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LB1028.55 .N67 2006



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Line coding generator system / Norhayati Ahmad Puad.

## **LINE CODING GENERATOR SYSTEM**

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**This report is submitted in partial of the requirements for the  
Bachelor of Computer Science (Computer Networking)**

**FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY  
KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA  
2006**

TESIS^ APPTOVAL STATUS FORM

JUDUL: LINE CODING GENERATOR SYSTEM

SESI PENGAJIAN: 2006/2007

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## **DEDICATION**

Specially dedicated to  
my beloved parents, En. Ahmad Puad Husain, Pn. Ropiah Baba,  
my beloved family members and friends who have  
encouraged, guided, blessed and inspired me throughout my journey of education.

## **ACKNOWLEDGEMENTS**

I would like to express my warmest gratitude and a heartfelt thank you to Kolej Universiti Teknikal Kebangsaan Malaysia and also a heartfelt appreciation to Faculty of Information Technology and Communication (FTMK) for providing an excellent quality of its learning system and environment for students to study and to produce a well educated graduates ad it has been the first technical university in Malaysia.

First of all, I would like to express my greatest thank you to my supervisor, Puan Haniza Nahar for her invaluable guidance, thoughts, inspiration and support. Without those encouragements, this project will not be complete to the end.

My appreciation goes to my beloved parents, En. Ahmad Puad Husain and Pn. Ropiah Baba that had gave me a lot of courage, knowledge, support, advice, and the most important is for their blessing and tenderness of love for me throughout my journey of education in KUTKM. Nothing is possible without their support that brings me all this way.

Besides, I would also like to thank my friends and anyone who have been helping me to complete this project.

## ABSTRACT

The principle of developing a generator system to help students that is learning the sub-topic of line coding in the Data Transmission topic at Faculty of Information Technology and Communication (FTMK) which it is a compulsory for the semester three of FTMK students who is taking the subject Data Communication and Networking. Line coding concept has many schemes and techniques that are difficult for the students to learn, because of the deeply understanding. This project will integrate the main point of all the concept into a Graphical User Interface (GUI) mode to attract the students' attention to feel that it is an interesting subject to be learn. There are a few main functions; for example, choose line coding schemes that allow users (students and lecturers) to choose the line coding schemes that they wanted. This system will generate the binary data entered by the users into a wave form. The Rapid Application Development prototyping is chosen to be used in this system because of the compatibility and its excellent approach to this system. The language used for this system is Visual Basic (VB) and the system does not need any network requirement as it is an application that involve with the user friendly and a stand alone system. Line coding generator system will be a system that will give many benefits and advantages to the user; especially to the FTMK students that can help and guided them through out the learning system.

## ABSTRAK

Tujuan membangunkan satu sistem penjana untuk membantu pelajar yang sedang mempelajari tentang sub-topik 'line coding' di dalam topik Data Transmission di Fakulti Teknologi Maklumat dan Komunikasi (FTMK) yang harus diambil oleh pelajar-pelajar FTMK semester ketiga yang mengambil subjek Komunikasi Data dan Rangkaian. Konsep 'line coding' mempunyai banyak skema dan teknik yang agak susah untuk dipelajari dalam masa yang singkat, kerana topik ini ialah suatu topik yang memerlukan pemahaman yang mendalam. Projek ini akan menggabungkan semua konsep menjadi keadaan gambarajah (GUI) untuk menarik perhatian pelajar-pelajar untuk belajar. Terdapat beberapa fungsi utama di dalam sistem, contohnya memilih skema 'line coding' yang membolehkan pengguna (pelajar dan pensyarah) untuk memilih skema 'line coding' yang dikehendaki. Sistem ini akan menjana data binari yang dimasukkan oleh pengguna kepada bentuk gelombang (wave form). Metodologi Rapid Application Development (RAD) prototyping digunakan untuk sistem ini kerana sesuai dengan pendekatan yang diperlukan untuk membangunkan sistem ini. Bahasa pengaturcaraan yang digunakan untuk membangunkan sistem ini ialah Visual Basic (VB), dan sistem ini tiada memerlukan keperluan rangkaian kerana ia adalah aplikasi yang melibatkan mesra pengguna dan ia adalah sistem 'stand alone'. 'Line coding generator system' akan menjadi satu sistem yang akan memberi banyak faedah dan kelebihan kepada pengguna, terutama kepada pelajar-pelajar FTMK yang boleh membantu dan membimbing mereka sepanjang proses pembelajaran.

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## LIST OF ABBREVIATIONS

KUTKM	-	Kolej Universiti Teknikal Kebangsaan Malaysia
FTMK	-	Fakulti Teknologi Maklumat dan Komunikasi
BITC	-	Bachelor of Information Technology (Computer Networking)
BITS	-	Bachelor of Information Technology (Software)
BITM	-	Bachelor of Information Technology (Multimedia)
BITD	-	Bachelor of Information Technology (Database)
OS	-	Operating System
ODBC	-	Open Database Connectivity
GUI	-	Graphical User Interface
VB	-	Visual Basic
PSM	-	Projek Sarjana Muda
SDLC	-	System Development Life Cycle
RAD	-	Rapid Application Duration
JAD	-	Joint Application Duration
RZ	-	Return to Zero
NRZ	-	Non Return to Zero
NRZ I	-	Non Return to Zero Level

## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 Project Background**

The project that is going to be developed is a line coding generator system. It is a system that can help students who is taking the Data Communication subject to have a better understanding of one of the topics they learn in the topic Data Transmission, Line Coding. Line Coding is the method used for converting a binary information sequence into a digital signal communication system. The selection of a line coding techniques involves several considerations.

The waveform pattern of voltage or current used to represent the 1s and 0s of a digital signal on a transmission link is called line encoding. The common types of line encoding are Polar, Unipolar and Bipolar encoding.

In telecommunication, a line code is a code chosen for use within a communications system for transmission purposes. For digital data transport line coding is often used. Line coding consists of representing the digital signal to be transported, by an amplitude- and time-discrete signal that is optimally tuned for the specific properties of the physical channel (and of the receiving equipment). After line coding, the signal can directly be put on a transmission line, in the form of variations of the current.



This project is also focused on how the students can learn and see the result of the digital signals that are produced by the line codes for the binary sequence (for example, the sequence binary of 101011100). Students can see the waveform for each type of the line coding schemes. Common types of line encoding methods used in data communications are:

- Unipolar line encoding
- Polar line encoding
- Bipolar line encoding

Unipolar encoding is a very simple and primitive. Unipolar encoding uses only one voltage level. Unipolar encoding has two voltage states with one of the states being 0 volts.

When the digital encoding is symmetrical around 0 Volts, it is called a Polar Code. The signal does not return to zero, it is either a positive voltage or a negative voltage.

Bipolar line encoding has three voltage levels, a low or 0 is represented by a 0 Volt level and a 1 is represented by alternating polarity pulses. Synchronization of receive and transmit clocks is greatly improved except if there is a long string of 0s transmitted.

## **1.2 Problem Statements**

The current learning system of this Line Coding topic of the Data Communication subject is not appropriate and there is no module or any learning aid system to provide a better understanding for the students in this topic. Line Coding is one of the subtopic of the Data Transmission topic. This topic is chosen because lecturers found out that most of the students who took this subject face the difficulties to understand how the line coding is generate and transformed into signal form. The other problems are as following:

- **Insufficient learning schemes for Data Communication students**

The current system learning for Data Communication subject especially for the topic of line coding is not sufficient for the students.

- **No learning aid system to help students through the learning process**

Before this, lecturers did not have a learning aid system in helping them to teach the students how the data can be transmit into a digital signal based on the line coding schemes chosen. Currently, students need to draw the result of the transmission (waveform) and this process took a quite long time and it also seem to waste the precious time by drawing the output manually.

- **Unattractive learning system**

The current learning system is not attractive enough to attract students to have a better understanding of this subject. It is because the current learning process is via the transparency slides on the projector.

### 1.3 Objectives

The goal of this project is to provide the lecturers a simple and easy tool to teach their students in the class. Thus, the generator tools provide a lot of benefits to the students and also to the lecturers itself.

The objectives of this project are:

- **To develop a line encoding generator for Data Communication students.**

The aim of this encoding generator that will be developed is to help the students who are taking the Data Communication subject.

- **To provide a learning aid system to simplify the learning process.**

Via this encoding generator, the students can see how the binary sequence data can be convert (encode) into a digital signal schemes.

- **To produce a user-friendly interface**

This encoding generator will be a medium of interaction between the system and users to have an interactive and dynamic system. User will be using this system effectively and efficiently

#### **1.4 Scopes**

This encoding generator will provide an idea about the data transmissions. This project will indicate most of the Data Transmission topics, therefore students can have a better understanding of the topics better by looking at the graphical interface shown on the screen, and hence it also can help reduce the lecturer's time to prepare the teaching material before starts the class. The quiz can measure the student's knowledge on the related topics. Lecturer will be an administrator and authorized user to the system.

The scopes for this project are:

1. The simulator system that is going to be developed and implement is based on the graphical user interface (GUI) approach.
2. The simulation system will be focusing on the FTMK students who were study in the third semester who is taking the subject "Data Communication and Networking" and also any user who interested in the subject.
3. The quiz application is using by the lecturers as an administrator and students as the users.

4. Students can only take the quiz and cannot do the changes to the system.
5. The topics that will be covered in the Data Transmission are on how the binary data will be encoded into the digital signal.

### **1.5 Project significance**

This project is developing especially to the students of Faculty of Information Technology and Communication (FTMK). This project is aim to the FTMK's students who is taking the subject Data Communication. The students who is taking the subject will gain many benefits from this system because currently there is no an efficient learning system to help the students to generate the waveform pattern of the line encoding types. The goal of this project is to help the students to have a better understanding in learning the topics of line coding, by not just understanding how the waveform are generated and also try themselves to use the system application to experience themselves how to generate the waveform. This system also allows students to have an extra understanding of the subject by answering the simple quiz about the system.

### **1.6 Conclusion**

As the number of students studying in KUTKM increasing each year, the learning system that have been used in teaching the Data Transmission subject is not efficient enough to help the students in understanding how the data (in binary) is encode into a digital signal (waveform). The result of the encoding generator can be in different line coding schemes; Unipolar line encoding, Polar line encoding and Bipolar line encoding.

The current system of teaching is using a manual system; where the students need to draw the output of the data based on the input (binary data) and also based on the schemes that they want. It is a difficulty for the students to understand the waveform that they need to draw manually based on the line coding schemes that the lecturer needs. This project is hoped can help the students to have a better understanding of the topic and save their time by drawing the output of the data encoding generator.

For conclusion of this chapter, in this phase introduction of system include project background in brief. Detailed explanation for problems statement will show the currents problems and what makes come out with the proposed system. Developed system scopes expounding each features and functions of the system are related in detail and suitable with the objective to develop a better system. Through project significance, the users and place to implement were identified plus the advantages of the system and why the system is the best to use. The next step is to perform literature review for research of the system developed. By the research the frailty can compared to perform a system that fulfill the current system constraints.

## **CHAPTER II**

### **LITERATURE REVIEW AND PROJECT METHODOLOGY**

#### **2.1 Introduction**

In this chapter, literature means the works you consulted in order to understand and investigate your research problem. A literature review discusses published information in a particular subject area and sometimes information in a particular subject area within a certain time period.

To make literature review for this system, it is based on the current situations and current systems so that comparison can be made to identify user and system requirements. In this system, the current situation is that there is no appropriate learning system for the students to understand the subject of digital transmission.

The literature review is done by reviewing sources from books that related to the Data Communication topics and also web pages on the Internet about the article/ journal or experiments done by other researcher on this topic or about the line coding generator system.

The best methodology will affect the flow of development system. For this system, Rapid Application Development (RAD) will be the implement method.

## **2.2 Fact and Findings**

### **2.2.1 Digital Transmission**

All computer generated data is digital, for example the encoded as binary digits (bits). Digital data may be transmitted using either digital or analog signaling. Analog data such as human voice may also be transmitted using either digital or analog signaling. Many different methods of encoding data onto signals are necessary.

Digital information is better transmitted in its digital form because converting the signal to analog and sending it through an analog network can be costly. Digital data is easily compressed; therefore it can be transmitted using a small bandwidth. Because of the nature of devices used to boost the signal strength during transmission, error performance is much improved when compared with analog. It is also better to transmit information in digital form because computer components used in the transmission process are very reliable.

### **2.2.2 Line Coding**

Line coding is the method used for converting a binary information sequence into a digital signal in a digital communications system. The selection of a line coding techniques involves several considerations. In the previous sections, we focused on maximizing the bit rate over channels that have limited bandwidths. Maximizing bit rate is the main concern in digital transmissions when bandwidth is at a premium. However, in other situations, such as in LANs, other concerns are also of interest. For example, another important design consideration is the ease with which the bit timing information can be recovered from the digital signal. Also, some line coding methods have built-in error detecting capabilities, and other methods have better immunity to noise and

interference. Finally, the complexity and the cost of the line code implementations are always factors in the selection for a given application.

Line coding is the process of converting binary data, a sequence of bits, to a digital signal. For example, data, text, numbers, graphical images, audio and video that are stored in computer memory are all sequences of bits. Line coding converts a sequence of bits to a digital signal.

A digital signal can have a limited number of values. However, only some of these values can be used to represent data; the rest are used for other purposes. We refer to the number of values allowed in a particular signal as the number of signal levels; we refer to the number of values used to represent data as the number of data levels.

### **2.2.3 Encoding and Modulating**

Digital-to-Digital encoding or conversion is the representation of digital information by a digital signal.

#### **2.2.3.1 Unipolar Encoding**

Unipolar encoding uses one polarity, assigned to one of the two binary states, usually the 1. The other state, usually the 0, is represented by zero voltage. It has two problems; a DC component and synchronization. A synchronization problem can occur whenever the data stream includes a long uninterrupted series of 1s or 0s. Lack of synchronization between the sender's and the receiver's clock distorts the timing of the signal.