists of the following parts: VGA IMAGE SENOR, COMPRESSION ENGIN EEPROM, PROCESSOR, RF MODULE, Which VGA IMAGE SENOR
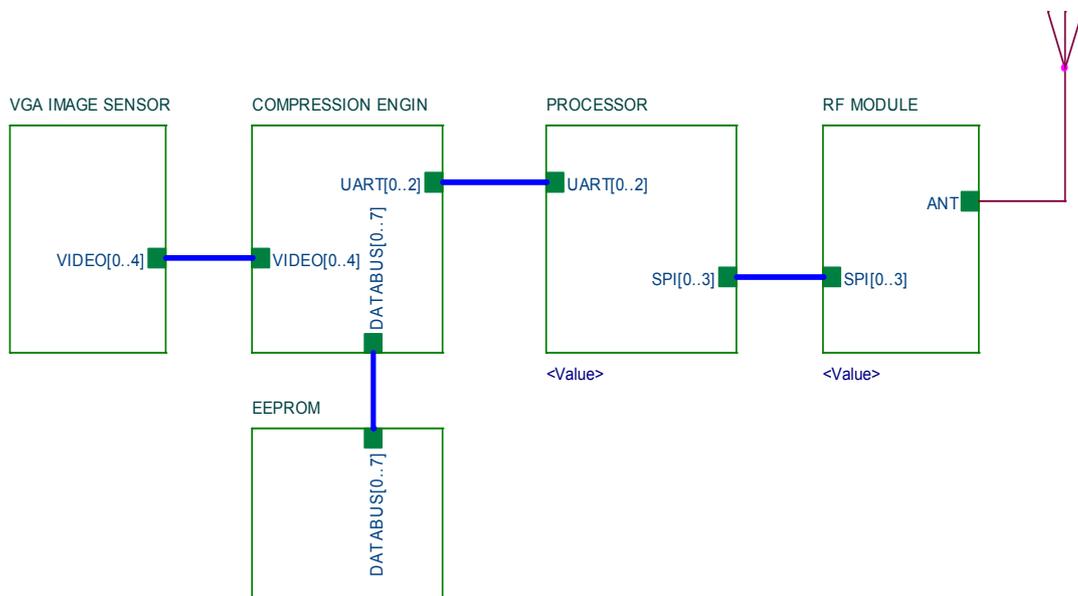

Fig.2 wireless video sensor node schematic

for video image acquisition and image signal information is converted to digital information, provided to COMPRESSION ENGIN, COMPRESSION ENGIN For image information compression, image and video processing of digital information into jpeg Format, through UART Serial interface to PROCESSOR, PROCESSOR Mainly complete information processing through SPI Interface and RF MODULE Connected by RF MODULE Image information is sent to the wireless sensor networks[3].

Fig.3 wireless video sensor networks node

JPEG COMPRESSION AND DECOMPRESSION

In ensuring quality requirements , Reduces or eliminates redundancy in the image , Achieve savings to storage and transmission bandwidth . Then decodes compressed images and refactoring . JPEG compression algorithm standard for still image compression standard , it adopts DCT transform coding as the core algorithm , with very high compression ratio , can reach (1/20, 1/25); currently most images are J PEG compression standard , various browser , picture browsing chulipin tools are JPEG image format , while , digital camera , camera , camera phone, the J PEG standard . This thesis in introducing J PEG Image compression algorithm based on the principle of , Adopts MA TLAB Grayscale images on a standard for J PEG Compression and reconstruction , And analyze the results of the experiment concluded [4].

JPEG compression algorithm. JPEG Compression algorithm for a basic system processes such as Figure 1 Shown , Compression process including image data chunking, DCT Transform, quantification, Huffman Coding four steps . Extraction process is exactly the opposite . Original
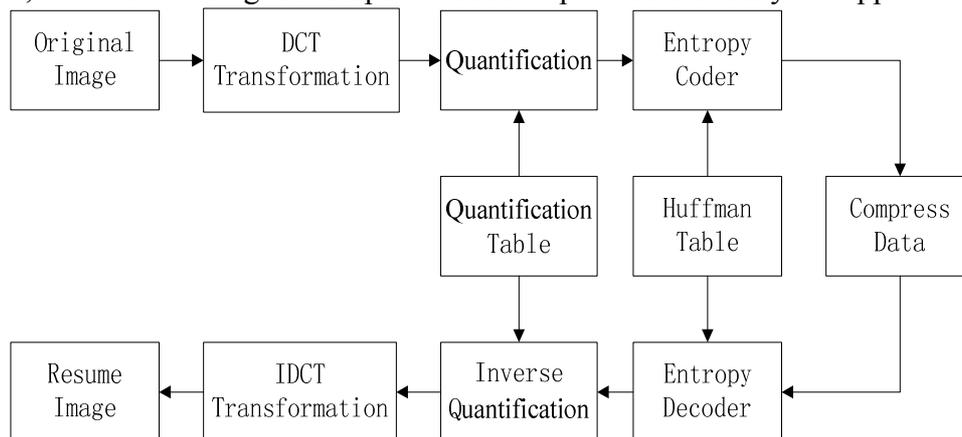

Fig.4 JPEG compression and decompression based on DCT/ IDCT

image data into a series of 8×8 Block , Then press from left to right , From top to bottom for processing , When horizontal or vertical pixel count is not a 8 Integer times , Filling 1 Methods complement . Figure 1 Based DCT/IDCT Of JPEG Compression, decompression algorithm block first image segmentation to be compressed into a certain 8 Pixels $\times$ 8 Pixel image sub-block , Then uses the discrete cosine transform (DCT) Will block becomes 8×8 Of DCT Coefficient array ; And then use a 8×8 Quantified value arrays to quantify these coefficients ; Final quantitative entropy

encoder will encode the coefficients a bunch of bit-stream . After transmission or storage , Bit stream after entropy decoder decodes , Rebuild of a set of quantified DCT Coefficient , Use when coding the same quantitative values array of those quantized coefficients for inverse quantization , Use reverse discrete cosine transform (IDCT) This 8×8 DCT Coefficient matrix[5].

Discrete cosine transform (DCT). 2-D DCT transform and inverse transformation formula (8×8) as in :

$$F(u,v) = \frac{1}{4} C(u)C(v) \left[\sum_{i=0}^{7} \sum_{j=7}^{7} f(i,j) \cos \frac{(2i+1)u\pi}{16} \cos \frac{(2j+1)v\pi}{16} \right] \tag{1}$$

$$f(i,j) = \frac{1}{4} C(u)C(v) \left[\sum_{u=0}^{7} \sum_{v=0}^{7} F(u,v) \cos \frac{(2i+1)u\pi}{16} \cos \frac{(2j+1)v\pi}{16} \right] \tag{2}$$

$f(i,j)$ — Original 8×8 Image data

$F(u,v)$ — Transformed 2D 8×8 Data.[6]

Conclusion

Video is an important information , Using wireless video sensor network gets image information and significantly expands the range of human vision. Wireless video sensor nodes can form self-organizing mesh network, extends the scope of application of sensor networks. On the other hand , the systems affected by environmental conditions limiting smaller , also applies to some inconvenient manpower to install and harsh environments. In this system on the basis of the study , follow-up will be combined with the practical application of the additional functionality to fit in more locations.

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