

Computer (Jing) based Teaching in Virtual engineering laboratories

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Abstract — Students who are currently enrolled in Electrical Engineering Laboratories at University of North Dakota (or at most ABET engineering institution) need to perform simulation of various Electrical Engineering circuitry experiments in the form of pre-labs using Multisim and Ultiboard (Electronics workbench) in a B.S.E.E undergraduate curriculum. Currently, we do not have any easy mechanism for distance students (or campus students) to learn this tool, although students have access to text based tutorial handout. It would make a huge impact on student learning, if there is a step by step video tutorial made available to students, keeping in mind that the current generation of students is on YouTube based learning environment. Hence I propose Jing based screenshot tutorials to understand how to simulate circuitry experiments and design a printed circuit board using Electronics workbench software. The feedback from students show that they benefit more through video based learning especially for simulation tools in our Distance Engineering Degree program (DEDP) program environment. It is important to note that University of North Dakota is the only ABET accredited engineering institution in the US offering Distance Engineering Degree program for Undergraduates (BSEE, BSME, BSChE).

Index Terms — Student learning, Tutorial Screenshots, Jing

INTRODUCTION AND RATIONALE

There is a growing need and request from students to have effective tutorials on Circuit Simulation tools such as Electronics work bench. As part of their BSEE degree program, students are required to perform various pre-labs and laboratory experiments using the Electronics workbench simulation tool first, before they begin working on their prototype development on breadboard. Currently student use text based tutorial handout to understand these simulation tool, with no video tutorials available.

By developing a video based tutorials on Multisim and Ultiboard, students will have a good grasp on various simulation concepts, an easier understanding of the component location and overall how to best simulate circuit experiments and operate under different test conditions. All EE Students (both campus and distance students) must take these labs, as part of the BSEE degree requirements. As these labs are mandatory labs, it is often offered throughout the calendar year (Spring, Fall, Summer). Typically, the enrollments vary from 25to 30 students in each of these laboratories. The following figures fig1 and fig 2 shows a Capture Icon and area of interest that should be visible on your screenshot video in Jing [1].



Fig.1 Jing screenshot “Capture” icon

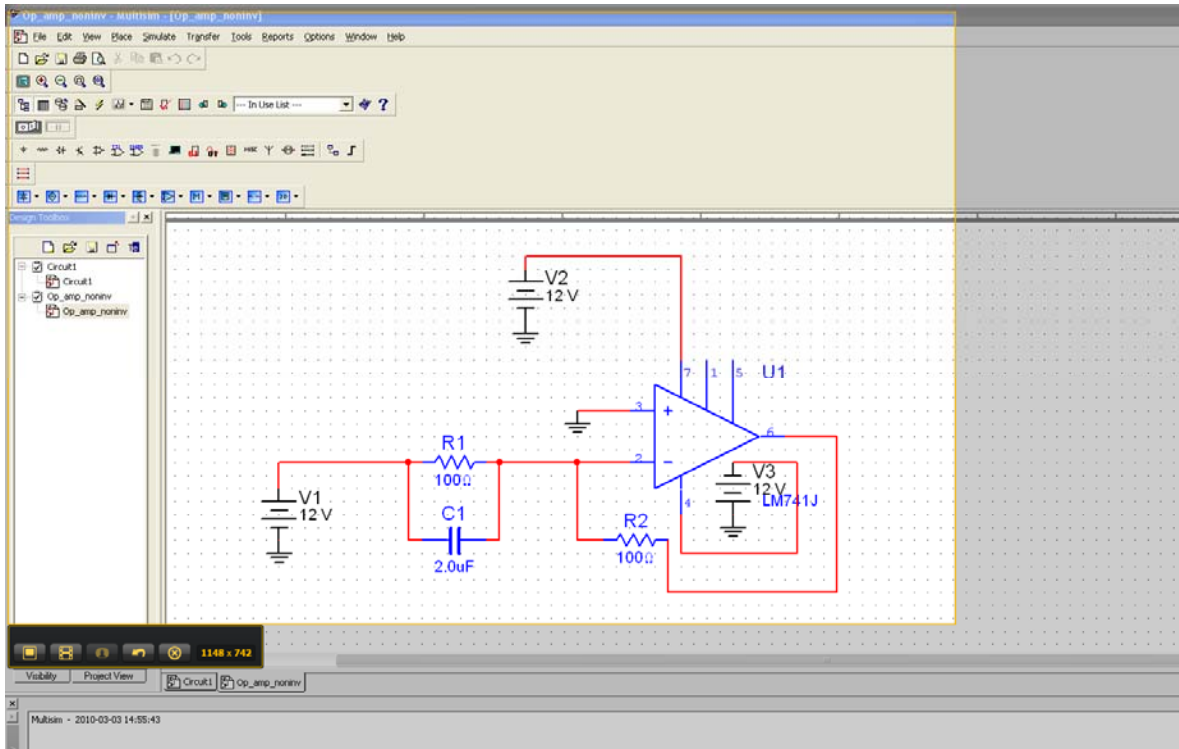


Fig.2 showing selecting Area Screenshot of your desktop with recording buttons

INVESTMENT OF TIME FOR INSTRUCTORS

Although, the time investment will depend on the nature of tool that you like to teach, but making a video based tutorial would be helpful is worth attempting due to its friendly and easy to use. Currently student use text based tutorial handout to understand these tutorials, with no such video tutorials in place at most educational institutions.

PEDAGOGY

The proposed Video screenshot tutorials project will benefit student learning highly to better understand the simulation environment and good prototyping in an engineering teaching colleges and Universities. This project will also reduce instructor and TA's teaching load slightly and better utilize instructor time on other aspects of student learning process at most universities. The

SUMMARY STEPS IN JING RECORDING

1. Install the Software first from CNET webpage or from www.jingproject.com
2. Go to the center of your screen, click “Capture” icon.
3. Select the area of your desktop screen on how you would like set up your video tutorial.
4. Hit “Capture Video”.
5. Record your tutorial or any lecture concept using your headset.
6. Use Stop or Pause Button to control your video.
7. Save the Video “tutorial1.swf”. Notice by default the videos are in shockwave format.
8. In order to know how your video turned out, right click on the video and use internet explorer or your default browser to see the captured video. See Fig 5.

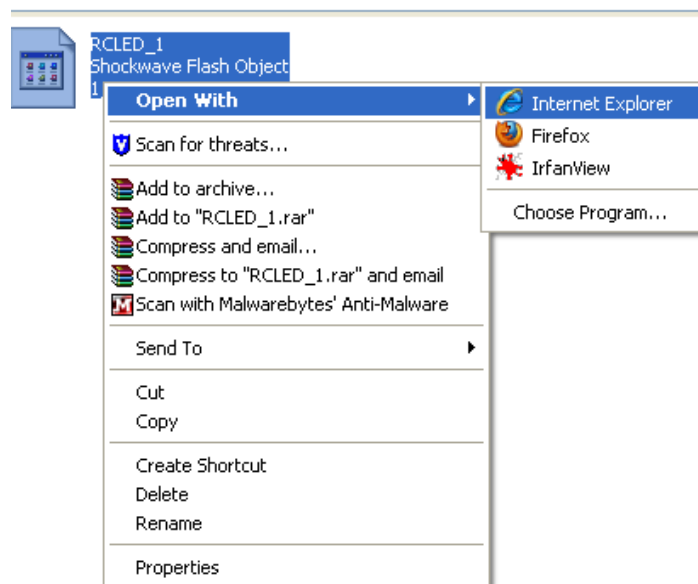


Fig. 5 How to open and view the .swf file

9. If your video content is blocked, then allow the blocked content as shown in Fig 6.

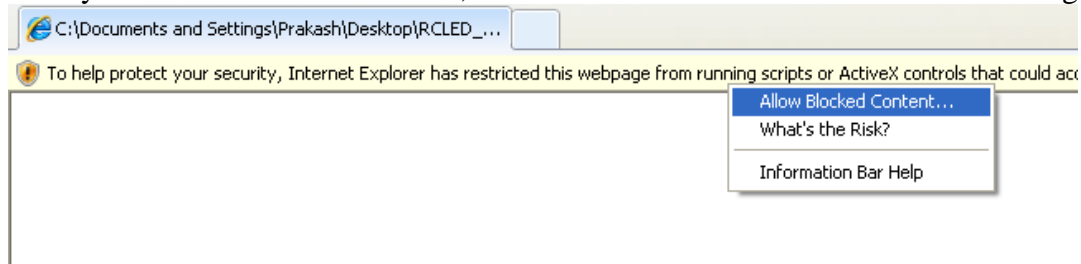
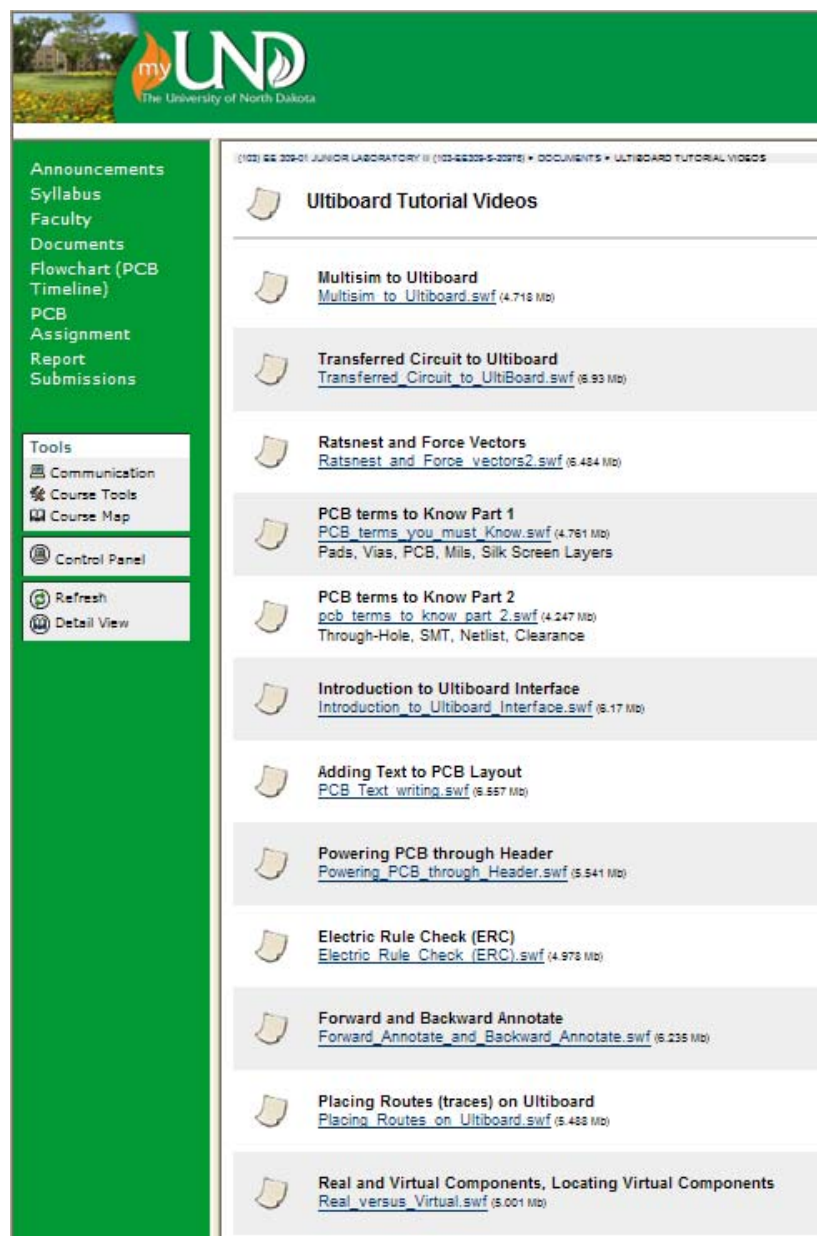


Fig. 6 Allow Access to ActiveX control

10. Hit Play button and enjoy your recorded video session.

ASSESSMENT OF USING JING IN STUDENT LEARNING

The University Student Assessment of Teaching (USAT) summaries (serving as direct assessment) and feedback from past student experience reflects the need for such video based tutorials and its learning impact of having video tutorials on laboratories can be easily assessed through direct and indirect assessments (laboratory discussions) from students in each academic calendar in their respective institutions. Fig 7 enumerates the difference concepts of Electronics workbench in Jing based .swf files.



The screenshot displays a web portal for the University of North Dakota (UND). The header features the UND logo and the text "The University of North Dakota". Below the header is a navigation menu with the following items: Announcements, Syllabus, Faculty, Documents, Flowchart (PCB Timeline), PCB Assignment, Report, and Submissions. A "Tools" section includes Communication, Course Tools, Course Map, and Control Panel. There are also buttons for Refresh and Detail View. The main content area is titled "Ultiboard Tutorial Videos" and lists several video tutorials with their file names and sizes:

- Multisim to Ultiboard: [Multisim to Ultiboard.swf](#) (4.718 Mb)
- Transferred Circuit to Ultiboard: [Transferred_Circuit_to_UltiBoard.swf](#) (6.93 Mb)
- Ratsnest and Force Vectors: [Ratsnest_and_Force_vectors2.swf](#) (6.484 Mb)
- PCB terms to Know Part 1: [PCB_terms_you_must_Know.swf](#) (4.761 Mb)
Pads, Vias, PCB, Mills, Silk Screen Layers
- PCB terms to Know Part 2: [pcb_terms_to_know_part_2.swf](#) (4.247 Mb)
Through-Hole, SMT, Netlist, Clearance
- Introduction to Ultiboard Interface: [Introduction_to_Ultiboard_Interface.swf](#) (6.17 Mb)
- Adding Text to PCB Layout: [PCB_Text_writing.swf](#) (6.657 Mb)
- Powering PCB through Header: [Powering_PCB_through_Header.swf](#) (6.541 Mb)
- Electric Rule Check (ERC): [Electric_Rule_Check_\(ERC\).swf](#) (4.978 Mb)
- Forward and Backward Annotate: [Forward_Annotate_and_Backward_Annotate.swf](#) (6.235 Mb)
- Placing Routes (traces) on Ultiboard: [Placing_Routes_on_Ultiboard.swf](#) (6.488 Mb)
- Real and Virtual Components, Locating Virtual Components: [Real_versus_Virtual.swf](#) (6.001 Mb)

Fig.7 A snapshot of various tutorial concepts in .swf of Ultiboard using Jing on Blackboard

PROS AND CONS OF JING

Although the free version of Jing Software can be used for quick tutorials of producing such simulation tools, each recording video session cannot exceed more than five minutes with the free version. For any extended Screenshot capture, one has to rely on other purchase software Snagit 9 or JingPro. The author does not feel the necessity or nor endorse its use and buy such high priced softwares.

CONCLUSION

A “Jing” Software based step by step interactive video tutorial guide on Electronics workbench (Multisim, Ultiboard) software for students enrolled in Distance engineering degree program (DEDP) EE laboratories is presented. Having a screenshot based tutorial will make student learning environment far better than having text based tutorial handout. The concept of using Jing can be easily expanded to any discipline, where some tutorials need to be made. The author has also presented a workshop on using Jing arranged by Center for Instructional learning and Technology at University of North Dakota, Grand Forks in March 2010 and the feedback was very positive in its use from other colleagues within the University.

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Note: The author has neither association with Jing software nor any monetary benefit in using this tool. The paper was just an inspiration to promote student learning and teaching in distance environment.

REFERENCES

[1] <http://www.jingproject.com/>

[2] www.ni.com

BIOGRAPHICAL INFORMATION

PRAKASH RANGANATHAN- is currently a faculty member in the Department of Electrical Engineering at the University of North Dakota - Grand Forks. Ranganathan’s research area and teaching interests are in Distance Engineering Education, Electric Circuits.

Kendall E. Nygard is Professor of Computer Science and Operations Research at North Dakota State University where he has served on the faculty since 1977. From 1996 to 2005 he served as Department Chair. In 1986 and 1987 he was on the adjunct faculty in operations research at the Naval Postgraduate School in Monterey, California. In 1994 and 1995 he was Director of the Scientific Computing Center at the University of North Dakota in Grand Forks. In 1984 he was a visiting scientist at the Air Force Logistics Command at Wright-Patterson AFB in Ohio. In 2000 he was a research fellow at the Air Vehicle Directorate of the Air Force Research Lab. His research areas

involve combinatorial optimization methods, with applications to management of networks and sensor networks, cooperative mission control for unmanned air vehicles (UAVs), computer-based transportation analysis, and bioinformatics.