

DEVELOPMENT OF VIRTUAL EXPERIMENT ON FLIP FLOPS USING VIRTUAL INTELLIGENT SOFTLAB

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Abstract:

The scope of this paper includes study and implementation of Flip-flops. In this research paper we have formulated how experiments on flip flops are performed using the concept of virtual Intelligent SoftLab (VIS). A D-Type Flip flop, T-Type Flip flop and Master slave Flip flop constructed by J-K flip flop using the Virtual SoftLab and observed actual outputs. VIS helps us to create results using visual display. Software for conducting the experimentations in Flip flop has been developed which helps students to perform and practice the experiments. VIS model determine the logic operation of J-K flip flops. We made connection and observe the state transition of J-K Flip flop with VIS Model. The Characteristic of flip flop also represented using a animated pictorial method of design and evaluating experiments. In this paper we have designed the software that can observe the results. This will help students in understanding working of Flip Flops.

Keywords:- SoftLab, Flip-Flop, VIS Model

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1. About SoftLab:

Electronics devices and the lack of resources make us unable to perform experiments, especially when they involve sophisticated instruments [1]. Web-based and video-based courses address the issue of teaching to some extent. Conducting joint experiments by two participating institution and also sharing costly resources has always been a challenge. With the present day internet and computer technologies the above limitations can no more hamper students and researchers in enhancing their skill and knowledge [2].

The SoftLab philosophy challenges 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 part of the SoftLab project, we are investigating the issues involved in the design and development of SoftLab Model for Electronics, Computer science and engineering. This paper 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.

The basic facilities include with VIS:

- High-performance graphics processors to support scientific visualization, and multimedia facilities.
- Software that allows application researchers to make full use of these facilities to evaluate their experiments without any risk.
- Virtual laboratories that provide scientists with a full range of functionality, both for experimental activities and for the mathematical modeling and simulation of the experimental processes.

The laboratory presents an ideal environment in which to accept and meet the challenges of computational science and engineering. Issues that must be addressed include mathematical software, electronic prototyping, geometric modeling, parallel algorithms, databases, software

engineering, and computer systems. This facility is use for research in electronics, computer science and engineering Department.

In order to support the various activities that take place in an physical laboratory, scientists must be able to use the virtual laboratory to

- perform physical experiments by interacting with and controlling remote instruments,
- simulate physical experiments through computer modeling of the experimental process,
- compare physical and simulated data by playing back recorded experiments, and
- Train scientists to understand the physical experiment, the computational model of the experiment, and the relationships between them.

A choice of these four *scenarios* is available to scientists after they have selected their virtual laboratory at the SoftLab gateway. The graphical interface which is then presented to the user is a software representation of the physical laboratory. Each important physical device is present, in particular, all instruments and equipment used during the experimental process must have a visual representation in the virtual laboratory.

In the *virtual experimentation scenario*, scientists will set up the virtual instruments and experimental process just as in the physical scenario. Afterwards, the physical setup is transformed to the input required for the computational model. Additionally, parameters that are strictly numerical will be specified via special interfaces, and an expert system will be on hand to query for process characteristics or computational parameters. During the processing of the computational code, the virtual instruments will receive intermediate results so that they can be animated to show the progression of the simulation process. Results can be visualized exactly as in the physical case. The simulated experiment may also be saved to the experiment database. Here, too, the input configuration and output results will be used to define the experiment in the database. Since the physical and simulated experiments now reside together, computations on their associated data can easily be done for comparison or analysis.

VIS can benefit thousands of students and professors to learn difficult experiments. The “Virtual laboratory” will bridge physical distance and availability of resources. Today it is possible to design good experiments among students for better learning.

VIS provides following benefits for Teachers

- Visual experiments for lectures.
- Home Experiments for students.
- Virtual laboratory exercises in lab session.
- Opportunities for independent exploration for highly motivated students.
- Animated visualization for students in classroom.

VIS provides following benefits for Students

- Experiment with electronics component safely and independently
- Supplement classroom exercises to improve understanding with electronics devices.
- Visual classroom laboratories at any place.

1.1 VIS Users:

VIS Can used by

- Colleges to perform practical using SoftLab
- Teachers will teach the student with different practical based concept.
- Research student perform their experiments with different devices.
- Students can read and perform their task in classroom.

Virtual Labs would helpful to students at the graduate level, postgraduate level as well as to research scholars. This would help them in learning basic and advanced concepts through Virtual Intelligent SoftLab (VIS) experimentation. This system provides a complete Learning Management system around the virtual Labs where the students can learn, observe and research the various tools. Video-lectures, animated demonstrations and self evaluation program available in future. This system also shares costly equipment and resources with visual effects. The functionality provided by this problem solving environment will therefore be:

- Collect the experimental data in real time.
- Provide visualization of the experiments.
- Control the experiment.
- Input the experimental data to the computational model.
- Control the computational model and visualize the numerical simulation solution

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. Algorithms implemented so far have achieved the desired flexibility, and SoftLab has been well received.

The SoftLab philosophy challenges 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 in a seamless manner

Once this problem has been solved for a particular scientific environment, the design of the virtual laboratory can begin. In order to support the various activities that take place in an physical laboratory, scientists must be able to use the virtual laboratory to

- perform physical experiments by interacting with and controlling remote instruments,
- simulate physical experiments through computer modeling of the experimental process,

2. Flip-flops:

Flip-flops are sequential logic elements. Their operation is influenced by their previous condition, or by the sequential application of clock pulses that set the timing of all computers.

The output of a flip-flop (0 or 1) remains the same until a specific input signal changes its output state. Flip-flops are used to store data temporarily, perform mathematical operations, count operations, or to receive and transfer data. They have only two distinct outputs and can have different inputs depending on the type of flip-flop. They can represent one bit or more than one bit. Computer Logic Training Board on Flip-Flops has been specifically designed to give students an idea about Flip-Flops and to study different types of Flip-Flops. The output of the Flip-Flops can be observed with the help of logic level indicators (LEDs), which are provided on the panel. Practical experience on this board carries great educative value for Science and Engineering Students.

We constructed the following Flip-Flops and study their characteristics:

- J-K Flip-Flop
- D Flip-Flop
- T Flip-Flop.
- Master Slave J-K Flip-Flop.

The board consists of the following virtual instruments:

- +5V D.C. at 100mA, IC regulated power supply.
- IC 7476
- One inverter (NOT gate).
- Eight LEDs with driver circuit to observe the output of flip-flops.
- A pulser to provide the pulses virtually for triggering
- Adequate no. of other Electronic Components.
- AC power supply.

Flip-flops and latches are used as data storage elements. Such data storage can be used for storage of state, and such a circuit is described as sequential logic. It can also be used for

counting of pulses, and for synchronizing variably-timed input signals to some reference timing signal.

We construct following types of Flip flop such as J-K, D-type, T-type and Master slave Flip flop. They differ in the number of inputs and in the response invoked by different value of input signals. All flip-flops have output signals Q and Q'. Q refers to the present state and Q (next) refers to the next state after the occurrence of the clock pulse. The circuit symbol of possible J-K flip-flop shows in fig-1.

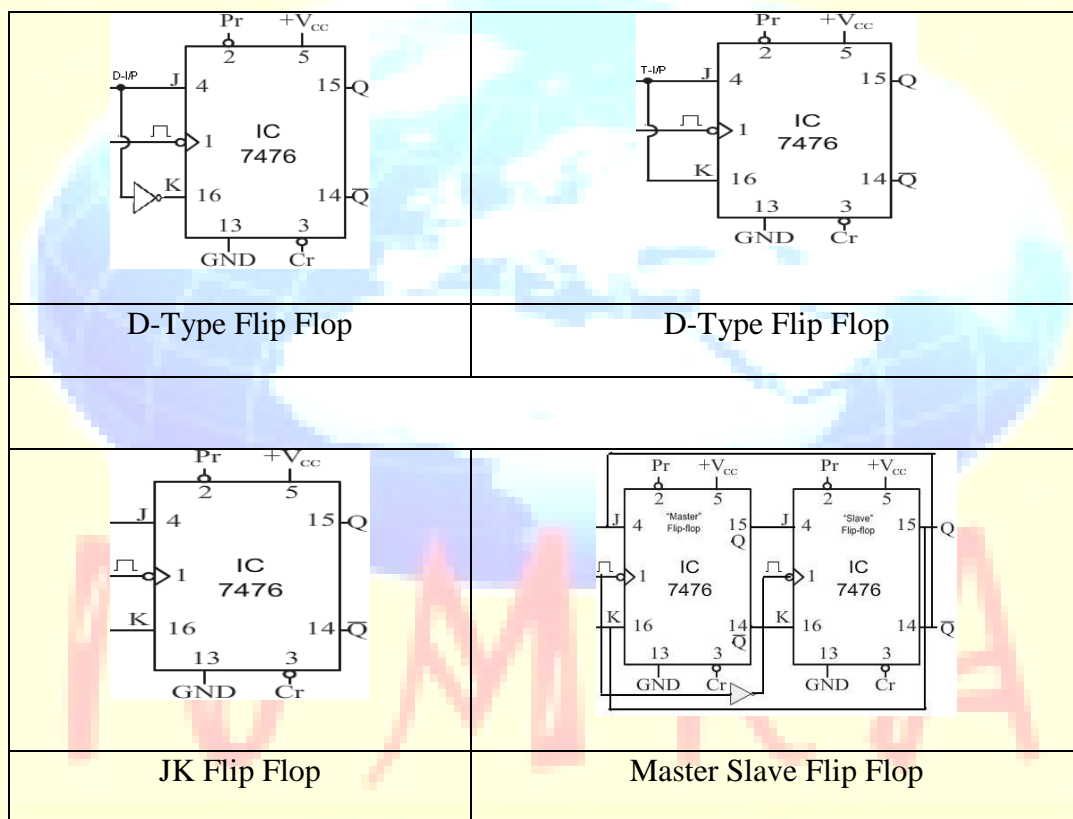


Fig-1 : Flip Flops

The characteristic table for the JK flip-flop is the same as that of the RS when J and K are replaced by S and R respectively, except for the indeterminate case. When both J and K are equal to 1, the next state is equal to the complement of the present state, that is, $Q(\text{next}) = Q'$. The next state of the D flip-flop is completely dependent on the input D and independent of the present state. The next state for the T flip-flop is the same as the present state Q if $T=0$ and complemented if $T=1$.

3. Tools & 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 [5].

4. VIS Model:

We have constructed the programs in 'VB' such that all the blocks in the model can be fully visualized on the screen. This model can demonstrate the activities of Flip flop visually. Inputs accepted through software and virtual output will observe on screen. In an experiment we can provide different input values and observe output. This model provides circuit connection facility to user to make connection properly otherwise the result not generated.

4.1 *design specifications*

You need to design flip flop experiments that accept virtual input from input switches and generate outputs with LED's switches that correspond to the set or reset. A flip flop is a logical circuit that accepts input from J, K pin and Clock with pulse generator device and appropriate outputs for enabling/disabling each of the LED.

Important screen shots are the screen of the monitor are shown in figure in fig-2, fig-3, fig-4.

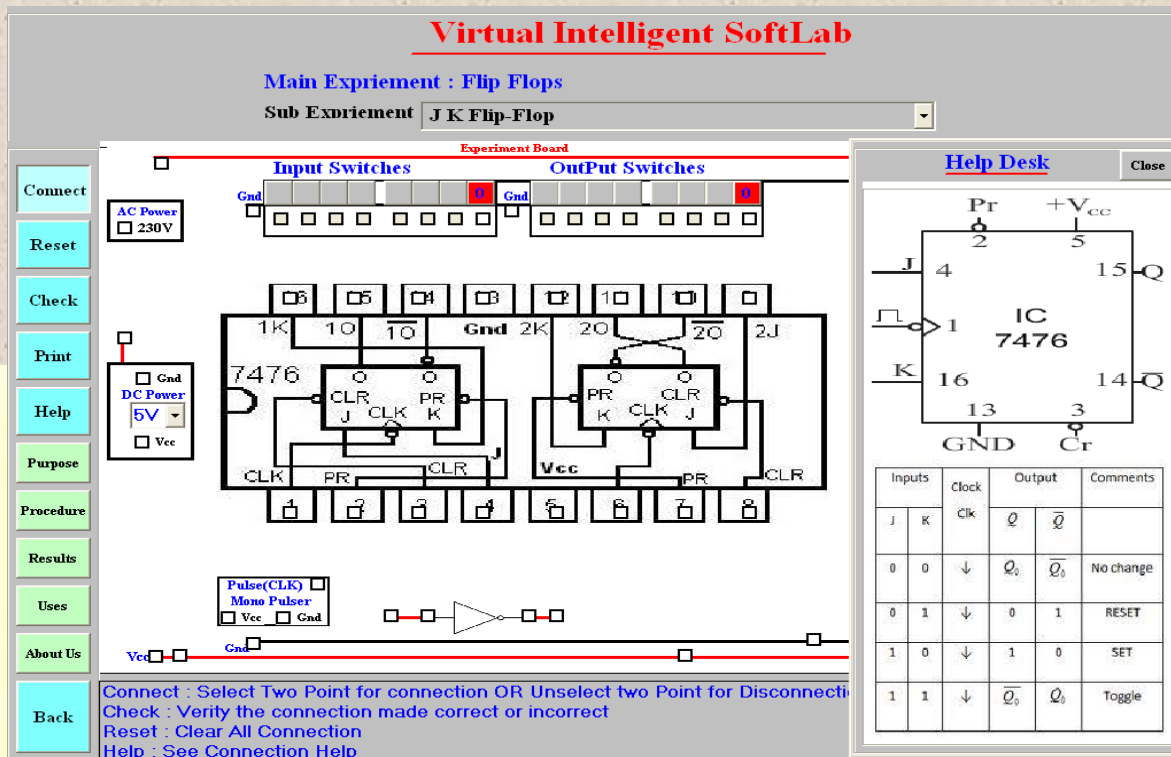


Fig-2: VIS JK Flip flop Model Before Connection

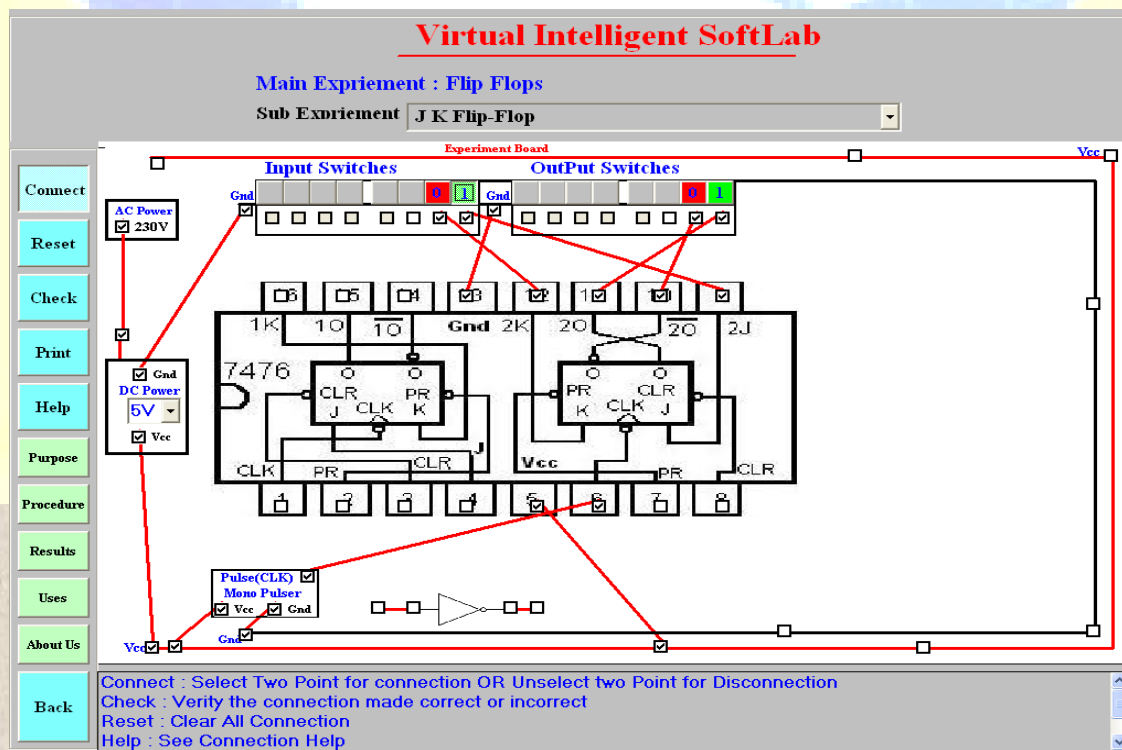


Fig-3: VIS Model After connection and Results

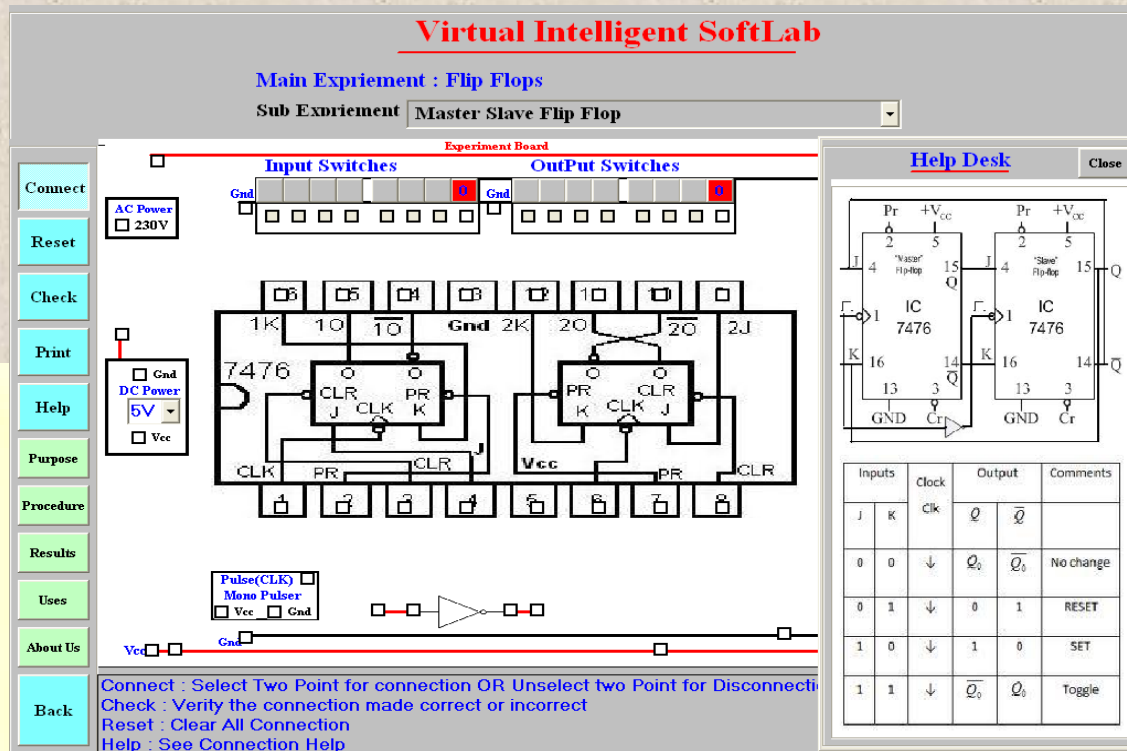


Fig-4: VIS Master-Slave before Connection

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 HELP
- Click on Menu Button if you want to perform other Experiments

4.3 results

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

5 conclusions:

SoftLab will help Electronics, Computer Science and Engineering department students to perform and practice experiments to improve their skill & understanding of the subject. VIS is designed in such a way that it's made more effective and realistic by providing virtual inputs and product outputs. For the 'touch and feel' part, the students can possibly visit an actual laboratory.

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