http://ansinet.com/itj

ITJ

ISSN 1812-5638

INFORMATION TECHNOLOGY JOURNAL

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Information Technology Journal 10 (9): 1789-1792, 2011
ISSN 1812-5638 / DOI: 10.3923/itj.2011.1789.1792
© 2011 Asian Network for Scientific Information

Intelligent and Multimedia Receiving System for Early Warning Information

Suting Chen
College of Electronic and Information Engineering, Nanjing University of Information Science and Technology, Jiangsu, Nanjing 210044, China

Abstract: An intelligent receiving system for disaster early warning information based on (Digital Multimedia Broadcasting) DMB is proposed. Through the study of DMB transmission protocol standard, real-time receiving scheme of multimedia information for disaster warning information is put forward, including text information, audio information and video information. Aimed at the research for the algorithm of region-selectivity of receiving and the design for feedback control unit, the function of intelligent receiving is realized. By the research of the system, single receiver mode (Digital Audio Broadcasting, DAB) for text and audio information at present has been changed and multimedia receiver method of disaster early warning is achieved for the first time. Meanwhile, theory difficulty of region-selective receiving is implemented. The receiving capability of disaster early warning is improved in real-time, accuracy and diversity.

Key words: Intelligent receiving system, multimedia information processing, region-selective receiving, feedback control, early warning information

INTRODUCTION

China is a country prone to natural disasters. Typhoon, rainstorm (or snowstorm), lightning, drought, wind, hail, fog, haze, dust storms, heat waves, low temperature freezing and other disasters have been occurred frequently. These disasters have many species, wide geographical distribution and high frequency and have resulted in severe losses (Fang, 2008).

At present, early warning information receivers based on DAB have been applied to some meteorological departments in our country. However, DAB receivers have limited functions. Early warning information can be broadcasted only in text and audio and the regional location can not be realized (Lili *et al*., 2009). To improve the accuracy and diversity of early warning information receiving, an intelligent receiving system for early warning information based on DMB is proposed. Through the study of the intelligent receiving system, the accuracy and intelligence of early warning information receiving are improved greatly.

THE DESIGN SCHEME OF INTELLIGENT AND MULTIMEDIA RECEIVING SYSTEM FOR EARLY WARNING INFORMATION

The whole intelligent and multimedia receiving system for early warning information is shown in below Fig. 1. The system includes receiving and conversion module, DMB information processing module and display module. Firstly, through RF (Radio Frequency) and A/D (Analog/Digital) conversion in receiving and conversion module, the signal of received satellite antenna is processed and digital signal is realized from

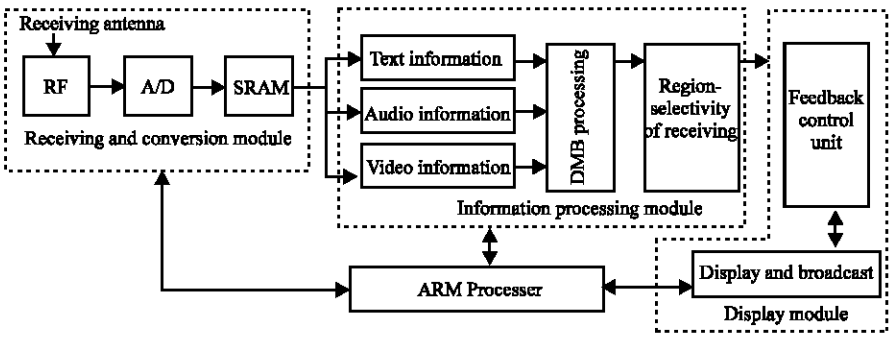

Fig. 1: Intelligent and Multimedia Receiving System for Early Warning Information

output baseband analog signals. Secondly, in DMB information processing module, encoding and decoding units are designed for DMB digital signal (text information, audio information and video information) in ARM (Advanced RISC (Reduced Instruction Set Computing Machines) and intelligent region-selectivity receiving algorithm and adaptive feedback unit are realized. Lastly, under the influence of the feedback control unit, repeated playing and displaying of the warning information and other extended function are designed in display module.

RECEIVING AND CONVERSION MODULE

Through the conversion of received signal by receiving antenna, RF function and A/D transformation are realized.

In receiving and conversion module, signal from received satellite antenna is conversed. There are two units in this module: RF unit and A/D unit. In RF unit, tuning function is realized and frequency is moved from the received RF DMB signal of the Band (174~230 MHz) or L Band (1452-1492 MHz) to the intermediate frequency (2.048 or 38.912 MHz). According to DMB standard, receiving the signal of the two frequencies accurately is necessary. In this system, MAX2170 chip is used to realize RF function through reading and writing control of ARM processor's internal register by I^2C interface. Meanwhile, in order to achieve subsequent decoding of DMB digital signal, baseband analog signals which is output from RF unit is converted to digital signals in A/D unit. MAX1191 chip is used to achieve A/D conversion (Wei *et al*., 2011; Wu *et al*., 2010).

DMB INFORMATION PROCESSING MODULE

The traditional DAB early warning information receiver's function is limited which is used to receive early warning information in text and audio and unable to realize regional orientation. In order to improve the visualization and multimedia information transmission, video processing of early warning information multimedia transmission is added to improve the defect of traditional transmission only in text and audio. Thus the multi-functional receiving of early warning information in text, audio and video is implemented through the study of DMB standard.

There are two units in traditional DAB processing receiver (ETSI, EN 300 401 v1.3.3, 2001): text information unit and audio information unit. In text information unit, text and symbol transmission is realized. The text information is packed to several packages. Every package's length is fixed according to the information

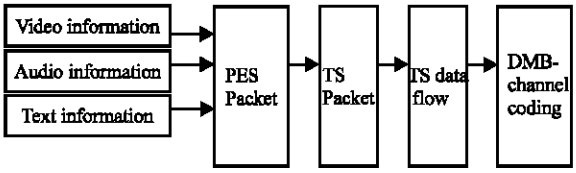

Fig. 2: Multi-media warning information prossesing flow

context. Through the packet mode coding, packed data are input to the DAB encoding units. In audio information unit, audio data and auxiliary control data (including X-Pad data, ScF-CRC (Scale Factor-Cyclic Redundancy Check) and the F-Pad data) are included in a complete frame format of DAB audio information. Audio data represents the continuous audio stream data. Auxiliary control data are consisted of three parts: X- Pad data, SCF-CRC and the F-Pad data. X-Pad data is used to load the user's flags and other data; SCF-CRC is used to check the scale factor; F-Pad is used to load control information (characters or data). According to the DAB audio frame format, audio data channel mainly realizes the transmission of audio data. The channel of auxiliary control data is used to explain and illustrate the audio stream (Lay *et al*., 1999).

To improve the visual and multimedia information transmission capacity, the transmission of warning information based on DMB is realized based on the traditional DAB information transmission. DMB uses the TS multiplexing form of MPEG (Moving Picture Exports Group)-2 Systems (ISO/IEC 13818-1 standard) (Bosi, 2000).The processing flow is shown in Fig. 2. That is, ES (i.e. the encoded signal of video image, audio and other elements) are cut into the appropriate length with added header data to form the PES (Packetized Elementary Stream) data packets firstly. Then the PES configuration packet is put in the useful loading of TS (Transport Stream) packet. Finally the whole TS packets are organized into the TS data stream for multiplexing. Meanwhile, during the information transmission, supplementary text information data, such as relevant channels, configuration and synchronization information which is mainly used to decode TS file are needed to load. Then, loaded supplementary text information data is multiplexed in TS in form of data segment and DMB data frame is combined. Thus, DMB data frame are sent by DMB transmitting system lastly. According to the DMB standard, the TS combination of DMB can be achieved by combining the H. 264 video and audio of AAC (Advanced Audio Coding) format. Receiving is the reverse operation of DMB transmitting encoding. Through decoding operation, DMB warning information is received perfectly.

DISPLAYING MODULE

In the role of feedback control unit, broadcasting and displaying early warning information included in text information, audio information and video information are main function of displaying module. Broadcasting unit realizes the audio broadcasting of early warning information which is received from DMB information processing module. Audio decoder chip-MAX9850D (Cgao *et al*., 2010) is used. Through I^2C interface, control and transmission of MAX9580D is realized through ARM processor. Displaying unit uses 3.5 inch color LCD (Liquid Crystal Display) screen to display real-time early warning information received from the DMB information processing module. Here, early warning information and the parameter information are displayed through backlit displaying function and displaying module is also controlled by ARM processor (Cong *et al*., 2007). Thus, by display and broadcasting decoded early warning information, real-time transmission of early warning information is achieved.

KEY TECHNOLOGY OF INTELLIGENT RECEIVING SYSTEM

Implementation of regional Selective reception: Due to various natural disasters and wide distribution in China, an intelligent algorithm of region-selectivity of receiving is put forward to resolve the difficulty of processing large and redundant early warning information in our country. According to the comparison between early warning district address and early warning information receiver's address, the present warning information can be automatically received or reserved.

The format of DMB warning information district is consisted of four parts: $L_aD_aL_oD_o$. L_a is for the latitude code, D_a is for the latitude information, consisted of 6 bits totally, $L_{a1}L_{a2}$, $L_{a3}L_{a4}$, $L_{a5}L_{a6}$ are the information of latitude in degrees, minutes and seconds, respectively. L_o is for the longitude code, D_o is for the longitude information data, consisted of 7 bits totally, $L_{o1}L_{o2}$, $L_{o3}L_{o4}$, $L_{o5}L_{o6}L_{o7}$ represents the degree of longitude information, minutes and seconds, respectively.

According to the latitude and longitude of location information, DMB receiving system for early warning information region in China is from 3°52' to 53°33' in latitude and from 73°40' to 135°2'30" in longitude. That is:

$$\lambda = 135°2'30''\ \lambda w = 73°40'\ \varphi_s = 3°52'\ \varphi_n = 53°33'$$

In accordance with the above-mentioned range, national latitude and longitude district can be divided into n×m rectangular area. The [n,m] vector represents for the address code of the current region. Implementation process of the algorithm is as follows:

Step 1: Unpacking received early warning information, store and extract information address code section [nm]

Step 2: Through the position and timing information obtained by DMB receiving system, extracting the longitude and latitude data

Step 3: According to the extracted latitude, longitude information, a processing algorithm is put forward

Definition: x,y is the final output of the DMB receiving address code, the vector [x,y] represents for the received address information. Between them, x means longitude information and y means latitude information. The final address vectors of DMB receiver are as follows:

$$x = \text{int}\left[\frac{(D_a - \lambda_w)\, n}{(\lambda_e - \lambda_w)}\right], y = \text{int}\left[\frac{(D_o - \varphi_s)\, m}{(\varphi_n - \varphi_s)}\right]$$

Step 4: By comparing its own region address vector [x,y] and address vector [n,m] loaded by warning information frame, current early warning information can be received or reserved intelligently. If the two vectors are different, the present early warning information is reserved. If the two vectors are the same, the present early warning information is transferred to DMB receiver

Design and implementation of feedback control unit: To implement early warning information's intelligence further, feedback control unit is designed to ensure the received early warning information in real-time and in accuracy. Two major functions are achieved in feedback control unit: On the one hand, the light and buzzer switch are worked to control the audio information output of DMB processing module if present early warning information is received by DMB receiver and the user does not check the information manually, continuous audio will be prompted through the feedback switch. On the other hand, if continuous audio broadcasting does not work, through the feedback unit by the switch of the adapter and the information pre-processing, the current early warning information will be re-released until the switch of the light and buzzer are indicated.

CONCLUSION

With the study of the intelligent early warning information receiving system based on DMB, various

warning information from different levels and spices can be received in real-time and accuracy. At the same time, the algorithm of intelligent region-selectivity of receiving is put forward and adaptive feedback control unit is designed to improve real-time receiving. From the complete scheme of early warning information in application and the intelligent algorithm and design of early warning information in theory, DMB early warning information is implemented intelligently.

ACKNOWLEDGMENT

This study was supported by Jiangsu Cooperation Program of Industry, Academe and Research and was funded by the Priority Academic Program Development of Jiangsu Higher Education Institutions, China.

REFERENCES

Bosi, M., 2000. Multi-channel audio coding and its applications in DAB and DVB. IEEE Trans. Signal Process., 42: 5-10.

Cgao, Z., G. Xiaqo-feng, W. Guo-yu and Z. Hong-sheng, 2010. Study of DAB emission system and encoder design. Audio Eng., 31: 78-81.

Cong, M., X. Kong, Y. Du and J. Liu, 2007. Wafer pre-aligner system based on vision information processing. Inform. Technol. J., 6: 1245-1251.

ETSI, EN 300 401 v1.3.3, 2001. Radio broadcasting systems digital audio broadcasting DAB to mobile portable and fixed receivers. http://www.lrr.in.tum.de/Par/arch/dab/mpspecs/dab_main.pdf.

Fang, L., 2008. Public warning information research of Mobile telecommunication network. Commun. Technol., 41: 211-213.

Lay, T.H., Y.H. Lee, L.C. Lo, C.Y. Leu and P.M. Gong, 1999. Design and implementation of channel encoder-decoder for the Digital audio broadcasting DAB system. IEEE Trans. Commun., 1: 680-683.

Lili, S., Y. Junping, C. Zhaowu and H. Junheng, 2009. Technology of digital audio broadcast in application of meteorological warning information release. J. Yunnan Univ., 31: 252-254.

Wei, W., P. Qian, B. Zhang and B. Huang, 2011. Adaptive symbol-level network coding for broadcasting retransmission. Inform. Technol. J., 10: 1264-1267.

Wu, Z., Q. Wang, N. Zhao and G. Ren, 2010. Bit synchronization of PCM/FM signals at low SNR. Inform. Technol. J., 9: 686-691.