INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATIONS AND ROBOTICS
ISSN 2320-7345

DEVELOPMENT OF VIRTUAL EXPERIMENT ON ENCODING TECHNIQUES USING VIRTUAL INTELLIGENT SOFTLAB

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Abstract: - The scope of this paper includes development and implementation of virtual lab for Encoding Techniques. The study of encoding is important in Electronics, Computer Science and Engineering. The encoding experiment can be performed by using the concept of virtual Intelligent SoftLab (VIS). The virtual experiment described here will help students to perform it any time anywhere. The screen shows the Characteristics of encoding shows related outputs. There is a facility for change of Input values using virtual instruments and observed the outputs with virtual Instrument. In this paper we check the input output characteristics of Amplitude-shift Keying (ASK), Frequency-shift keying (FSK) and Phase-shift keying (PSK) using encoding technique. The effect of encoding characteristics is visible on the screen.

Keywords: SoftLab, Shift-keying, ASK, FSK, PSK, Virtual Lab etc.

1. Introduction

The basic concept of VIS (Virtual Intelligent SoftLab) Model of an experiment is to provide a virtual platform for learners to perform the experiment with their own selection. The effort is towards the working procedure in a real laboratory and its environment in the virtual workbench. Virtual experiments are designed and sequenced in such a manner as to give a real feel of performing the experiment. During the experiment, the learner can save and edit the desired data for his/her analysis. Apart from these the focus is also aims to embed a maximum number of learning components in virtual experiments. Virtualizations of experiments could be broadly classified, based on the form data used for performing the experiment. The Soft Lab philosophy facilitates us to link the physical laboratory experiment with its theoretical simulation model within a unified and interactive environment. The goal for each instance of a SoftLab laboratory is to create a software environment where experimental research, simulation and education coexist and interact with each other. As a part of the SoftLab project, we have elaborated the various issues involved in the design and development of SoftLab model for Electronics, Computer science and engineering. This model describes how the SoftLab philosophy was used to design and implements. The VIS forces us to address the challenge of solving experiments. Such systems require a wide range of expertise plus a flexible and diverse array of equipment. The SoftLab framework should provide the infrastructure and facilities that serve the needs for basic research.

SoftLab is such a flexible laboratory environment. Its goal is to simulate a laboratory space having a well-equipped storeroom of instruments and a variety of materials. Using SoftLab a student may be guided by an instructor to perform an experiment, or the student might also conceive of one on his own. The student may choose a substance to study, take out the instruments he needs, connect them together, make his measurements, and record and plot his results. The computer screen is the laboratory room. The experimental possibilities open to the student certainly are limited by the ability of the developers to maximize flexibility in a practicable way [1].

2. Encoding Techniques

Modulation involves operation on one or more of the three characteristics of a carrier signal: amplitude, frequency, and phase. Accordingly there is three basic encoding or modulation techniques for transforming digital data into analog signals.
A program is constructed for conduct of phase shift-keying experiment in VIS in 'VB' such that all the blocks in the model can be fully visualized on the screen. This model also can demonstrate the activities of phase shift-keying, amplitude shift-keying and frequency shift-keying including circuit connection visually. Inputs accepted through virtual carrier signal generator and modulating signal generator generates Modulated virtual output which is observable on screen. In an experiment, one can provide different amplitude and frequency values for modulating signal and observe modulated signal. This model provides circuit connection facility to user so that the user can practice circuit connection also [5, 6]. The screen shot for studying the Amplitude-Shift-Keying is shown in fig 2.

2.1 Amplitude-Shift-Keying (ASK)

In ASK, the two binary values are represented by two different amplitudes of the carrier frequency. Commonly, one of the amplitudes is zero; that is, one binary digit is represented by the presence, at constant amplitude, of the carrier, the other by the absence of the carrier. The resulting signal is

$$s(t) = \begin{cases} A\cos(2\pi f_c t) & \text{binary 1} \\ 0 & \text{binary 0} \end{cases}$$

Where the carrier signal is $A\cos(2\pi f_c t)$. The ASK technique is used to transmit digital data over optical fiber. For LED transmitters, the equation above is valid. That is, one signal element is represented by a light pulse while the other signal element is represented by the absence of light. Laser transmitters normally have a fixed "bias" current that causes the device to emit a low light level. This low level represents one signal element, while a higher-amplitude light wave represents another. The screen shot for studying the Amplitude-shift-keying is shown in fig 2.

2.2 Frequency-Shift-Keying (FSK)

In FSK, the two binary values are represented by two different frequencies near the carrier frequency. The resulting signal is

$$s(t) = \begin{cases} A\cos(2\pi f_1 t) & \text{binary 1} \\ A\cos(2\pi f_2 t) & \text{binary 0} \end{cases}$$

Where f_1 and f_2 are typically offset from the carrier frequency f_c by equal but opposite amounts. The experimental Frequency-shift-keying is shown in fig 2.

2.3 Phase-Shift-Keying (PSK)

In PSK, the phase of the carrier signal is shifted to represent data. In this system, a binary 0 is represented by sending a signal of the same phase as the previous signal. A binary 1 is represented by sending a signal of opposite phase to the preceding one; this is known as differential PSK, as the phase shift is with reference to the previous bit transmitted rather than to some constant reference signal. The resulting signal is

$$s(t) = \begin{cases} A\cos(2\pi f_c t + \pi) & \text{binary 1} \\ A\cos(2\pi f_c t) & \text{binary 0} \end{cases}$$

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The experimental Phase-shift-keying results are shown in fig 1.

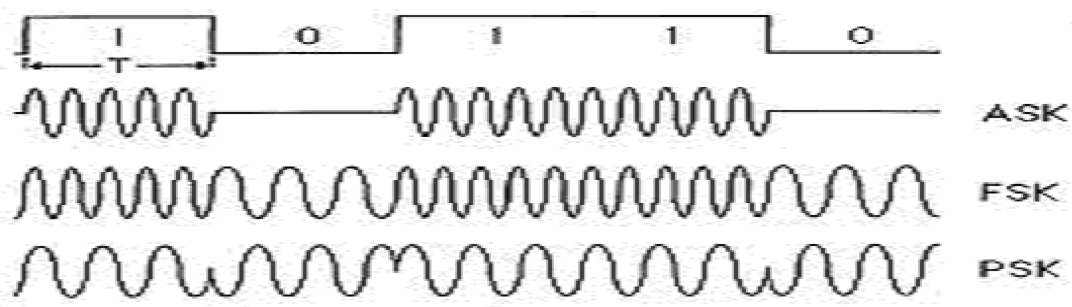

Fig 1: Phase-Shift-Keying Results

3. Tools and Technology

Visual Basic is a third generation event-driven programming language and integrated development environment from Microsoft for its COM programming model. VB is also considered as relatively easy to learn and use programming language, because of its graphical features. Visual Basic was derived from BASIC and enables use of graphics user interface, access to database and creation of ActiveX controls and objects. A programmer can put together the component provided with Visual Basic itself to develop an application. The language not only allows programmers to create simple GUI applications, but can also develop complex applications. Programming in VB is a combination of visually arranging Component or control on a form, specifying attributes and actions of those components. Visual Basic can create executables (EXE files), ActiveX control or DLL files, but is primarily used to develop Windows applications. The beauty of this model is that it does not require the Database to manage data [4].

4. VIS Model

We have constructed the programs in Visual Basic such that all the blocks in the model can be fully visualized on the screen. This model can demonstrate the activities of Encoding Technique. Inputs accepted throw software and virtual output will observe on screen. In an experiment we can provide different input values and observe outputs. This model provide circuit connection facility to user to made connection properly otherwise the result not generated.

4.1 Design Specification

A program is constructed for conduct of shift-keying experiment in VIS such that all the blocks in the model can be fully visualized on the screen. This model also can demonstrate the activities of shift-keying including circuit connection visually. Inputs accepted through virtual waveform generator and resultant waveform virtual output which is observable on screen. In an experiment, one can provide different input values using virtual instruments and observe results on virtual instruments. This model provides circuit connection facility to user so that the user can practice circuit connection also. The screen shot for studying the shift-keying shown in Fig 2.

Apparatus:

1. VIS Environment.
2. Waveform Generator.
3. Virtual Oscilloscope.
4. AC power supply and DC power supply.
5. Circuit Board.

Procedure:

1. Connect the circuit shown in Fig 2.
2. Set the sine wave generator frequency and amplitude.
3. Change the Amplitude, frequency and observe the output waveform.

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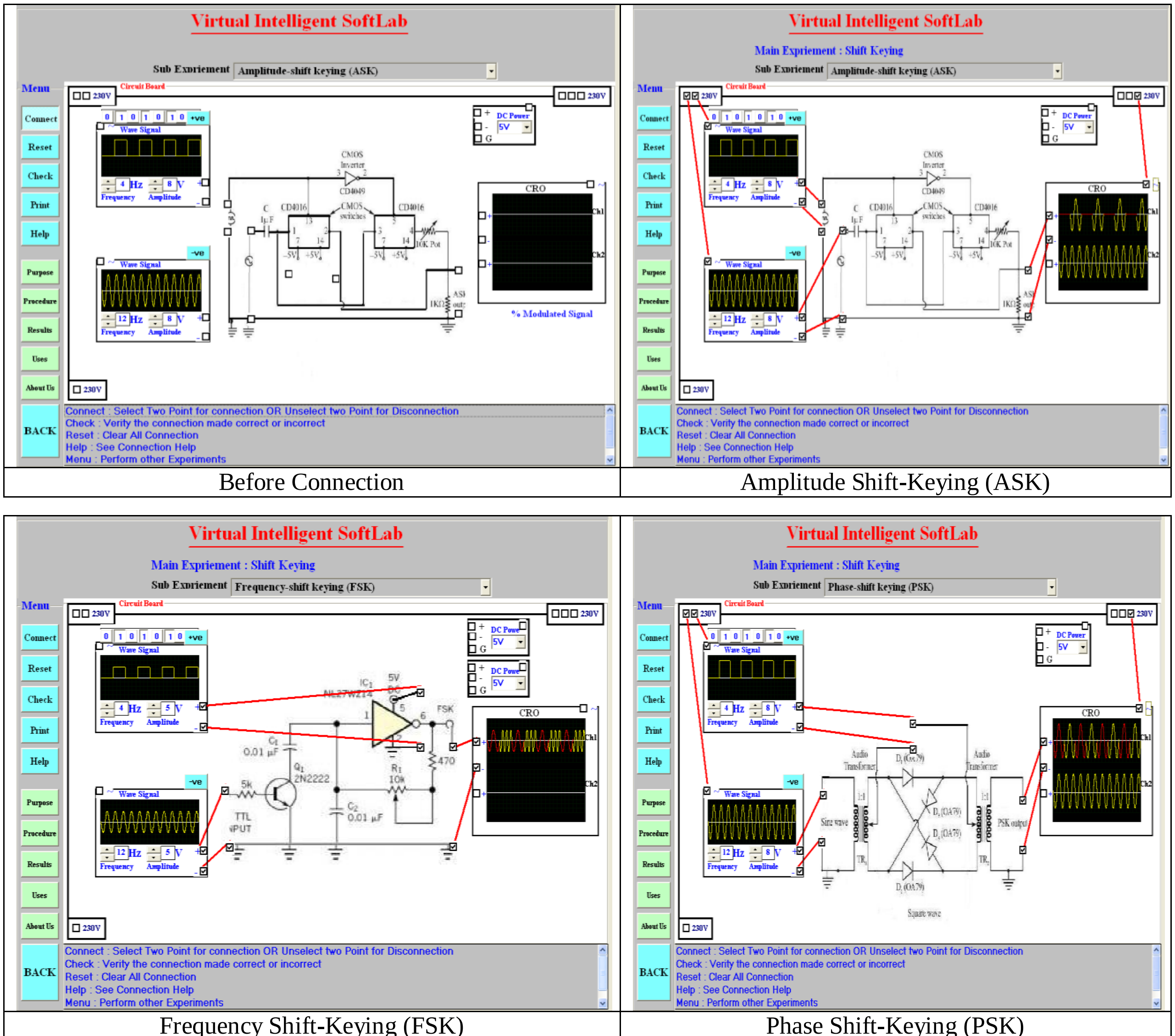
January 2016



Before Connection | Amplitude Shift-Keying (ASK)

Frequency Shift-Keying (FSK) | Phase Shift-Keying (PSK)

Fig 2: VIS Experiment on Shift-Keying

4.2 Implementations

Once the VIS is ready then we implement the circuits using then following steps. The Circuit Connection Steps are

- Connect AC socket to DC Converter device
- Connect DC power supply to IC VCC pin
- Connect Ground Socket to IC Ground Pin
- Connect Output IC pin to Output switches
- Connect Input IC pin to Input switches

Experiment Implementation Steps are

- Made connection to selection two switches using mouse
- Click on Check Button to verify the connection
- Click on Reset Button if the connection are WRONG
- Click on Help Button if you need Connection HELP
- Click on Menu Button if you want to perform other Experiments

5. Result

Virtual outputs are totally animated with the combination of software and observed actual outputs virtually.

6. Conclusions

SoftLab will help Electronics; Computer Science and Engineering students perform and practice experiments to improve their understanding of the subject. The design of the VIS model is more effective and realistic as necessary variable inputs and outputs are visible on the monitor screen. This model created for the client based system, can be converted into a client - server based application system. This virtual experiment provides practice for students for the 'touch & feel' part they have already performed in the laboratory.

7. Acknowledgement

We are very much thankful to Dr. S. M. Bhuskute, Principal Bhawabhuti Mahavidyalaya, Amgaon. We thanks to Dr. P. B. Dahikar and Dr. D. A. Deshpande for his valuable inputs, constant guidance and his extensive support an encouragement for this work. We also thanks to Dr. P. K. Butey for his kind support.

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