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BRT(Bits Rotation Technique)

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Abstract

In data communication when we send data from on side to another then due to some impairments the data corrupts and couldn't receive the same. it is due to noise heat and some other errors. As the data converts in 0 and 1 form before transmission and during transmission some 0 changes from 0 to 1 and vice versa. many techniques available but we purpose a method BRT.

In this research work, BRT(Bits Rotation technique)technique is proposed to detect errors. This technique is based on bits rotation and addition. In this technique we just rotate bits and then add the message with the rotated form that tells us the about the signal either it is with error or not.

Index Terms Single bit error ,double bit error ,multiple bit error and burst error

1. Introduction

in Data communication when we transmitte data from one device to another device then the message signal can be interrupt due to some affecting factors like transmission impairments like attenuations, distortion and noise these things changes the message signals.

In the error the "0" changes to "1" and vice versa. Errors can be single bit, multiple bits and burst error .To find such errors we use different techniques to find out and correct the error from the message signals by appending some extra redundancy bits with the message signal at the receiving end those redundancy bits check that receiving signal is same as message signal or not. There are many error detection methods available which are used to detect error by appending some extra redundancy bits with information bits. Some of These famous methods are VRC, LRC, CRC, checksum and 2D parity Check.

In VRC after counting number of 1's is even or odd we append an extra bit at the end of binary data, it can only detect burst error if number of changed bits are ODD.

While LRC can detect single bit error and burst error but some of bits not follow even parity rule.

In checksum, we add all binary data and take its complement, then we appended this complement to at the end of binary data. Checksum can't detect error if two bits swap in a column.

In 2D parity Check we write parity of each row and columns by counting number of 1's. Then we transmit row and column parity with information bit so this method takes more redundancy bits.

In this research work, the use just simple bits rotation and simple binary addition, this method detect all type of errors like single bit error multiple bit error and burst error also.we compare this method with other existing techniques.

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2.0 Procedure

Now we describe our proposed error detection technique Additive Redundancy Check (ARC).

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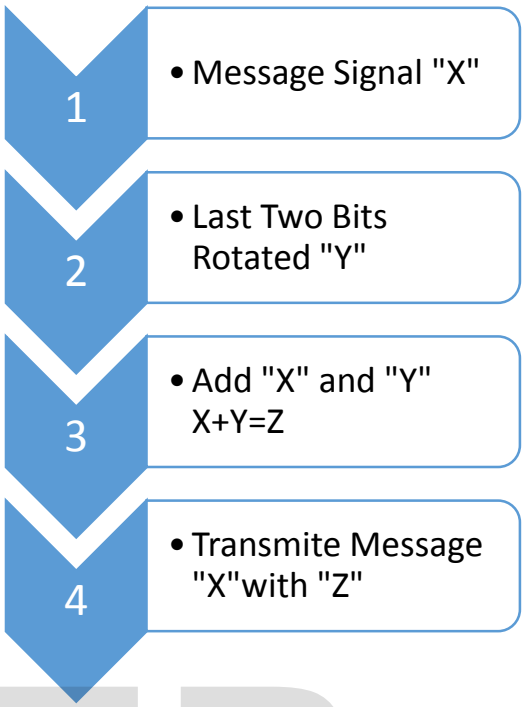
Here we are describe the method we are using in BRT(Bits Rotation Technique)
The steps are Following…

2.1 Transmission side

1. Lets we have n number of bits message signal we call it **"X".**
2. Now the steps of **BRT(**Bits Rotation Technique**)** are following.
3. We have a message signal of bits **n** '**X**'
4. Rotate the last two least significant bits to the left most of the message signal's bits now this rotated signal is name as '**Y**'.
5. Now using simple binary addition add '**X**' with '**Y**'
6. The resultant of **X+Y=Z.**
7. if carry bit occurred then we neglect carry bit
8. We append the Z with the original message signal X and transmitte the message
9. Block diagram of the transmitting side is given below.



2.2 Receiver Side

At the receiver side we again calculate BRT by following same steps as we follow at transmitter side

After that compare receiver side BRT with Transmitter site BRT, If receiver site ARC is equal to Transmitter site BRT, it means there is no error occur we receive data correctly else there is an error occur.
Block diagram for Bits Rotation Technique at Receiver side is given below in .

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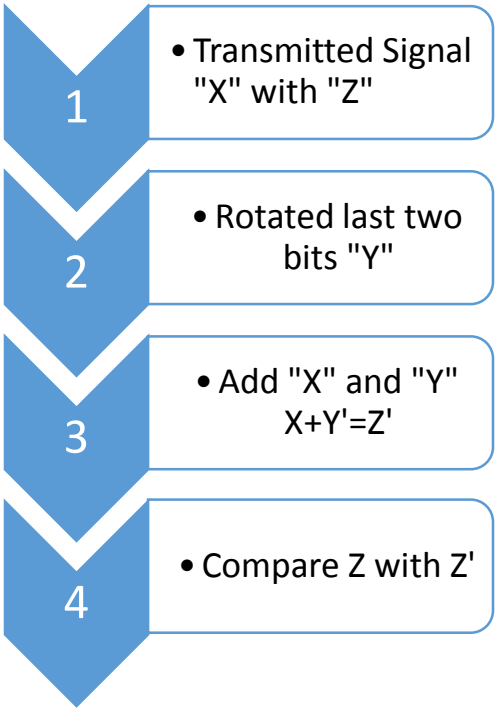

3.0 Results

To Check the performance of this technique we solve different examples of single bit error, double bit error , multiple error and burst error

3.1 Message signal

Suppose we have a 8 bit of message signal
e.g 10011011
X=Message Signal Y=Rotated Form
X+Y=Z

X= **1 0 0 1 1 0 1 1**
Last Two Bits rotated

Y= **1 1 1 0 0 1 1 0**

Now X+Y=Z
X =1 0 0 1 1 0 1 1
Y =1 1 1 0 0 1 1 0
Z 1 0 0 0 0 0 0 1

Now append Z with X and Transmitte signal in the form

X **Z**

1 0 0 1 1 0 1 1 1 0 0 0 0 0 0 1

3.2 For Single Bit Error

If at the receiving side the message signal change by one bit, any "0" change into "1" or vice versa then the signal will be like
e.g
X =1 0 1 1 1 0 1 1
Y =1 1 1 0 1 1 1 0
Z' 1 0 1 0 1 0 0 1

Now Compare Z with Z'
Z=10000001 Z'=10101001
Both are different so error detected

3.3 For Double Bit Error

If at the receiving side two bit from the message signal change from 0 to 1 or from 1 to 0 then the message signal will be like that
X =1 0 0 0 1 1 1 1
Y =1 1 1 0 0 0 1 1
Z' 0 1 1 1 0 0 1 0

Now Compare Z with Z'
Z=10000001 Z'=01110010
Both are different so error detected

3.4 For Multiple Bit Error

If in the message signal multiple bits change at a time then the signal will be like that
X =0 0 1 1 0 0 0 1
Y =0 1 0 0 1 1 0 0
Z' 0 1 1 1 1 1 0 1
Now compare Z with Z'
Z=10000001 Z'=01111101
Z is not equal to Z' so error detected

3.5 For Burst Error

If the whole data change through transmission and we found a garbage data at the receiving end and the bits are like
X =0 0 0 1 0 1 0 0

Y =0 0 0 0 0 1 0 1
Z' 0 0 0 1 1 0 0 1

Now compare Z with Z'
Z=10000001 Z'=00011001
Both are different bits so error detected

4.0 Analysis

Number of BRT bits= N
Number of data bits to be transmit = $N + N$
Code rate=$\frac{No.\ of\ data\ bits}{No.of\ data\ bits\ to\ be\ transmit} = \frac{N}{N+N}$

5.0 Discussion

If we compare this method with all other error detection methods then we can easily judge that this is very easy and simplest method to detect every error easily.

5.1 VRC

VRC used to detect single bit error it can only detected burst error when total number of changed bits are odd.in VRC when number of bits changed are even then it wll not detect the error.

5.2 LRC

In LRC it will detect single bit error burst error but can not detect error if one 0 change from 0 to 1 and vice versa

5.3 Checksum

checksum is very effective error detection method. If bit inversion in one segment is balanced by bit inversion in another corresponding segment then Checksum fail to detect error and error will remains invisible.

5.4 2D parity check

In 2D parity check we calculate parity of individual column and row. 2D parity check is also a very effective error detection method. For a long binary data it takes more redundant bits. If even number of 0's swap with even number of 1's and vice versa, then 2D parity check fail to detect this type of erro

This technique BRT(Rotation technique) which is based on basic arithmetic operation (Addition) and simple rotation of bits, we send redundant bits with the data as key to compare with the receiving end signals key to check either the signal is with error or not..It is more effective than other methods. It can easily detect those errors which other methods fail to detect.

Comparison of BRT method with other error detection methods is shown below in table 1.

Comparison With other Error Detection methods

Method name	Original data	Corrupted data	Error detection
VRC	01100111	01100100	No
LRC	01100111 11010110	00100110 11010111	No
Checksum	00100111 11010110	00100110 11010111	No
2D parity check	00100111 11010110	11100111 00010110	No
BRT	00100111 11010110	11100110 00010111	Yes

Table 1. Comparison table of BRT with other methods

As we saw in above table BRT method detects those error which other methods unable to detect.

5.1Shortcoming

The Only probability of this method's failure is that if the key we are sending as redundancy bit with our message signal changed due to error then the error will not be detect.

Otherwise in every case single bit error, double bits error, multiple error and burst error all kind of error will detect by this method

6.0 Conclusion

There are many other error detection methods to detect errors but some error these methods can't detect .but in this method every sort of error can detect. advantage of this method if that it will detect every error and disadvantage is elaborate above.

7.0References

1. "Data Communication and Networking" 4th edition by Behrouz A.Forouzan (Chapter 10th page 267)
2. "Modern Digital and Analog Communication Systems" 3rd edition by B.P Lathi (Chapter 16th page 728)