



INDIAN INSTITUTE OF
INFORMATION TECHNOLOGY,
NAGPUR

ECL-320

Digital Communication System

Project Report

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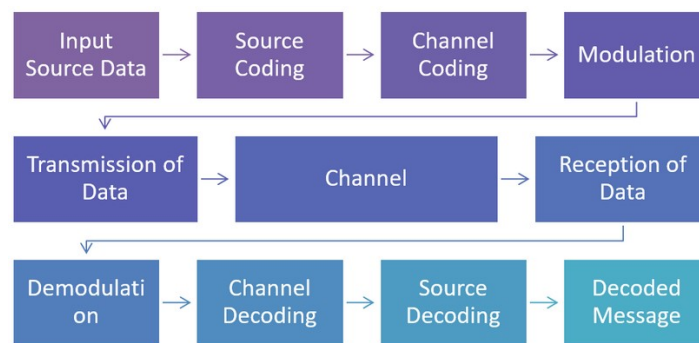
Submitted To :

Dr. Rashmi Pandhare

Course Instructor

About our project :-

This project is the simulation of a complete digital communication system. A digital communication system consists of multiple blocks and each block is implemented here as a MATLAB function and the maincode.m file combines them all to build the complete system. The system reads text and process the text data accordingly and writes the received text. The block diagram below shows all the blocks of the system in a sequential manner.



Each block is built using the following techniques.

- Source Coding: Huffman encoding
- Channel Coding: Convolutional encoding
- Modulation: BPSK modulation
- Channel: Additive White Gaussian Noise Channel
- Demodulation: BPSK demodulation
- Channel Decoding: Viterbi decoding
- Source Decoding: Huffman decoding

Source Coding :-

The source encoder compresses the data into minimum number of bits. This process helps in effective utilization of the bandwidth. It removes the redundant bits unnecessary excess bits, i.e., zeroes

- Huffman encoding :- Huffman Coding is a technique of compressing data to reduce its size without losing any of the details. It was first developed by David Huffman. Huffman Coding is generally useful to compress the data in which there are frequently occurring characters

Channel Coding :-

The channel encoder, does the coding for error correction. During the transmission of the signal, due to the noise in the channel, the signal may get altered and hence to avoid this, the channel encoder adds some redundant bits to the transmitted data. These are the error correcting bits.

- Convolutional encoding :- Convolutional code is another type of error-correcting code where the output bits are obtained by performing a desired logical operation on a present bitstream along with considering some bits of the previous stream. This coding technique rather than depending on the block of bits shows dependency on bitstream.

Modulation :-

it is the process of encoding a digital information signal into the amplitude, phase, or frequency of the transmitted signal. The encoding process affects the bandwidth of the transmitted signal and its robustness to channel impairments.

- Binary Phase-shift keying (BPSK) :- it is a digital modulation scheme that conveys data by changing, or modulating, two different phases of a reference signal (the carrier wave). The constellation points chosen are usually positioned with uniform angular spacing around a circle. This gives maximum phase-separation between adjacent points and thus the best immunity to corruption

Channel :-

The channel or a medium, allows the analog signal to transmit from the transmitter end to the receiver end.

- Additive White Gaussian Noise Channel :- AWGN is a basic noise model used in information theory to mimic the effect of many random processes that occur in nature.

Demodulation :-

This is the first step at the receiver end. The received signal is demodulated as well as converted again from analog to digital. The signal gets reconstructed here.

- Binary Phase-shift keying (BPSK) :- The BPSK Demodulator Baseband block demodulates a signal that was modulated using the binary phase shift keying method. The input is a baseband representation of the modulated signal. This block accepts a scalar or column vector input signal. The input signal must be a discrete-time complex signal.

Channel Decoding :-

The channel decoder, after detecting the sequence, does some error corrections. The distortions which might occur during the transmission, are corrected by adding some redundant bits. This addition of bits helps in the complete recovery of the original signal.

- The Viterbi algorithm is based on the Maximum-Likelihood decoding technique. The main purpose of the decoder is to select the code word with the minimum distance between the received signal and the code word. Viterbi algorithm is utilized to decode the convolutional codes.

Source Decoding :-

The resultant signal is once again digitized by sampling and quantizing so that the pure digital output is obtained without the loss of information. The source decoder recreates the source output.

- Huffman decoding :- In Huffman decoding we use Huffman Encoded data to obtain the initial, uncompressed data again. Having our Binary Huffman Tree obtained during encode phase, decoding is a very simple process to perform.

Project Link For Code Files :-

https://github.com/sarthu07/digital_communication.git

Output :-

```
Command Window
Reading data: heyy i am sarthak babra my enrollment no. is bt19ece028, heyy i am avish my enrollment no. is bt19ece037,
Source statistics: Elapsed time is 0.319694 seconds.
Huffman encoding: Elapsed time is 0.218978 seconds.
Stream generator: Elapsed time is 0.046207 seconds.
Channel coding: Elapsed time is 0.812274 seconds.
Modulation: Elapsed time is 0.169558 seconds.
Channel: Elapsed time is 0.402365 seconds.
Demodulation: Elapsed time is 0.254308 seconds.
Channel decoding: Elapsed time is 1.296515 seconds.
Huffman decoding: Elapsed time is 0.065582 seconds.
Writing data: heyy i am sarthak babra my enrollment no. is bt19ece028, heyy i am avish my enrollment no. is bt19ece037,
Total execution time: Elapsed time is 3.648025 seconds.
Total Bit Error: 0
fx>>
```

Conclusion

In this project we have successfully make multiple block of Digital communication system using matlab for transmitting and receiving messages.