# Digital Electronics Tutor

## PROJECT REPORT

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# SYNOPSIS

Multimedia packages are increasingly gaining popularity due to their characteristics of being interactive, user friendly and immensely interesting.

This multimedia tutor package in Digital Electronics incorporates all these characteristics to yield an end product that provides for a comprehensive and easily comprehensible learning aid for students pursuing the subject of Digital Electronics at the bachelor's level of study. The basic fundamentals of Digital Electronics have been elucidated in this tutor package using the maximum of illustrations and examples. This tutor is tailor made for the needs of a Computer Science and Engineering undergraduate undertaking study of digital computer fundamentals for the first time.

# INTRODUCTION

Conventional education techniques are rapidly being replaced by more revolutionary methods. One method that has the potential to monopolise the sphere of education is computer aided education.

The multimedia tutor creates an amiable learning environment using audio-visual aids that make way for a very comprehensive, easily comprehensible and interactive teaching session. The package also enables a student to undertake study at his or her own pace and frequency - an advantage over the conventional classroom technique. This Digital Electronics tutor package is resplendent with animation and diagrams that enable easy comprehension of the subject as well as making the learning session interesting rather than soporific as classroom sessions usually are. The tutor package contains the essential fundamentals of Digital Electronics that are required as a foundation to advanced study in the same.

# TOPICS

## Chapter One :

BINARY SYSTEM

1. Introduction
2. The Binary number system
3. The Hexadecimal number system
4. The Octal number system

## Chapter Two :

BOOLEAN ALGEBRA

1. Basic Definitions
2. Theorems and properties of Boolean Algebra
3. Reduction of Boolean expressions

## Chapter Three :

LOGIC GATES

1. Types of Logic
2. Logic Diagrams
3. Logic gates
4. Universal gates

# Chapter Four :

## COMBINATIONAL CIRCUITS

1. Introduction
2. Design Procedure
3. Truth tables and Maps
4. Sum of products and product of sums reduction
5. Adders and Subtractors


# Chapter Five :

## SEQUENTIAL CIRCUITS

1. Introduction.
2. Flip-flops.
3. Counters.
4. Shift registers.

## Chapter One :

Chapter one starts of with a brief introduction to digital electronics. After a discussion of the decimal number system, the tutor elucidates the binary, hexadecimal and octal number systems that are necessary as a foundation for further study in digital electronics. The discussions on the number systems deal with their representation and their conversion from one number system to another. It also covers the basic arithmetic operations that are done using these number systems.

## Chapter Two :

Chapter two introduces the student to the concept of Boolean algebra which is the concept that digital computers today work on. The student is exposed to the basic definitions of Boolean algebra and then taught the way of forming expressions in Boolean algebra. The chapter closes after a session on the rules and techniques that are to be adopted for reducing Boolean expressions, which is illustrated with examples.

## Chapter Three:

Chapter three deals with the logic gates that are the basic functional units of any digital circuit. The different types of logic that are used are explained along with their logic diagrams and their truth tables. Animated diagrams are used to show the effect of different inputs on the output of each logic gate. This chapter also introduces the user to the Universal gates and emphasises their importance to the user along with the various possibilities that they offer.

## Chapter Four :

The fourth chapter starts off with an introduction to the combinational circuits that are formed using the different logic symbols. After a clear explanation of these circuits, the tutor goes on to explain the design procedure to create combinational circuits from Boolean functions. The chapter closes with the elucidation of the working of the adder and subtractor circuits.

## Chapter Five :

The last chapter of the tutor complements the students knowledge of digital circuits by explaining the concept of sequential circuits , the circuits that compose the bulk of the digital circuits in a computer. The tutor explains the concept of the flip-flop and illustrates its working and properties. A thorough session on the different types of flip-flops available and their truth tables and functions are carefully explained. The chapter closes the tutor after a discussion on the counter and shifter circuits that are formed using these flip-flops.

# SYSTEM REQUIREMENTS

The package being a multimedia product, a minimum system configuration as detailed below is required for the execution of the Digital Tutor program :

```
# 486 Microprocessor

# 8 MB Primary Memory

# 1 MB Video Memory

# 8 Bit Sound System

# 800X600 Resolution Monitor

# Windows 95/NT Operating System
```

# TOOLS USED

The project being a multimedia package, a host of software tools have been utilised to obtain the end product. The tools used and their brief description follows :

## Director 5 :

This multimedia product from Macromedia has numerous utilities that can be used to make a multimedia presentation. By and large the project has been implemented using this flexible and easy-to-use package. Apart from facilitating easy sequencing of multimedia objects, Director 5 is highly compatible allowing single images , digital movies and sounds created by other software to be imported and edited, producing an integrated and eclectic multimedia product.

## 3D Studio :

Created specially to produce three dimensional animation effects, this software provides a large number of functions that can be used to achieve high quality three dimensional animation sequences. This package has been

utilised to produce the all the three dimensional animation sequences observed in the tutor package.

## Adobe Photoshop 4.0 :

Adobe Photoshop 4.0 is an excellent paint and image editing utility. Adobe Photoshop can been used to convert digital images from one format to another to enhance the image quality and properties. Adobe Photoshop has been extensively used to enhance the effects of the images and the typecast that have been used in the project.

## Creative Wave Studio :

An application to produce high quality digital sound, Wave Studio provides a comprehensive range of sound manipulating and editing functions to chose from. The audio track of the project has been developed using Wave Studio.

# SCRIPT

Movie name    : Menu
Script type    : Frame Script
Frame number : 1

```
on exitFrame
    repeat while the mouseDown =FALSE
    if rollOver(8) then
      go to frame 7
    end if
    if rollOver(9) then
      go to frame 1
    end if
    if rollOver(10) then
      go to frame 1
    end if
     if rollOver(2) then
      go to frame 1
    end if
    if rollOver(11) then
      go to frame 1
    end if
    if rollOver(3) then
      go to frame 2
    end if
    if rollOver(4) then
      go to frame 3
    end if
    if rollOver(5) then
      go to frame 4
    end if
    if rollOver(6) then
      go to frame 5
    end if
    if rollOver(7) then
```

```
        go to frame 6
      end if
    end repeat

    if rollOver(3) then
      play movie "c100"
      go to frame 1
    end if
    if rollOver(4) then
      play movie "c200"
      go to frame 1
    end if
    if rollOver(5) then
      play movie "c300"
    end if
    if rollOver(6) then
      play movie "c400"
    end if
    if rollOver(7) then
      play movie "c500"
    end if
    if rollOver(8) then
      go to frame 8
    end if

    end
```

```
Movie name    : c100
Script type   : Frame Script
Frame number : 5

on exitFrame

  repeat while the mouseDown =FALSE

    if rollOver(2) then
       play movie "c101"
    end if
    if rollOver(3) then
       play movie "c102"
    end if
    if rollOver(4) then
       play movie "c103"
    end if
    if rollOver(5) then
       play movie "c104"
    end if
    if rollOver(6) then
      go to frame 6
    else
       go to frame 5
    end if

  end repeat

end
```

Movie name     : c201
Script type        : Cast Script of Cast Member 12:Exit
Frame number : 2

```
on mouseDown
  quit
end
```

Movie name     : c201
Script type        : Frame Script
Frame number : 2

```
on exitFrame
  set the visible of sprite 12 to TRUE
  set the visible of sprite 11 to TRUE
end
```

Movie name     : c201
Script type       : Sprite Script of Sprite 4
Frame number : 2

```
on mouseDown
  set the visible of sprite 4 to FALSE
  updateStage
  pause
  delay 60
  continue
  set the visible of sprite 4 to TRUE
  go to frame 3
end
```

Movie name     : c201
Script type      : Cast Script of Cast Member 17:Playup
Frame number : 2

```
on mouseDown
if the visible of sprite 12 = FALSE then
  set the visible of sprite 6 to FALSE
  updateStage
  pause
  delay 60
  continue
  set the visible of sprite 6 to TRUE
  set the visible of sprite 11 to TRUE
  set the visible of Sprite 12 to TRUE
  Updatestage
  continue
end if
end
```

Movie name    : c201
Script type    : Cast Script of Cast Member 20:Stopup
Frame number : 2

```
on mouseDown
  set the visible of sprite 8 to FALSE
  updateStage
  pause
  delay 60
  continue
  set the visible of sprite 8 to TRUE
  go to frame 15
end
```

Movie name    : c201
Script type    : Sprite Script of Sprite 10
Frame number : 4

```
on mouseDown
  set the visible of sprite 10 to FALSE
  updateStage
  pause
  delay 60
  continue
  set the visible of sprite 10 to TRUE
  go to frame 1
end
```

Movie name    : c201
Script type      : Cast Script of Cast Member 24:Pauseup
Frame number : 2

```
on mouseDown
  set the visible of sprite 12 to FALSE
  set the visible of sprite 11 to FALSE
  updateStage
  pause
end
```

# CONCLUSION

This project aimed at facilitating the study of Digital Electronics at the undergraduate level of the study Engineering, has been successfully developed to cater to all the planned objectives.

Though every consideration has been taken to ensure that the user of this product is availed of all the possible requisites, there is still scope for an enhancement of the product. This could be in the way of including additional illustrations and also by including brief introductions to more advanced topics that were not dealt with in this project.

# BIBLIOGRAPHY

Digital Electronics
- William H. Gothman

Digital Logic And Computer Design
- M. Morris Mano

Digital Computer Fundamentals
- Thomas C. Bartee

Macromedia Director 5
- Chuck Henderson