DEVELOPMENT OF ERROR CONTROL CODING TECHNIQUE IN DIGITAL COMMUNICATION SYSTEM

Mr.Vishal G. Jadhao*

Prof.Prafulla D. Gawande*

Abstract:

During digital data transmission in digital communication system, noise is added and physical defects in the communication medium can cause random errors during data transmission. Error coding is a method of detecting and correcting these errors to ensure information is transferred intact from its source to destination. Error coding is used for fault tolerant computing in computer memory, magnetic and optical data storage media, satellite and deep space communications, network communications, cellular telephone networks, and almost any other form of digital data communication. Error coding uses mathematical formulas to encode data bits at the source into longer bit words for is transmission. Decoding of the code word is possible at side of receiver. The extra bits in the code word provide redundant bit, according to the coding scheme used, will allow the destination to use the decoding process to determine if the communication medium's expected error rate, signal to noise ratio and whether or not data retransmission is possible. Faster processors and better communications technology make more complex coding schemes, with better error detecting and correcting capabilities, possible for smaller embedded systems, allowing for more robust communications.

The proposed title discloses a novel approach for detection and correction of binary stream transmission errors such as *random errors* and *bursts errors* in digital communication systems. The fault detection and correction will be accomplished by Linear Block Code, Convolution Code or concatenated Code *Error-Control Coding* techniques.

Keywords- Fault Tolerant Computing, Embedded Communication, Real-Time System, Software Reliability formatting, concatenated code error control coding technique.

* Department Of Electronics and Telecommunication, Sipna College Of Engineering and Technology, Amravati, India

1.INTRODUCTION:

Error coding is a method of providing reliable digital data transmission and storage signal-to-noise ratio (SNR). Error coding is used in many digital applications like computer memory, magnetic and optical data storage, media, satellite and deep space communications, network communications, cellular telephone networks, rather than transmitting digital data in raw bit form. The data is encoded with extra bits at the source. The longer "code word" is then transmitted, and the receiver can decode it to retrieve the desire information. The extra bits transform the data into a valid code word in the coding scheme. The space of valid code words is smaller than the space of possible bit strings of that length. Therefore, the destination can recognize invalid code words.

2.REVIEW OF PRIOR FEATURE EXTRACTION TECHNIQUE:

Improved Analysis on Decoding and Its Application to Convolution Codes and BCH Codes by Chunlong Bai and Bartosz Mielczarek. Their design employs a list decoder generates a list of more than one codeword candidates, and decoding is erroneous if the transmitted codeword is not included in the list. This decoding strategy can be implemented in a system that employs an inner error correcting code and an outer error detecting code that is used to choose the correct codeword from the list Probability.

On the Performance of Short Forward Error-Correcting Codes Shang Tong and Dengsheng Lin they investigated the performance of short forward error-correcting (FEC) codes. Convolution codes and modern simple iteratively decodable codes, respectively. Additionally, random binary linear codes are used as a baseline reference.

I. TYPES OF ERROR AND COADING TECHNIQUES

A. Type Of Errors

In digital data transmission mainly two types of transmission errors encountered because of noise in the communication channel.

Random Errors: The transmission errors occurred due to white Gaussian noise are called random errors. Sources of Gaussian noise include thermal and short noise in the transmitting and receiving equipment, thermal noise in the channel, and radiation picked up by the receiving antenna.

Bursts Errors: Bursts errors occur due to presence of impulse noise encountered in a communication channel.

B. Types Of Codes

Following are the major types of coding schemes

Linear Block Codes: Linear block codes are characterized by segmenting a message into separate blocks of fixed length, and encoding each block one at a time for transmission. Linear block codes are so named because each code word in the set is a linear combination of a set of generator code words. If a message are k bit long, and the code words are n bit long (where n>k), there are k linearly independent code words of length n that form a generator matrix.

Convolutional codes: Convolutional codes are generally more complicated than linear block codes, more difficult to implement, and have lower code rates (< 0.90) but have powerful error correcting capabilities. They are popular in satellite and deep space communications, where bandwidth is essentially unlimited, but the BER is much higher and transmissions are infeasible.

Concatenated codes: concatenated code form a class of error-correcting codes that are derived by combining an inner code and an outer code that has both exponentially decreasing error probability with increasing block length and polynomial-time decoding complexity. Natural concept for a decoding algorithm for concatenated code is to first decode and inner code and then the outer code for the algorithm to be practical if must be polynomial time in the final block length consider that there is a polynomial time unique decoding algorithm for the outer code.

3.SYSTEM BUILDING BLOCKS:

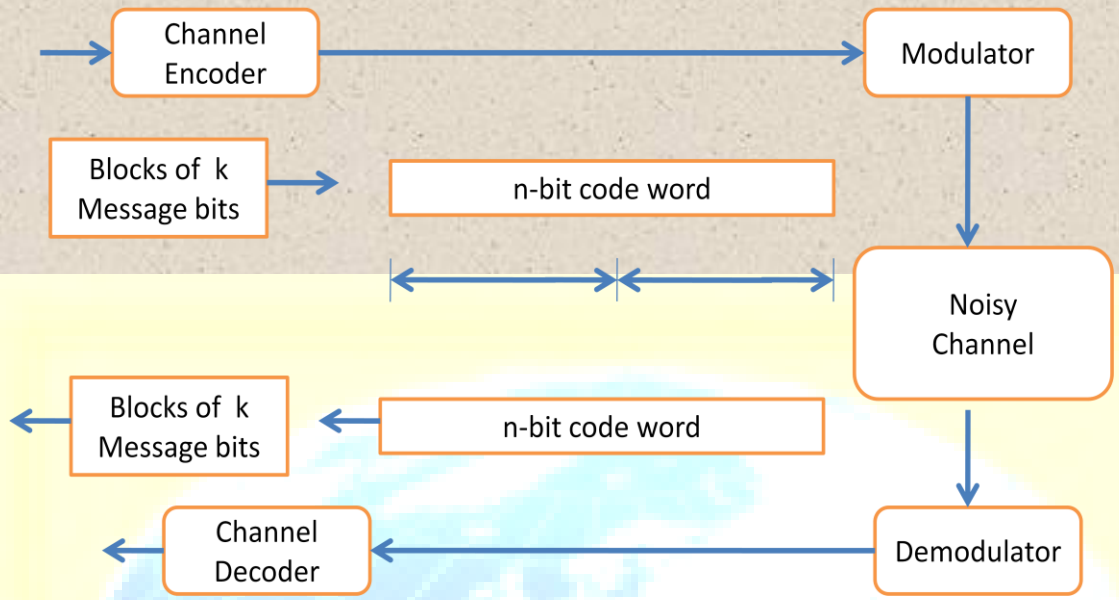


Fig. 1 Block Diagram

1. Information source

The information source generates the message single to be transmitted. In case of digital communication, the information source generate a message single which is not continuously varying with time. Rather the massage single is intermitted with respect to time in sampling the analogy single the chopped off at regular time intervals it is chopped samples from a discrete single.

2. Source encoder & decoder

The symbol produced by the information source are given to the source encoder. The source encoder covert this symbol into the digital from.

3. Channel encoder and decoder

Channel encoder add some redundant binary bits to the input sequence this redundant bits are added with some properly defined logic. For example, consider that code word from the source encoder to make it four bit long. This 4th bit added such that number of one's in encoded

word remain even. At the receiver, if odd number of one's are detected, then receiver comes to know that there is an error in the received signal. The channel decoder at the receiver is thus able to reconstruct error free accurate bit sequence, and reduce the effect of channel noise and distortion.

4. Digital modulators and demodulators

whenever the modulating single is discrete then digital modulation techniques are used . The carrier signal used by the digital modulators is always continued sinusoidal wave of high frequency. The digital modulators maps the input binary sequence of 1's and 0's to analog signal waveform. In the receiver, the digital modulators converts the input modulators signal to the sequence of binary bits. The most impotent parameter for the demodulator is the method of demodulation.

5. Communication channel

The connection between transmitter and receiver is established though communication channel. The media such as optical disks, magnetic tape and disks etc. can also be called as communication channel, because they can also carry the data though them.

In this project, we are trying to develop a software for detection and correction of transmission errors such as *random errors* and *bursts errors* in digital communication systems. The fault detection and correction will be accomplished by *Error-Control Coding* techniques.

4.PROPOSED DESIGN DIAGRAM:

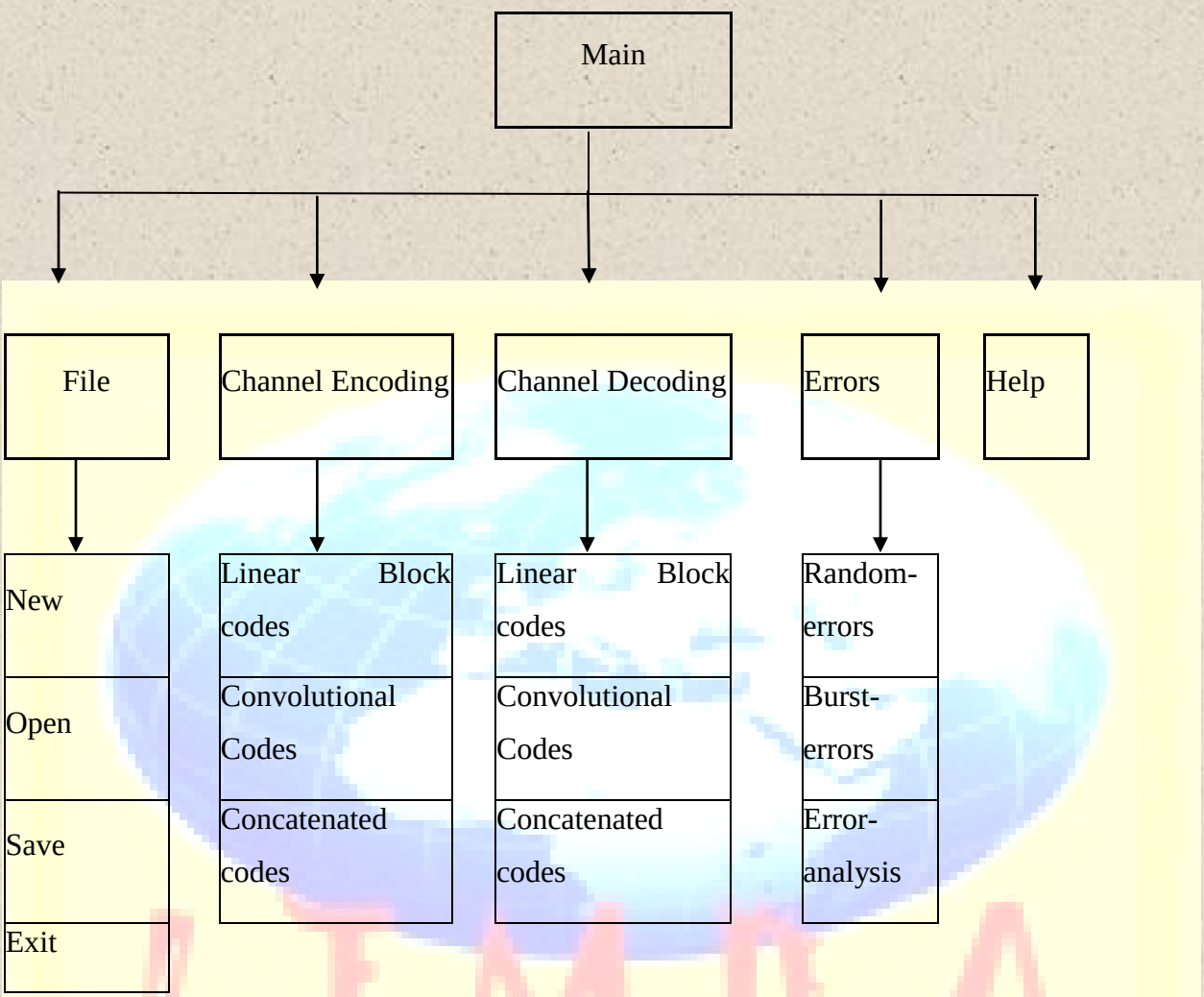


Fig. 2 Proposed Design Diagram

To Design and Develop a Software for Simulation of Error-Coding Techniques in Digital Communication systems. The software should be able to detect errors encountered in the data transmission in digital communication systems, and it should also perform analysis of BER (Bit-Error-Rate) and SNR (Signal-to-Noise Ratio) for Linear Block Codes, Convolutional Codes and Concatenated codes.

Design a software give a input of analog or message signal system can perform different error coding techniques. First can be encoded the given signal in three different coding techniques linear block code, convolutional code and concatenated code.

Different parameter setting are required generator matrix, codeword length(n), message length(k) then put the value after passing the signal to the noisy channel noise should be added channel decoder remove the noise and result error can be detected whose bit can courted graph is show.

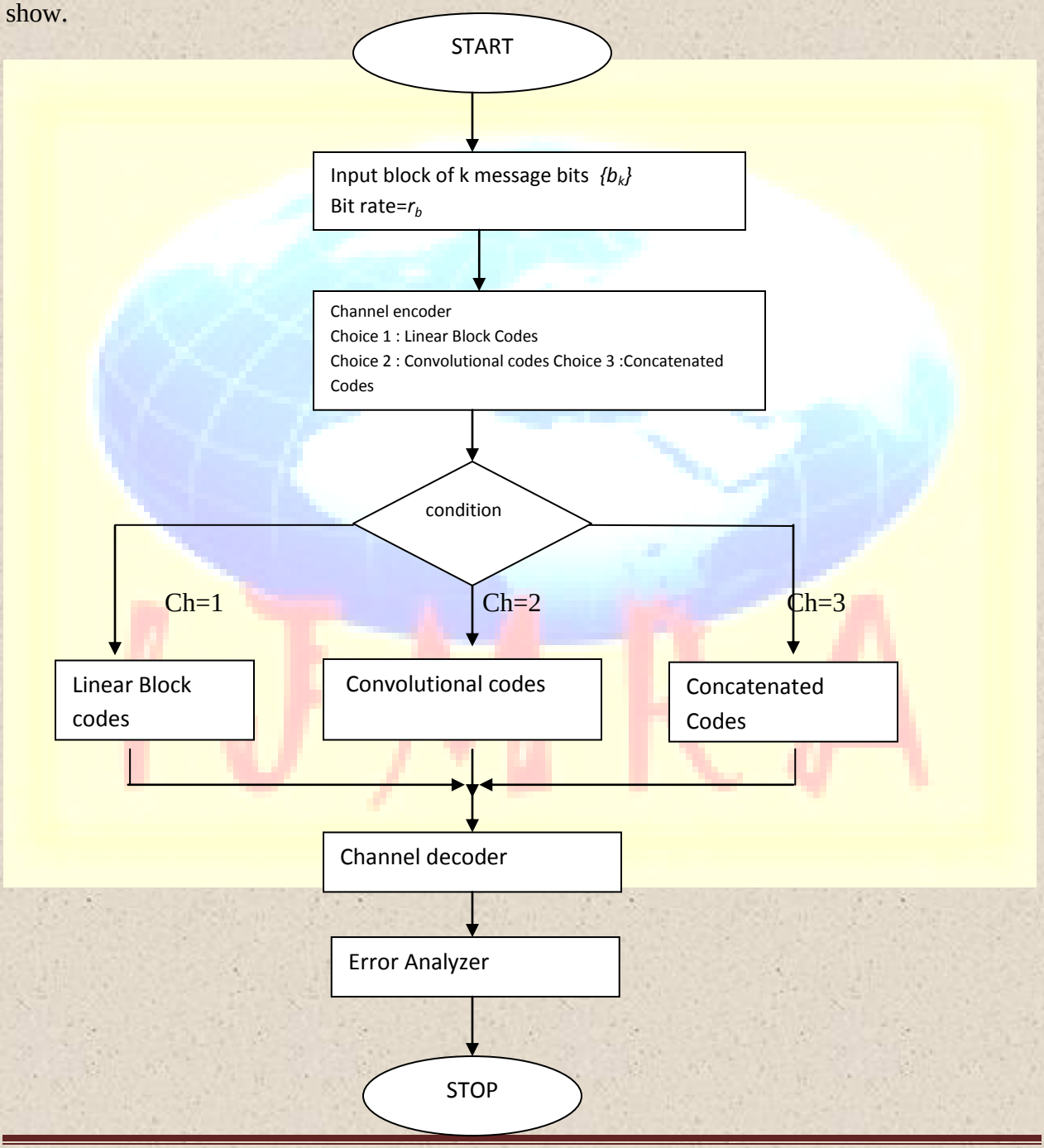


Fig.3 Flow Chart

5. Observations:

```
function varargout = errdet(varargin)
                                    gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
'gui_Singleton',  gui_Singleton, ...
'gui_OpeningFcn', @errdet_OpeningFcn, ...
'gui_OutputFcn',  @errdet_OutputFcn, ...
'gui_LayoutFcn',  [] , ...
'gui_Callback',   []);
if nargin & isstr(varargin{1})
gui_State.gui_Callback = str2func(varargin{1});
end
if nargout
[varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
gui_mainfcn(gui_State, varargin{:});
end
function errdet_OpeningFcn(hObject, eventdata, handles, varargin)
handles.output = hObject;
guidata(hObject, handles);
function varargout = errdet_OutputFcn(hObject, eventdata, handles)
varargout{1} = handles.output;
```

```
function mFile_Callback(hObject, eventdata, handles)

function mNew_Callback(hObject, eventdata, handles)

system('c:\winnt\system32\notepad.exe')

function mOpen_Callback(hObject, eventdata, handles)

a=uigetfile;

function mSave_Callback(hObject, eventdata, handles)

a=uiputfile;

function mExit_Callback(hObject, eventdata, handles)

close

function mCE_Callback(hObject, eventdata, handles)

function mlbc_Callback(hObject, eventdata, handles)

lin

function mbcc_Callback(hObject, eventdata, handles)

cyclic_enco

function mCc_Callback(hObject, eventdata, handles)

convo_enco

function mCd_Callback(hObject, eventdata, handles)

function mdlbc_Callback(hObject, eventdata, handles)

decoder

function mdbcc_Callback(hObject, eventdata, handles)

cyclic_decoder

function mdcc_Callback(hObject, eventdata, handles)

convo_decoder
```

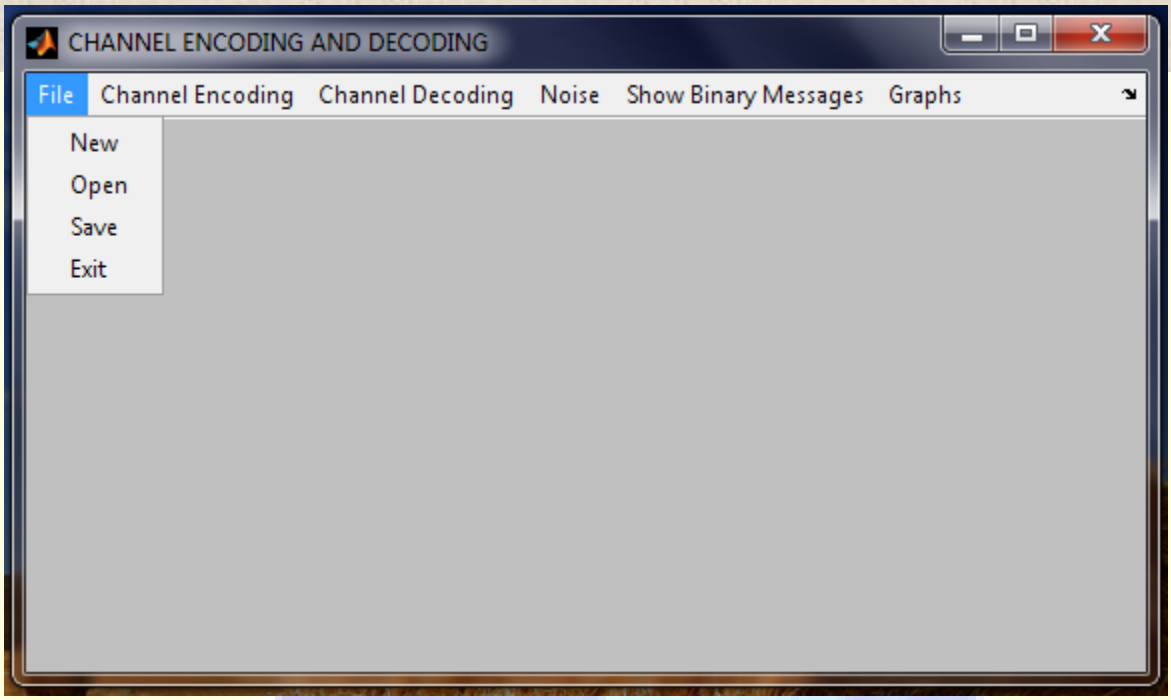
```
function Untitled_9_Callback(hObject, eventdata, handles)

noise

function errors_Callback(hObject, eventdata, handles)

a=1;

disp(a);
```



6. Conclusion:

In today's era, digital communication has become extremely important aspect of our life. Diversified applications such as fault tolerant computing in computer memory, magnetic and optical data storage media, satellite and deep space communications, network communications, cellular telephone networks are based on this technology. Environmental interference and physical defects in the communication medium can cause random bit errors during data transmission.

The fault detection and correction can be accomplished by *Error-Control Coding* techniques. Thus, theoretical aspects of Error-coding techniques are thoroughly studied and

presented. However, the conceptual things become significant after their practical implementation.

Important reasons to use coding are achieving dependable data storage in the face of minor data corruption/loss mid gaining the ability to provide high precision *I/O* even on noisy transmission lines such as cellular phones (error coding decouples message precision from analog noise level).

7. ACKNOWLEDGMENT:

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9. Authors Information:

Mr. Vishal G. Jadhao: He is also pursuing his M.E. in Digital Electronics from the Sipna's College of Engineering and Technology, Amravati (India). His areas of interest are Digital Communication System and Digital Signal Processing.

Prof. Prafulla D. Gawande: is currently working as Professor in Electronics and Telecommunication Engineering Department, Sipna College of Engineering, Amravati (India).