International Journal of Electrical, Electronic and Communication Sciences
ISSN: 2517-9438
Vol:8, No:9, 2014

H.263 Based Video Transceiver for Wireless Camera System

Won-Ho Kim

***Abstract*—**In this paper, a design of H.263 based wireless video transceiver is presented for wireless camera system. It uses standard WIFI transceiver and the covering area is up to 100m. Furthermore the standard H.263 video encoding technique is used for video compression since wireless video transmitter is unable to transmit high capacity raw data in real time and the implemented system is capable of streaming at speed of less than 1Mbps using NTSC 720x480 video.

***Keywords*—**Digital signal processing, H.263 video encoder, surveillance camera, wireless video transceiver.

I. Introduction

THE video surveillance systems based on image analysis were recently developed to monitor events automatically in building or special areas [1]-[5].

Wireless video transmission is an essential task in developing wireless sensor network. Usually wireless video transmitter is used to send video signals from place to another place and the other way receiver receives the video signal that sent from transmitter. Recently lot of surveillance cameras such as CCTV camera, IP camera is installed in many fields for various purposes as vision sensor networks. It is big problem that if all of them have to be connected by wires. It makes the vision sensor system to be more complex and inconvenience in use. Therefore it needs to develop a wireless video transmitters and receivers in order to overcome the difficulties mentioned above. So far, many video transceiver systems had been developed to transmit video over wireless network in size of 360x240 due to the narrow bandwidth [6]. Thus some data compression algorithms have introduced to compress video data and send them over narrow bandwidth channel [7].

Video transmission system offer analogue [8] or digital solutions and the designed system in this paper uses digital solution since digital models utilize standards more familiar with Computer Networks such as wired LAN or WIFI. Standard WIFI transceiver is used in the designed system in this paper. Basically the system is designed to send video data at speed of less than 1Mbps over WIFI network up to 100m distance. Therefore H.263 video compression technique is used to compress raw video data into a desired size for sending over WIFI network. The wireless video transceiver is designed with NTSC composite video input & output port. Design of each parts of the H.263 video transceiver is explained in next section. Implementation and test results are summarized in the final section.

Won-Ho Kim is with the Division of Electrical, Electronic and Control Engineering of Kongju National University, 1223-24 Cheonan-Daero, Seobuk-Gu, Cheonan, Chungnam, 331-717, Republic of Korea (e-mail: whkim@kongju.ac.kr).

II. Design of H.263 Wireless Transceiver

A. Design Requirements

The major design requirements of the wireless video transceiver are as followings.

- IEEE 802.11 standard Wi-Fi operation
- H.263 encoding and decoding function
- 720x480 NTSC video processing
- 1Mbps of data rate
- DC 5V single power

B. H.263 Wireless Transmitter

The H.263 wireless transmitter is designed as five function blocks. They are NTSC decoder, H.263 encoder, FIFO buffer, Micro-Processor and WIFI module as shown in Fig. 1.

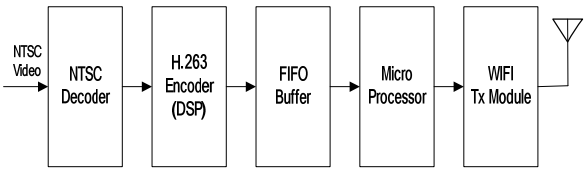

Fig. 1 Functional block diagram of H.263 wireless transmitter

The size of raw data of a frame that captured is bounded to 1MByte since it captures 720x480 color images. Therefore this raw data need to be compressed in order to send over WIFI network in real time. The designed system is used H.263 encoder which is embedded in a Digital Signal Processor for data compression and it can resize down the data to be transmit.

After DSP encoding process, the micro-processor sends the encoded data one byte by one byte to the WIFI module for wireless transmission. Standard WIFI module is embedded and serial peripheral interface with 25MHz clock speed is established between micro-processor and WIFI module for data transmission.

The standard H.263 encoding algorithm is used in the implemented DSP based transmitter to compress raw video and the functional block diagram of the H.263 is shown in Fig. 2 [9], [10]. The main elements are prediction using motion estimation and compensation, DCT based block transform and quantization.

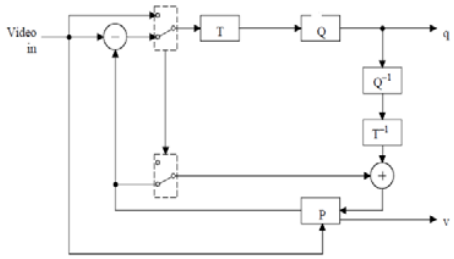

Fig. 2 Functional block diagram of standard H.263 encoder [9] T: Transformation based on DCT; Q: Quantization; P: Picture memory with motion estimation and compensation; q: Quantizing index for DCT transform coefficients; v: Motion vectors.

After video encoding of every frame, the encoded data are transmitted from DSP to micro-processor through FIFO buffer by using message as shown in Fig. 3.

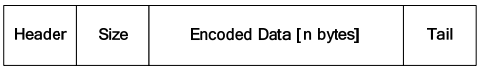

Fig. 3 Message format of DSP encoder

Whenever the micro-processor decodes the header and tail of H.263 output message, it starts to send the message to the wireless module. The main operation of TX micro-processor is shown in Fig. 4.

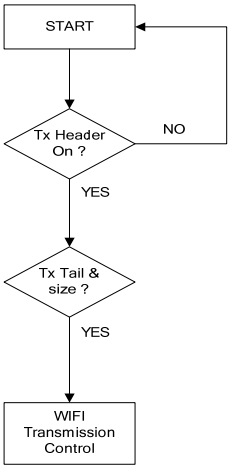

Fig. 4 Operation of TX micro-processor

C. H.263 Wireless Receiver

The H.263 wireless receiver is designed as five function blocks. They are NTSC encoder, H.263 decoder, FIFO buffer, Micro-Processor and WIFI RX module as shown in Fig. 5. The standard H.263 decoding algorithm [9] is used in the implemented DSP based receiver to reconstruct raw video. The main elements of H.263 decoder are reconstruction using motion vectors and inverse DCT function.

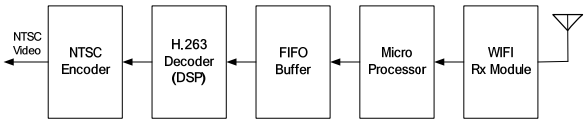

Fig. 5 Functional block diagram of H.263 wireless receiver

The video data is saved in FIFO memory until all the data for one frame is received by micro-processor operation. It recognizes a frame by checking header and tail of the encoded data. The H.263 decoder sends decoded data to the NTSC encoder. NTSC encoder converts these digital data into NTSC analog video signal.

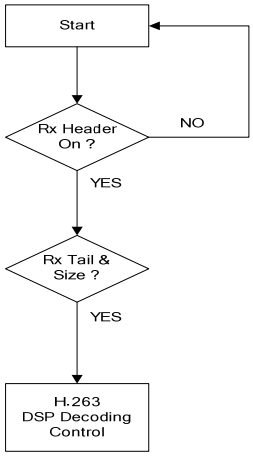

Fig. 6 Operation of RX micro-processor

The main operation of RX micro-processor is shown in Fig. 6. When it starts to receive data from the transmitter, first it checks the header to recognize the encoded image. If the header is recognized as header of the h.263 encoded data then it is check for the size field to recognize the size of the encoded data that going to be receiving. Then the micro-processor direct the data to the encoder till the counter is equal to the size of the image that received and then it send massage to the decoder by indicating the data for an image is completely received and then the decoder starts decoding the received data. If any tail is unable to receive in a certain time, the micro-processor will discard the received data and it waits until new header is received.

III. Implementation and Test

Fig. 7 shows the designed PCB top layer diagram of H.263 encoder board and WIFI transmitter module.

The implemented H.263 wireless transmitter is shown in Fig. 8. The H.263 encoder was implemented by using high performance 16-bit digital signal processor. The TX WIFI module is integrated with H.263 encoder board via connector.

Fig. 9 shows the designed PCB top layer diagram of H.263 decoder board and WIFI receiver module.

Fig. 10 shows the implemented H.263 wireless receiver. The H.263 decoder was implemented by using high performance 16-bit digital signal processor. The RX WIFI module is

integrated with H.263 decoder board via connector.

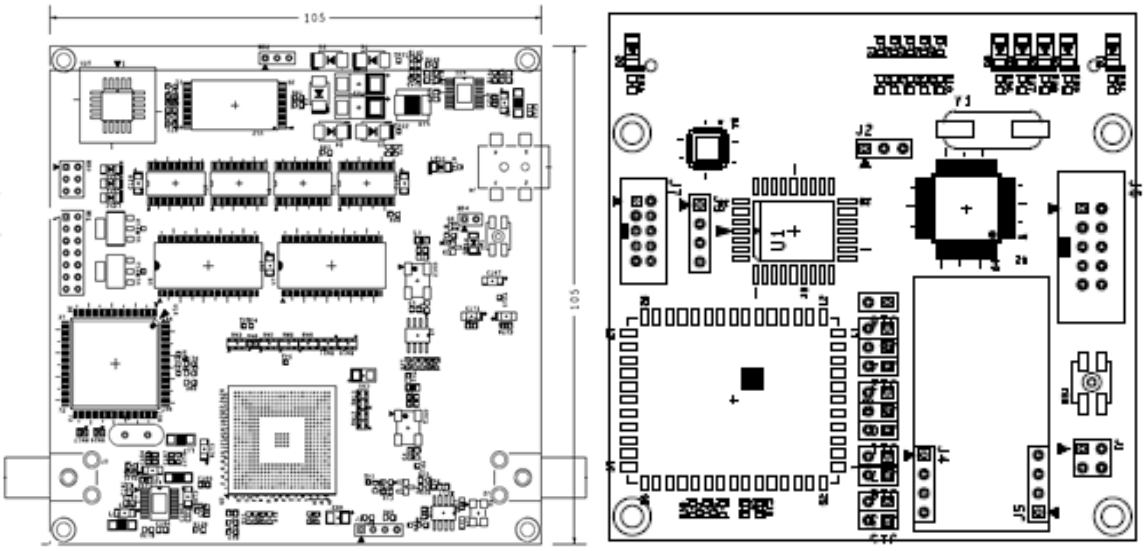

Fig. 7 PCB layout of H.263 encoder board and TX WIFI module

Fig. 8 Picture of implemented H.263 wireless transmitter

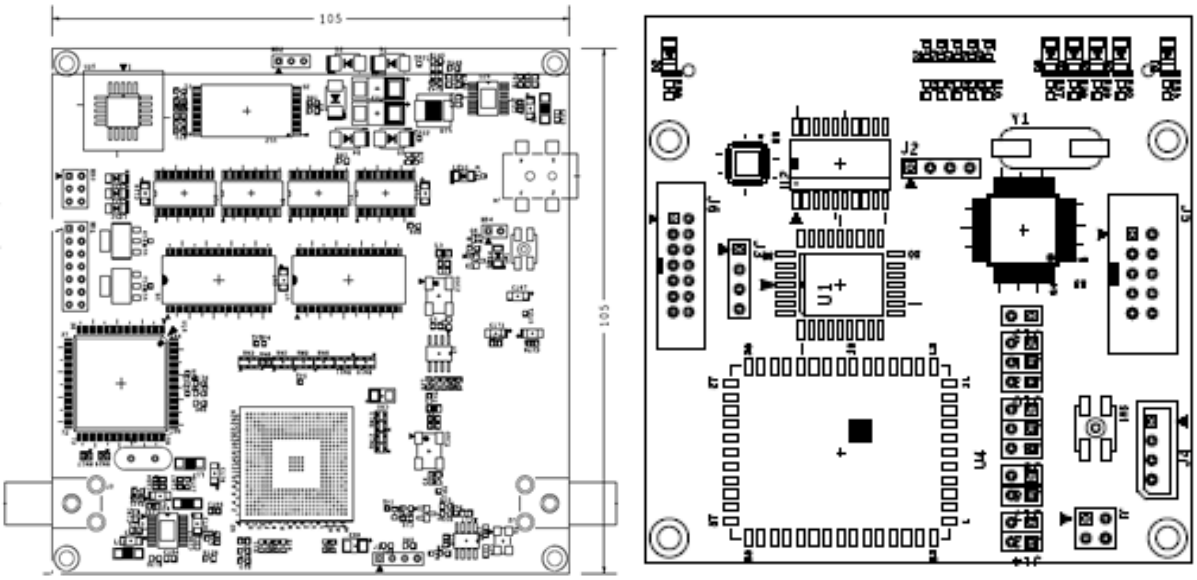

Fig. 9 PCB layout of H.263 decoder board and RX WIFI module

Fig. 10 Picture of implemented H.263 wireless receiver

The implemented H.263 wireless video transceiver was tested under various conditions. The implemented H.263 wireless transceivers were able to transmit 5 frames per second. The measured effective data rate was about 1.2Mbps. And also, the transmission range was covered up to 100m. Fig.11 shows the decoded test image (720x480) of receiver side.

Fig. 11 Received test image using implemented H.263 wireless transceiver

IV. Conclusion

This paper presented design and implementation of DSP based H.263 wireless transceiver. It transmits video data in speed of less than 1Mbps in standard size of NTSC 720x480. The standard H.263 video compression algorithm was used for video data reduction. Also the implemented wireless transceiver in this paper uses IEEE 802.11 WIFI standard technique. Finally a low cost and small-size wireless video transceiver was implemented. The next step is to developing wireless video transceiver to be enhanced the transmission frame rate.

Acknowledgment

The research was supported by the International Science and Business Belt Program through the Ministry of Science, ICT and Future Planning (former Education, Science and Technology) (2013K000490)

References

[1] Turgay Celik, “Fast and efficient method for fire detection using image processing”, ETRI Journal,vol. 32, pp 881-890, 2010.
[2] Ramzmi S.M., Sad N., Asirvadam V.S., “Vision-based flame detection: motion detection & fire analysis”, In Proceedings of IEEE Student Conference on Research and Development, pp. 187-191, 2010.
[3] Zhibin, M., ChunyuY, “Machine vision based flame detection using multi-features”, In Proceeding of 24th Chinese Control and Decision Conference, pp. 2844-2848, 2012.
[4] Zhengwen Xie, Qiang Wang,“Large space fire detection in laboratory-scale based on color image segmentation”, In Proceedings of ninth International Symposium on Distributed Computing and Applications to Business Engineering and Science, pp. 572-575, 2010.
[5] Tjokorda Agung Budi, W.Supriana Suwardi,“Fire alarm system based on video processing”, In Proceedings of International Conference on Electrical Engineering Informatics, pp. 1-7, 2011.
[6] Irfanullah1, Amjad Ali1, Abdul Qadir Khan1, Rehanullah Khan1, Akhtar Khalil, “WiMAX Based Audio/Video Transmission”, IJCSI, vol.10, No.3, 2013.
[7] Scott Pudlewski, Tommaso Melodia, “Compressive Video Streaming: Design and Rate Energy-Distortion Analysis”,IEEE Transactions on Multimedia, vol.15, No.8, 2013.
[8] Shing-Fong Su, “Analog Video Transmission System”,Proceedings of IEEE Conference on Laser and Electro-Optics, pp361-362, 1995.
[9] ITU-T Recommendation H.263,Video coding for low bit rate communication. 2005.
[10] Khalid Sayood, *Introduction to Data Compression*, Elsevier, 2006, ch.18.