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AN ERROR CORRECTION METHOD FOR CONTROL DEGRADATION OF THE RECEIVED PICTURE IN THE DIGITAL TELEVISION BROADCASTING

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ABSTRACT

Systems of the digital broadcast are needed to control the corrosion of the digital contents received from the at the destination. That is a must due to errors caused by transmission mechanisms. The image is one of the most important digital content that needs to be corrected and received in good condition. One of the useful techniques and methods used is error correction algorithms. However, many other error correction methods, algorithms, and techniques need to be considered. Error management and control is an essential step that needs to be applied during the design of Digital Television Broadcasting Systems (DTBSs) and methods. However, error detection and correction is another issue that needs to be considered while Digital Television Broadcasting (DTB) sends digital content. Transmission equalization techniques and adjustment systems are key steps to transmit data using DTB. Besides, encryption modulation and error protection steps are also considerable. Knowledge of DTB fault characteristics and optimization methods for complete systems is central to carefully and deeply understanding the fault control method units.

1. Introduction

A development challenge for the Digital Television Broadcasting System (DTBS) [1, 2] is to improve the system outcomes with consideration of the occurrence of a limited radio frequency (RF) bandwidth. As a result, the carrier-to-noise ratio (CNR) probably occur and can be received in many cases and situations [3]. However, according to Shannon's theory, optimal proposed solutions could exist. The present state-run related to hands-on plan is a long way off.
DBS have many features and properties listed in the literature, such as they can decode contents at the receiver [4], the procedure of feeding the high energy amplifier can be prevented by the help of the huge fluctuations in DTBSs [5], and the loss of error could be reduced [6].
The DTBS consists of numerous phases that are nearly self-regulating for each other; This is one of the reasons causing the low capacity of information transmission; nonetheless, at the same time, it is very useful for system development [7]. Modules of technology developed elsewhere will be chosen and introduced. And a system that uses those modules as blocks of the building. This is the peculiarity of the development of the current DTBS and the conditions in which the system must be improved. Attentions of a system and all core technologies can be defined and designed first. all characteristics of transmission errors and the techniques dedicated to error correction codes will be described. Space limitations will make it unbearable to discuss all of the related techniques fully. The purpose is to explain the basics of each technique, provide clear and comprehensive interpretations of all used terms, and help understand each specific area and field of knowledge and technology.

The remaining sections of this paper is organized as follows: Section 2 is dedicated to explaining the proposed method; Section 3 explains Errors in Digital Television Broadcasting Systems (DTBS); Section 4 will provide a talk about the correction of error coding. In Section 5, the principle of correction of coding errors has been explained. Section 6 concludes.

2. Method – System Components

2.1. System Construction for DTBS

Configuration for a Digital Television Broadcasting System (DTBS) includes three encoder/decoder pairs, one of which is responsible for recording and two of which are dedicated to performing transmission in a radio frequency form. The transmission (channel) coding comprises multiplexing, fault correction, and modification coding. Several difficulties still meet recording. However, technical novelties are being made. It is assumed that no degradation happens during the recording phase. But errors might occur in radio frequency transmission due to the bandwidth existence. Receiving

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carrier-to-noise ratio (CNR) will be in a limited way received. The main job of error management is to reduce or remove these errors influence(s).

Causes of error include random (Gaussian) noise and city noise, as well as multi-path and other interference. The elements shown in Figure 1 are dependent because it is wished to maximize the efficiency of the systems. Current state-of-the-art systems are not constructed in this mode, but the entire design will be practical in the future. A minor example of movement in that direction is the introduction of coded modulation. This system merges the error-correcting code and modulation, as described next. We must thus examine the elements one by one from the viewpoint of error management. Roughly speaking, error management policy in designing a system may be summarized as:

Causes of the fault can contain random noise from (Gaussian) and city noise, in addition to multi-path intrusion and the like. The units shown in Figure 1 are dependable to maximize the system's efficiency. The most recent current systems in this model have not been built nor designed, but the entire design will be practical in the future. A simple example of movement in this direction is the introduction of cryptographic modulation. The proposed system incorporates an error correction and modification code, as described later. Therefore, it is necessary to check the elements one by one from an error handling point of view. The system design error handling policy can be highlighted as follows:
• Minimizing the causes of errors
• Low error rate
• Enhancement of multiplexing of the predictable fault degree
• Increased source cypher strength.
Several necessary considerations for particular system criteria, e.g., gradual degradation. They can be categorized into the third and fourth units shown in Figure 1.

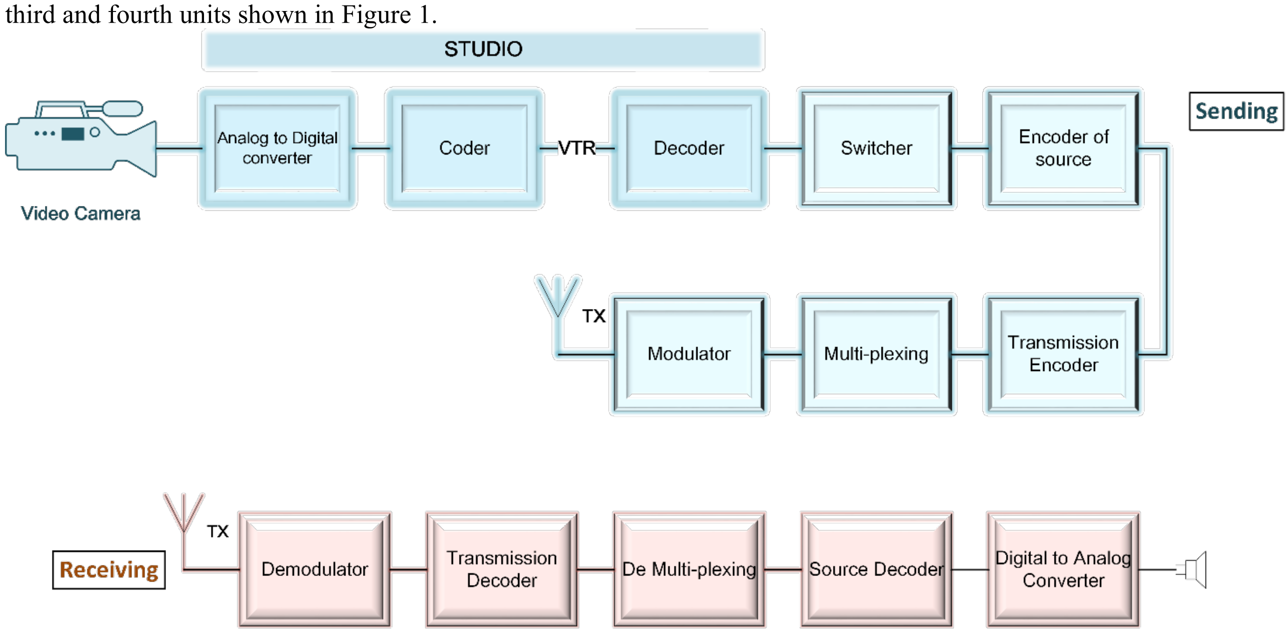

Figure: 1 A Simple Architecture and Design of the DTBS

2.2 Minimize the Causes of Errors

The causes of errors can be either noise or interference. The reasons for the deterioration and the measures taken against it. Some of the determinants of the counter-measures are of importance to be considered. The effective isotropic radiated power (EIRP) related to a transmitter can be effectively increased to reduce Gaussian noise, but the protection proportion limits the EIRP. This is significant; specifically, there might be digital channels and analogy channels have to co-exist. Both the noise of Gaussian and signals' interferences are described next.

2.3. Multipath Interference and Equalizing Method

Equalization is an effective way to decrease the impact of multi-path. The multi-path degraded signal can be equalized using an adaptable tap screen. The vital fact in the equalization system is the technique that could obtain an equalization signal. It might be statistical approaches to perceive the equalization signal from a naturally formed signal. However, introducing a training signal into the transmitted signal improves the performance of the equalizer.

The multi-path decays are unbalanced with the multi-path state because a fixed inflexion point might be there. In the case of a floatplane, the rate of change is in the direction of a few seconds. It follows that a dynamic equation would be obligatory. An efficient equalization system is essential for mobile reception. Some information should be shared for the sake of training reference, but it doesn't have to be that big. Thus, the CNR can be compact by removal. However, the

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decrease in the error rate is greater than the growth in the error due to the reduction in the percentage error rate in whole situations.

Orthogonal frequency division multiplexing (OFDM) is an active technique that could evade multi-path deprivation. It is a multi-carrier system that can use inserted in the time and frequency domains.

2.4. Reduce the Error Degree

Error correction code is an effective way that can reduce the fault amount. Several features of the technologies will be discussed as well as applications. All technical standings can be found. The error correction code can be determined using the nature of the error and the number in which it is occurred, using the frequency that the encoder intentionally added.

It can be adequate to know which bit has an error with binary cypher systems. The reason is that the error is the inverted form of the bit itself. It is convenient to specify the information number and the plus number in a codeword. This type is called regular code. These numbers are called information numbers and verification numbers, respectively. The class of code in which a set of linear operations can detect errors is called linear code. Linear systemic symbols are important in practice. Popular tokens, including Hamming and BCH tokens, are linear. Reed-Solomon Code is an exclusive version of the BCH Code.

3. Errors in Digital Television Broadcasting Systems (DTBS)

3.1. Overview

In a DTBS, there are two phases in which digital errors can be further to the signals of the television when there is recording and transmitting. Error checking is a key technology in the DTBS. That is a problem that does not belong to DTBSs. The recording is necessary for a television-based system.

Noise and interference are major causes of error in the transmission of the TV signal, which to some extent depend on the reception conditions. The overlap between other digital or analogue services is important for channel planning. The interference caused by the signal transmitted by different paths is central. This can be referred to as multi-path interference.

3.2. Noise

Two noise types are essential for such a TDBS, one of which is the thermal noise and the other is the city noise.

3.3. Thermal Noise

The Gaussian noise type is random. Generally, there are two sources of noise. Unlike satellite broadcast receiving, the receiving antenna can be directed to the ground. The related temperature is around 290 0 K because the transmitting station is on the ground. The problem is that the noise in this scenario cannot be unavoidable. A modern amplifier can cause this should that is less than the thermal noise caused by ambient temperature. This means that there is no need to consider the noise from the microphone amplifier when roughly estimating the CNR of the received signal; here, it is a must to notice that the current TV receivers do not have respectable amplifiers.

3.4. Noise Errors Random Noise

With the Gaussian noise, the error degree is easy to estimate. An example is the non-return-to-zero (NRZ) binary signal.

3.5 Multi-Path Interference

Multi-path interference is inevitable in TDBSs. The main cause of image degradation is multi-path interference, especially in remote areas or cities. Unlike interference from other facilities, multi-path interference might not be managed by tuning the EIRP. This problem is difficult to be solved by the assignment of the frequency.

3.6 Errors Caused by Interference

It is very hard to provide such an approximation to the errors caused by the interference because the arrangements of interference are not exclusive. There is a need to make comprehensive calculations and experimentations to determine the interference protection ratio for the common channel, adjacent channel and the image.

The relationship between beneficial and undesirable indications can be ignored for a very coarse approximation. In this case, the error rate using the statistical level spreading of the unwanted signal in the receiving bandwidth can be calculated.

4. Correction of Error Coding

Errors in the digital signal can be noticed and modified if the extra bits are added correctly. Algorithms for adding extra bits by error correction are given in a cryptographic theory.

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This section focuses on code systems with a relatively short blade length for convenience. It should be noted that longer code lengths are generally applied in real-world DTBSs.
There is a need for further knowledge about the Galois field GF(2) and the relevant extension field caused by polynomials in GF(2) to understand error correction theory. Engineers might find it difficult to understand that the error correction in accordingly. It is necessary to understand that the values of the binary digit (bit) number and the operand are binary, 0 or 1. To be noticed that, the basis of arithmetic is a modulus of 2, that is, 1 + 0 = 0 + 1 = 1, 1 + 1 = 0 and 0 + 0 = 0.

The decryption algorithms are the most interesting and are of practical importance in implementing the system. Decoder complexity is one of the main factors when choosing a debugging system. There is no single theory for practical algorithms. Still, each code can be decoded in principle by finding the closest codeword (by distance) to the received digital sequence, as described in the next section. The practical decoding algorithm is of secondary importance in understanding the nature of the error-correcting code. As a result, we will not discuss all the algorithms in this article.

5. The Principle of Correction of Coding Errors

The basics of the error correction code can be easily understandable from the most familiar and simple examples. A set of codewords of the Hamming code. The codeword length is seven, and the total number of codewords is sixteen. Consequently, this system can carry sixteen states, that is, four bits of information. Each codeword is at least three different from any other codeword. This means that the original codeword can be identified with single code errors.
Using the language of mathematics, an influential tool for error correction coding, the minimum Hamming distance (that is, the number of unintentional bits) between codewords (symbol distance) is three. Error cases individually contain a single Hamming distance shift from the word. The password by finding the closest original codeword can be found out.

5.1 Shorten the Code

The independence to design the length of the error correction codeword is not extended. The design of the system generally needs a certain length of words. The regular code can be abbreviated by omitting the information specifically bits to meet this criterion.
When it is needed to shorten the code (n, k) to the other form of the code to be: (n-l, k-l), code words needs to be used in which all the relevant information bits are set to the value of zero. Then, those “0” bits must be removed from each coded word. This results in codes of the general length n-1. In the decoder, the zeros or 0s are restored to the original positions, and then they are decoded again to the original form as (n, k).
The distance from the sheet becomes greater than or equal to the distance from the original sheet by default. As a result, the error control capability of the blade system does not decrease, but then again, the efficiency is probably of reduction.

5.2 Data Scrambling Process

Coding can be used for several purposes, such as clock rate feedback and correction of burst errors. Error-correcting code can be used to accurate a comparatively minor number of errors in a constraint length or block. Sometimes, error bursts are much larger than the length of the error being corrected. The process of data scrambling coding is effective in spreading errors. Well-ordered encoding is often used more than arbitrary encoding. An example of a well-organized scrambling process is a two-dimensional schematic diagram of an interleaving.

5.3 Gain-in Coding

The difference between the error correction code and the required CNR decrement for a specific error range. That is called gain-in coding. The difference between a non-coded signal and a signal encoded for the same error range or degree is the gain-in coding for that error range. It is previously mentioned that the gain-in encoding has a higher value in the low error degree area. This is normalized in bits and by the bandwidth of frequencies. The net gain-in coding specifying the encoding methods procedures and outcomes will be considered.

6. Conclusion

This research paper has proposed an error correction method applied for the digital television broadcasting system (DTBS) to control and manage digital contents, specifically pictures received at the reception part. It consisted of several steps. The first step is to construct the architecture of the DTBS. Then, the proposed procedure reduces the causes and errors leading to producing errors. Thirdly, an equalization method is applied to manage multi-path interference to degrade the error degree. After that, error corrections such as shortening the code and data scrambling have been applied. Finally, the gain-in coding process will be considered and utilized.

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