Solidworks Learning Tool

Mark Pennington

Submitted to the Faculty of the Information Engineering Technology Program
in Partial Fulfillment of the Requirements for
the Degree of Bachelor of Science
in Information Engineering Technology

University of Cincinnati
College of Applied Science
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Mark P. Pennington — Mark Pennington — 10 March 2003 — Date

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James F. Sullivan — James Sullivan, Department Head — 10 March, 2003 — Date

A) Acknowledgements / Dedication

After meeting with Tom Majeski and Tom Otterman of Microsolid Solutions they decided to sponsor me in this project. By providing me with an educational license of Solidworks I was able to complete this project for the Mechanical Engineering Technology Department in the College of Applied Science.

Todd Bryant was a big help with the programming inside Solidworks. He demonstrated many samples of how Solidworks and Visual Basic programming work within the software. He was willing to help me with any problems that I came upon in the project.

This project is dedicated to the Freshmen MET students who want to learn how to use Solidworks. The training lessons will give them guidance on how to use the software and how to interact with the user interface. It is a step-by-step process that each student needs to take to be successful in their career path.

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D) Abstract

The Mechanical Engineering Technology department at the College of Applied Science teaches their students many CAD software programs. They need to create a way that Solidworks CAD program to be taught individually to the students. A multimedia program on CD-Rom has been designed that will enable the students to take the CD home to learn on their own time. It includes thirteen different sections with text, graphics, animations, and voice recordings. All of these tools will allow the student to learn how to use the Solidworks software to design parts and assemblies.

Another program has also been designed for the students to use at the College of Applied Science. The object designed is a programming project that includes four of the main sections of the multimedia guide. It includes easily navigatable sections for the student to learn about the software. It includes graphical images of the software, buttons for navigation, and text that explains how to use the software. Users are entered into a database that includes checkpoints of their progress in the program. The administrator for the students runs an executable file that enables them to see the progress of each student. They will be able to see what lessons the students complete in the database tutorial. Overall, the learning guides will allow the MET students to increase their software knowledge in Solidworks for creating and designing mechanical engineering parts and assemblies.

Solidworks Learning Tutorial

1 Development

1.1 Statement of the Problem

Every MET Freshman student would benefit from knowing Solidworks software. Each student needs a strong knowledge base about the software to help him/her in the business world. The interactive multimedia tool will provide the essential steps needed to complete many tasks with the software. Many companies use Solidworks as a core engineering tool for company design capabilities, productivity, and functionality. One such company is Lockheed Martin in Orlando, Florida (9). They use Solidworks to design aircraft engines for the United States Navy.

The MET student needs a software program that uses the Windows interface to interact with the highly advanced software of Solidworks. It is important to establish a connection to the Solidworks software from another learning environment. This allows the user to receive credit for completing the lessons in the learning guide. Users must be Windows proficient in order to understand how the software works.

One of the pieces of literature used to develop this learning tool is, "The Student Guide of Solidworks.(8)" It is the book that is used by Professor Salehpour (7). It is similar to the book that is used by individuals who teach the course on how to use Solidworks. The class is offered by a supplier of Solidworks, Microsolid Solutions. It is taken in six day intervals at a cost of over $1,500. The book demonstrates functional ways to learn the software from the basics to more advanced applications.

The multimedia learning tool I developed includes animated files for students to hear, and Visual Basic forms to demonstrate the necessary steps in the software program.

This database functions give credit to students for completing the lessons. According to Professor Salehpour, "Using eye sight, hearing, and actual performance is the best way to learn new software."

1.2 Description of the solution

The multimedia learning tool starts with Chapter One from the textbook (8), *Solidworks 2000 – Parts, Assemblies, and Drawings*, that Professor Salehpour uses as a reference. This chapter offers an overview of Solidworks software. It discusses the purpose for using the software and describes the graphical user interface for the software. For this chapter, there are several examples of different user interface that is used in the software. This helps the student learn the functions discussed in Chapter Two. This chapter gives examples of core features that need to be learned by the student. It explains the steps involved in each different scenario of the software. The second chapter in the multimedia tool teaches the student more advanced features of the software such as the extrude function and filleting.

This multimedia learning tool includes spoken narrative that explains the steps involved with the program. Professor Salehpour asked for this specific feature. It allows the student to hear the steps to be modeled. Through the combination of seeing and hearing this tool makes learning the software much easier for the student. They learn the functionality of modeling and overall graphical user interface in the software.

The narrative in the tool was made with Goldwave sound editor. I used a microphone to record narrative to explain the key steps in using the software. The sound recordings can be played in the Lectora multimedia authoring tool I used to complete this project. The user is also able to play, pause, fast-forward, and replay the voice recordings

to have the correct narrative. If the student comes across a problem they can simply play the voice recording to hear the steps to resolve the problem.

Another part of the multimedia tool is the on-line Help guide. The user has the ability to click on a Help button at any point in the learning tool. Once they click on the Help button they will go to the Help file table of contents. There is a help section for each of the thirteen lessons in the multimedia tool. This allows the user to be comfortable when using the learning tool. It enables them to have a strong understanding of how to accomplish many things in the design of the Solidworks part.

The database product contains bitmap images that can be viewed through forms designed with Visual Basic 6.0. It focuses on giving visual representation of the Solidworks part modeling tools. The user can go through the learning tool and receive credit for completing the lesson by filling in their name at the final screen in the lesson. The tables are generated through Microsoft Access. There are check boxes in the user table that show that the user has completed the lesson. There is a file created specifically for Professor Salehpour to view the information in the table for that reports completion of lessons by the students. He will be able to view the file to give credit to the students for completing the Solidworks lesson.

Through the use of the database the user has the ability to run an executable file that will interact with the Microsoft Access database. They are not able to view the database tables but they can enter their information to receive credit for completing the lesson. Professor Salehpour has the password protected database code that he can use for administration of the database.

Another part of the final product is the multimedia executable file. This learning tool allows the students to have Solidworks running on the same screen while learning the software. It allows the student to run Solidworks and the learning tool simultaneously to complete the correct steps in the learning guide. This is the best way to learn the software through a hands on experience with the necessary guides.

1.3 Deliverables

1.3.1 A multimedia presentation on a CD-ROM to show concepts from first two chapters of Solidworks training manual.

1.3.2 Visual representation through graphical images from the software.

1.3.3 Audio information explains the steps with making the solid model.

1.3.4 Text shows the steps involved to perform the correct procedures.

1.3.5 Produce an executable file to allow the user to run the learning tool and Solidworks at the same time.

1.3.6 Animations to show the sequential steps involved to make the solid models

1.3.7 On-line help manual in the multimedia learning tool for the user to see the correct graphical image is part of the steps involved with making the solid model.

1.3.8 Database containing bitmap images of the graphical images in Solidworks.

1.3.9 Have a new user fill out a form in order to gain access to the learning tool.

1.3.10 Establish a connection between the database and Visual Basic forms to allow the user to go to any of the four main sections in the database learning tool.

1.4 Design and development

1.4.1 Budget and Software

Product	Retail Company	Cost
Notebook Computer	Dell Inc.	$2,000.00
Solidworks	Microsolid Solutions	$6,000.00
Lectora	Trivantis Corporation	$1,595.00
Visual Basic 6.0	CompUSA	$175.99
Access Database	CompUSA	$339.00
Adobe Paint Shop Pro	CompUSA	$101.00
Goldwave	Goldwave Inc.	$55.00
	Total Cost	**$10,265.99**

1.4.2 Timeline

See Appendix 4.2.

2 Proof of Design

Deliverables 1.3.1 and 1.3.2 refer to graphics and icons in the software that enable the user to see the correct way of performing the different features in Solidworks software. The graphical images are captured through Paint Shop Pro through the image capture function in the software.

Deliverables 1.3.3 and 1.3.6 refer to the animations and voice narratives in the learning tool. These help the user understand the different screen selections in the software by repeating text. It allows them to be clearer in their understanding of the correct steps involved with learning the software through redundancy of information.

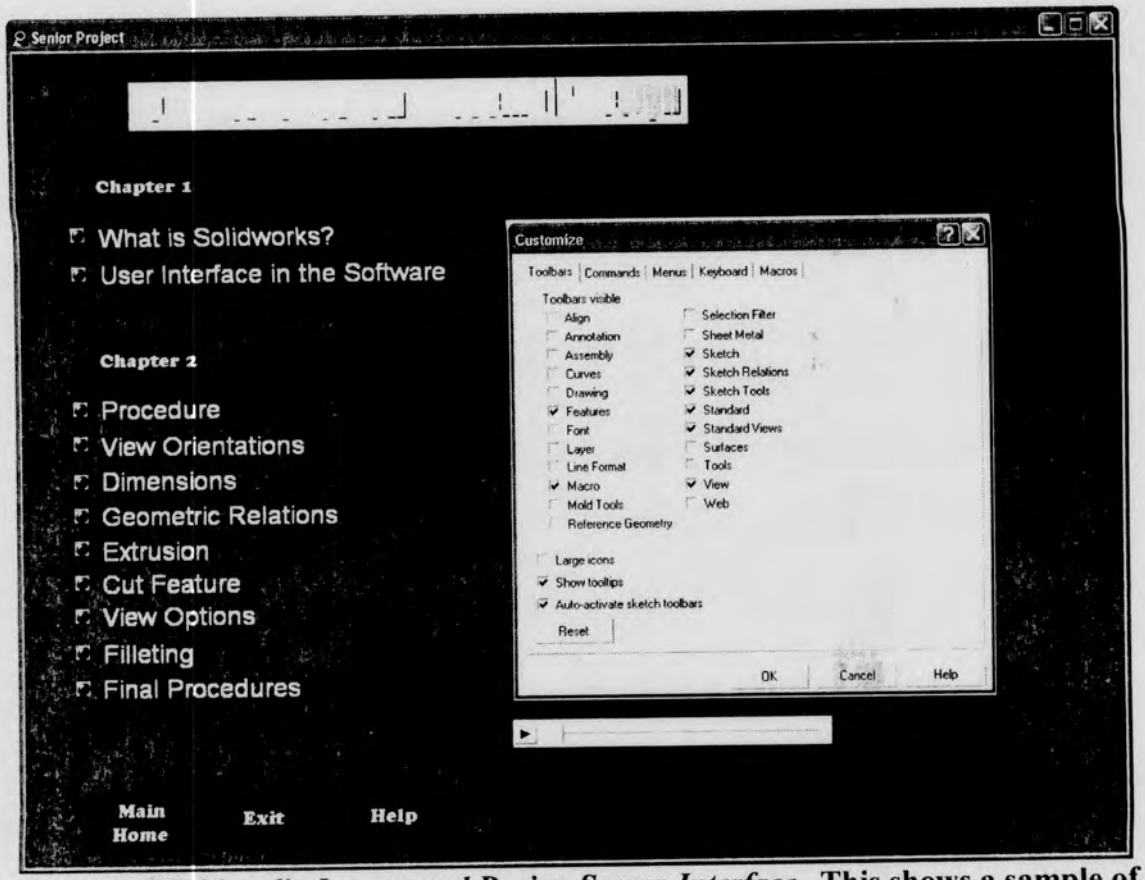

Figure 1. ***Multimedia Layout and Design Screen Interface.*** **This shows a sample of the layout and design of the Prototype. It is setup with user friendly navigation buttons and text for the user to see where they wish to go in the learning process.**

The background includes several different color schemes to help keep the attention of the user. This will keep the user interested in using the product. They will be more willing to move through the multimedia guide. If they have interaction with different interfaces in the program then they will continue through the rest of the lessons in the learning tool.

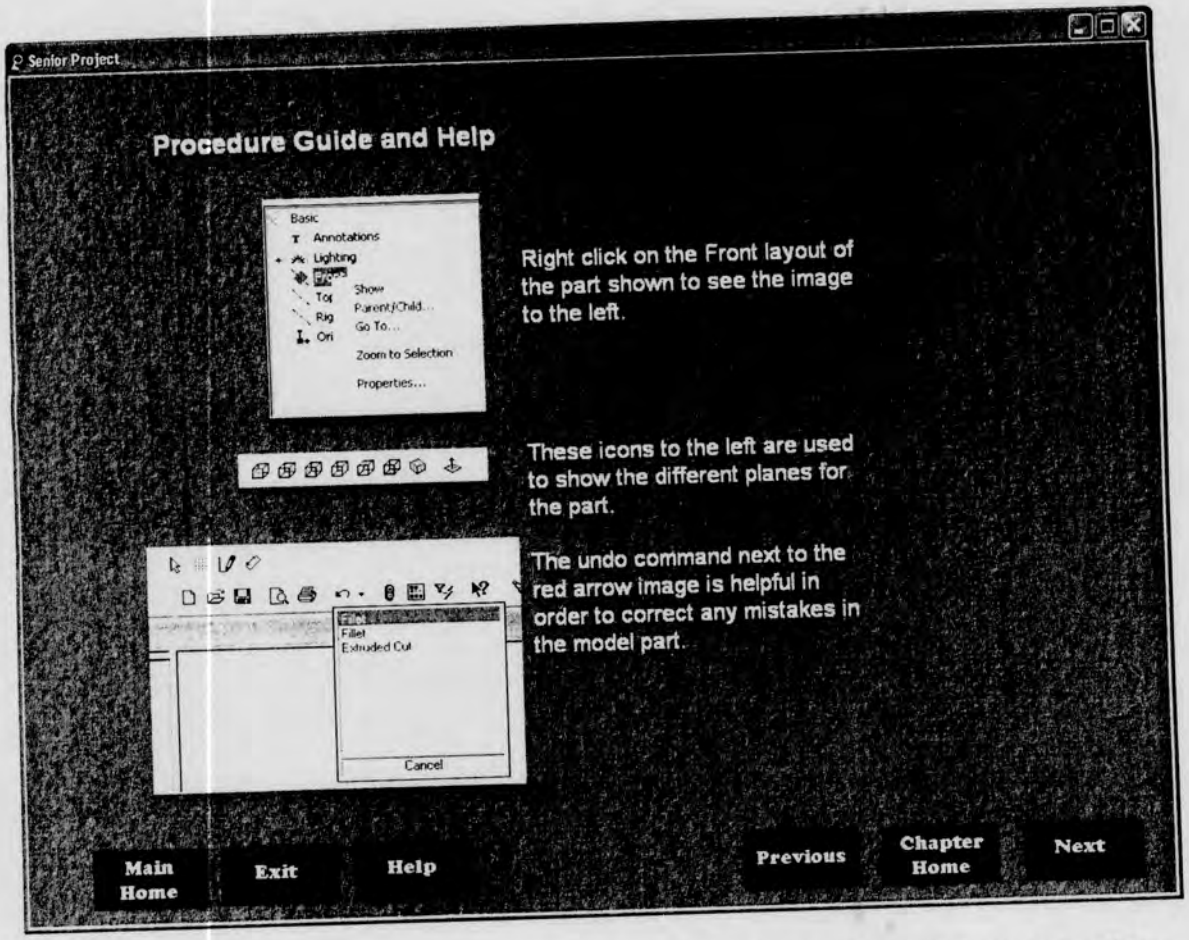

Figure 2. ***On-line Help Guide Screen Capture.*** **The image above is a display of the On-line Help guide. It is deliverable number 1.3.7. It shows the text and the graphical interface for the user. All of the Help pages give this type of in-depth information for the user. Each page shows graphical and text information on all the different lessons in the multimedia learning tool.**

The database program is accessible through a connection to Microsoft Access database. This step is deliverable number 1.3.10. It includes graphical Visual Basic forms for the user to learn the Mechanical Engineering Technology software. The opening screen (Figure 3) asks the user if they are a new or existing user. If they are an existing user they simply click on the "Existing User" button and are then taken to the Table of Contents Page (Figure 5.) If they are a new user they are taken to the New User screen (Figure 4.)

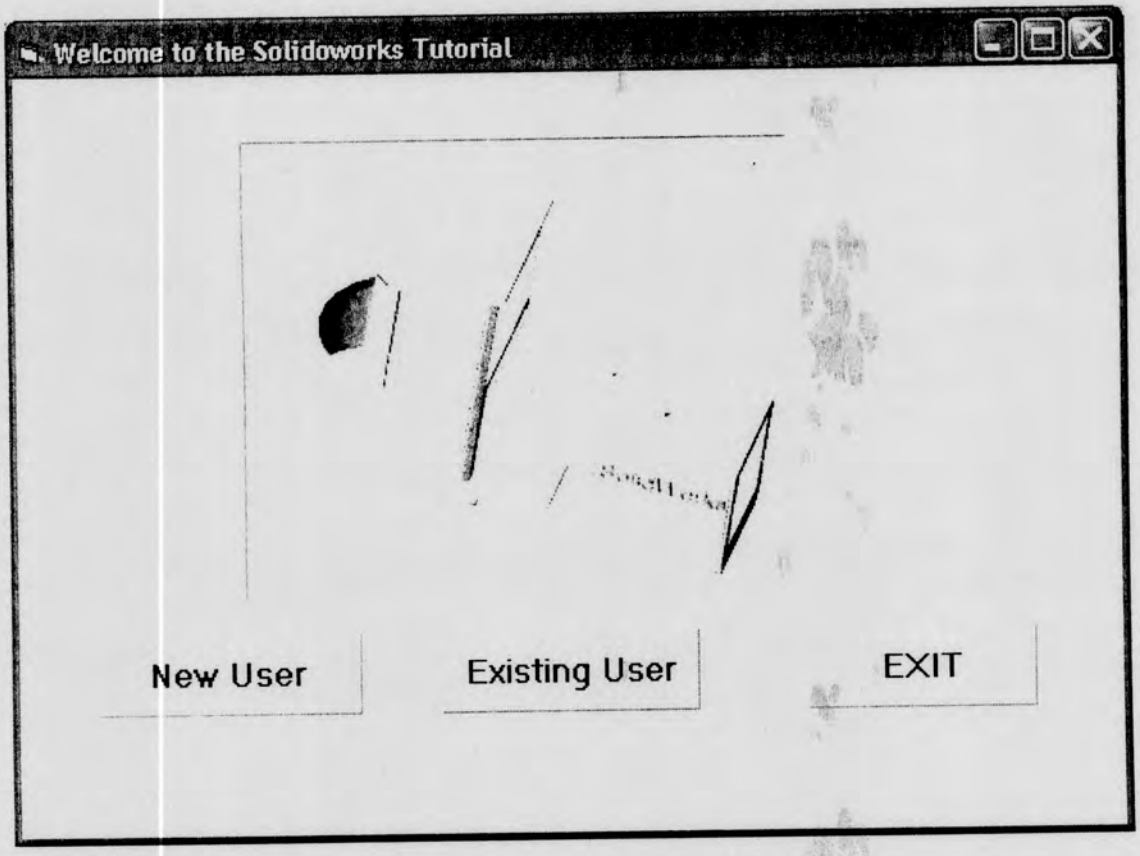

Figure 3. ***Opening Screen for Database Program.*** **This image shows the opening screen to the learning tool. This is where the first time user can click on the "New User" button and be sent to register (Figure 4.) If they are an existing user they can click on "Existing User" that will send them to the Table of Contents (Figure 5.)**

If the user is new then they click on the "New User" button. This takes them to the following screen (Figure 4.) The screen asks for a last name, first name, and email address. The new user button is deliverable number nine. All of this information is placed into a user information table in the main database. Refer to Figure 4 to see the form that is generated for the new user.

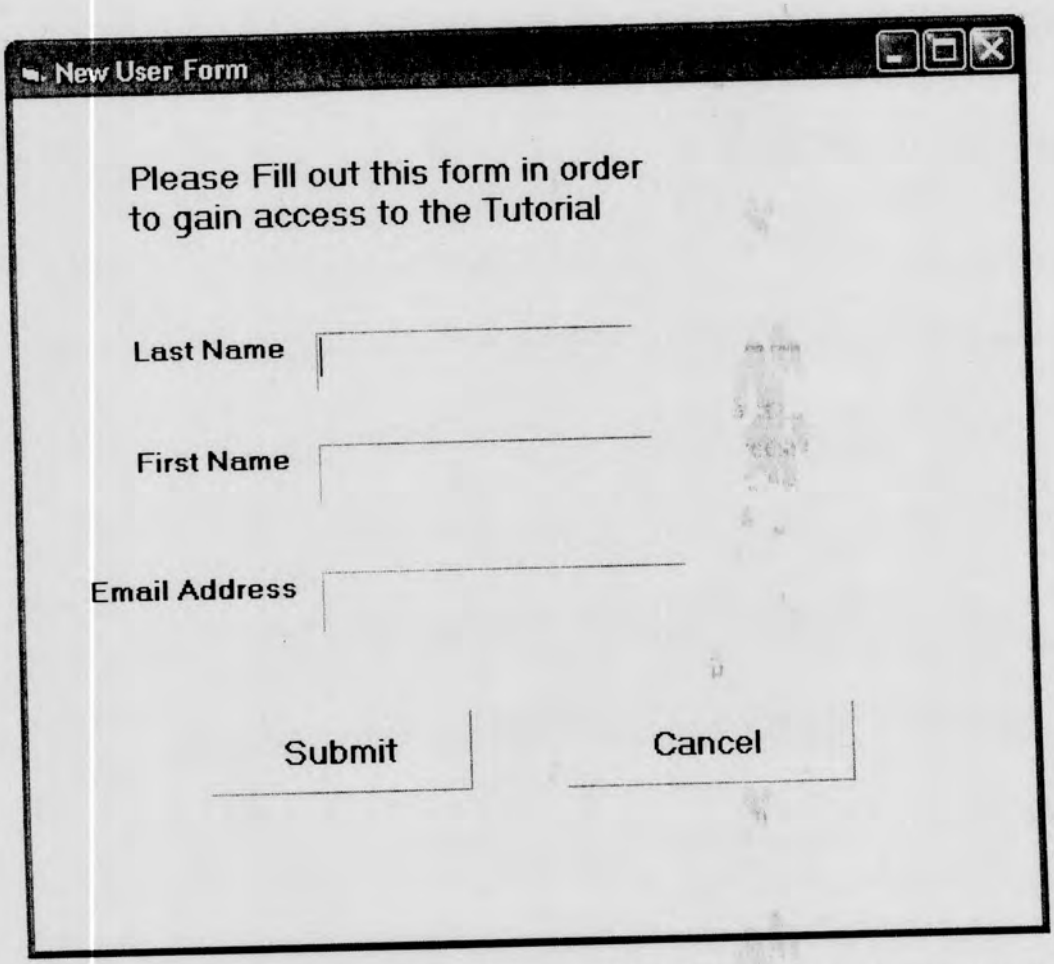

Figure 4. ***New User Form.*** **This shows the form that is displayed when the user clicks on New User. Once they fill in all the necessary information they click on "Submit". This enters them into the database. This is a starting point to having the user receive recognition for completing the lessons.**

The next screen in the database project includes information on several different lessons in the solid modeling process in Solidworks. The first two sections include information on the background knowledge needed for Solidworks. They include details on how to use important features including the Extrude function. This is important in learning some of the basic functions in the software.

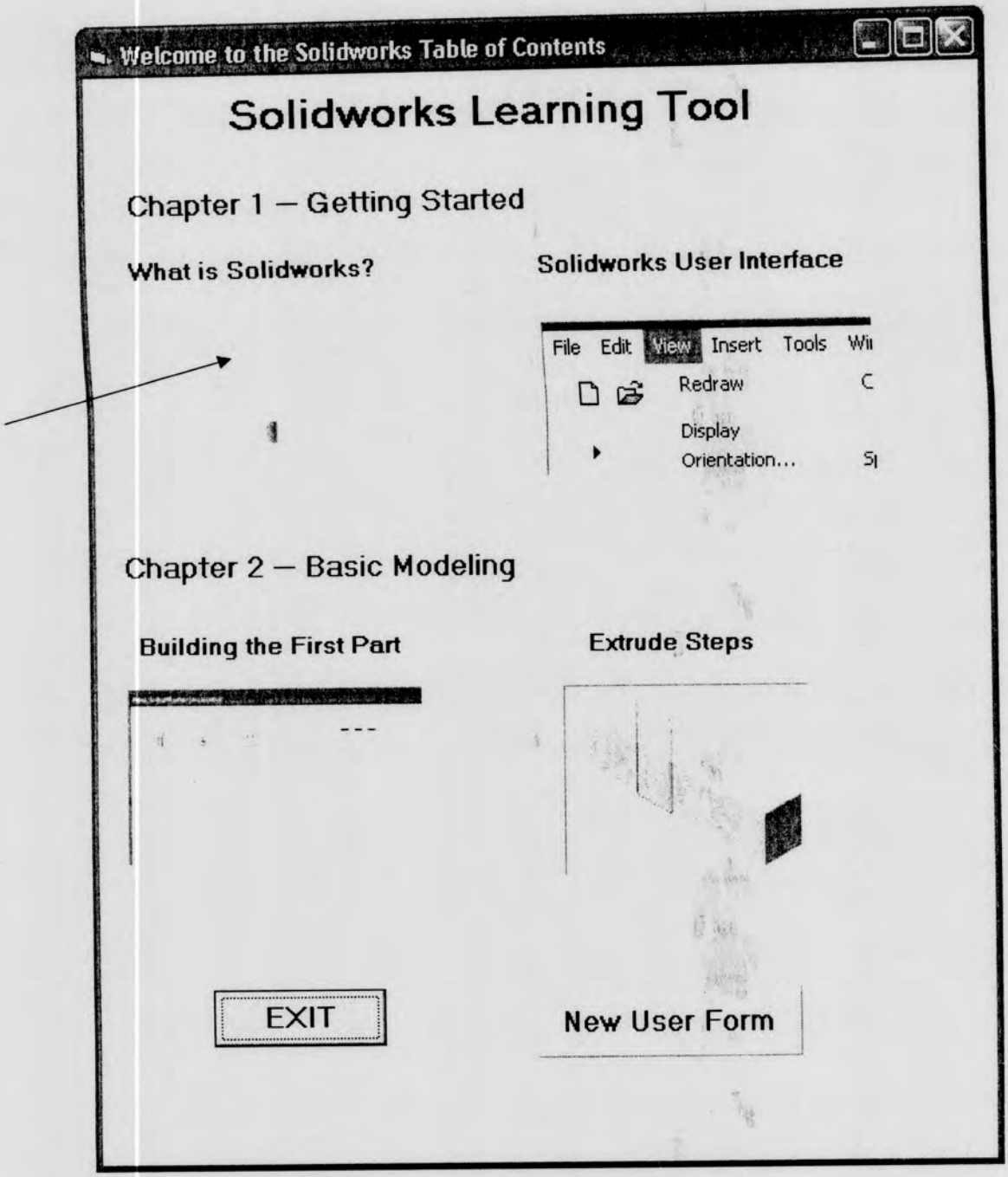

Figure 5. ***Main Table of Contents.*** **The screen shows the main Table of Contents in the teaching lesson. The user simply clicks on the section they wish to view. If they want to learn What Is Solidworks, they would click where the arrow is pointing.**

Next there is a series of screen that the user goes through in order to see all the necessary information in the lesson. Once they arrive at the final screen in the lesson

they click on Recognition button to receive the credit. Refer to the screen Figure 6 for a clear understanding of this feature.

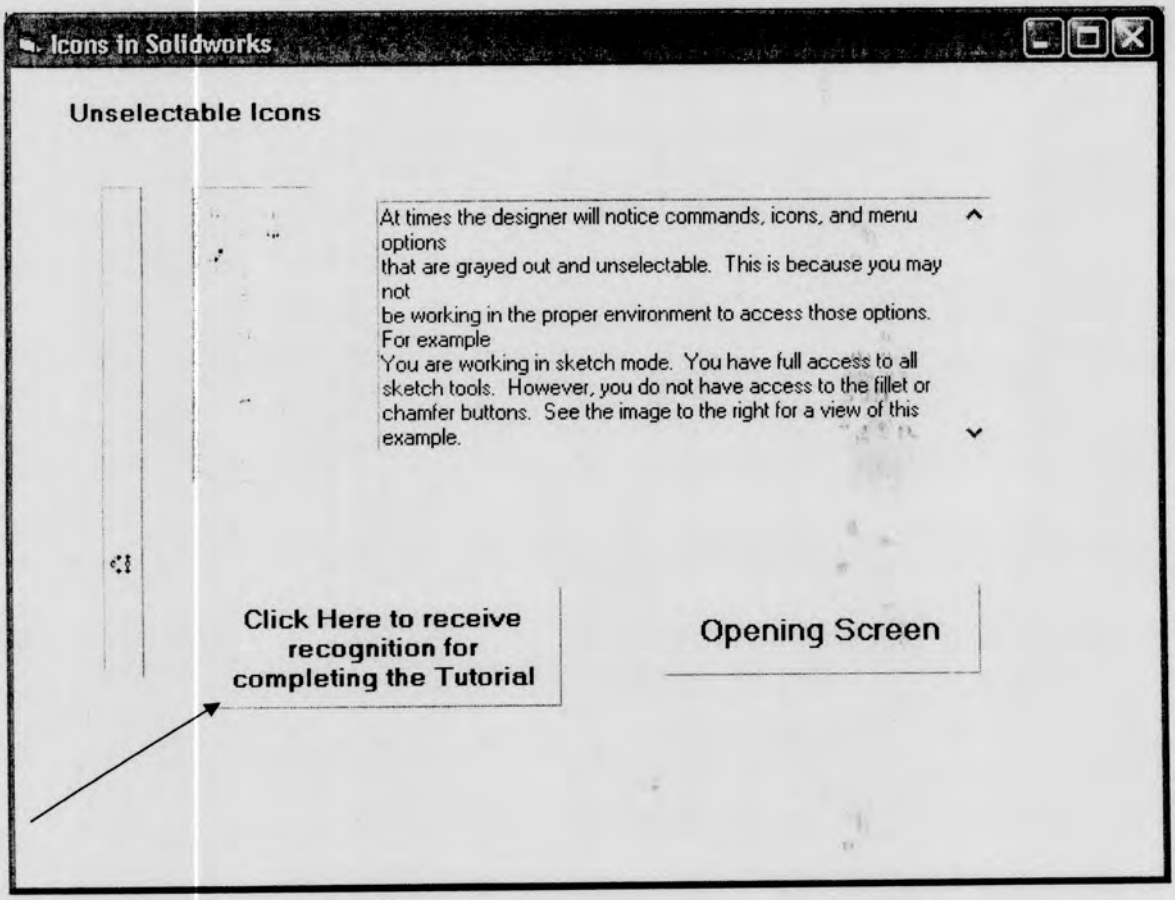

Figure 6. ***Recognition Screen for Completing Lesson.*** **The figure above is displayed when the user arrives at the final screen in the lesson. They simply click on the "Click Here (See Arrow) to receive recognition for completing the tutorial." This sends them to the screen shown in Figure 7.**

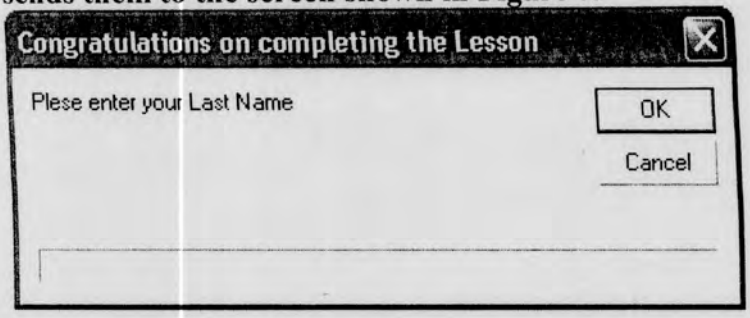

Figure 7. ***Completed Lesson Form.*** **The user fills in his/her last name in the form shown here. After clicking "OK" the user is entered in the database for completing the lesson. He/She can then move on to the next lesson in the tutorial.**

Once the user is entered into the database he/she is finished with that particular lesson in the learning tutorial. He/she can then advance to the next lesson in the guide. The administrator keeps track of the progress of the students through a User Interface designed to connect to the username table where all the information is stored for each user. Refer to Figure 8 for the user interface.

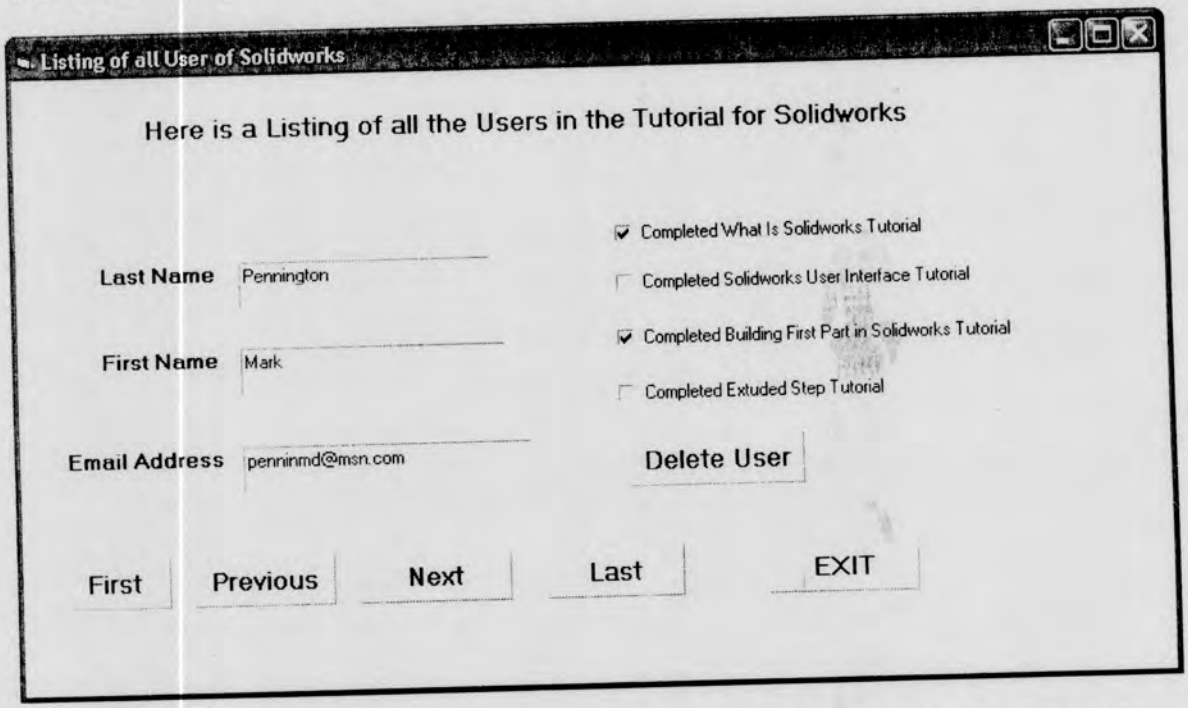

Figure 8. ***Listing of All Users and Lesson Completion Progress.*** **This screen is for Professor Salehpour to see how each student is doing with the database tutorial. He has the power to update and delete any unwanted users in the lesson.**

The database contains all the images that are included in the tutorial. It is divided into several tables. See Figure 9 below. This is deliverable number 1.3.8. The database is accessible by all students for the tables with graphical images. All of the tables have images except the Username table. This is the only table that is hidden from the user when they are viewing the information. He will have an individual file that he can run to see who has completed the lessons in Solidworks.

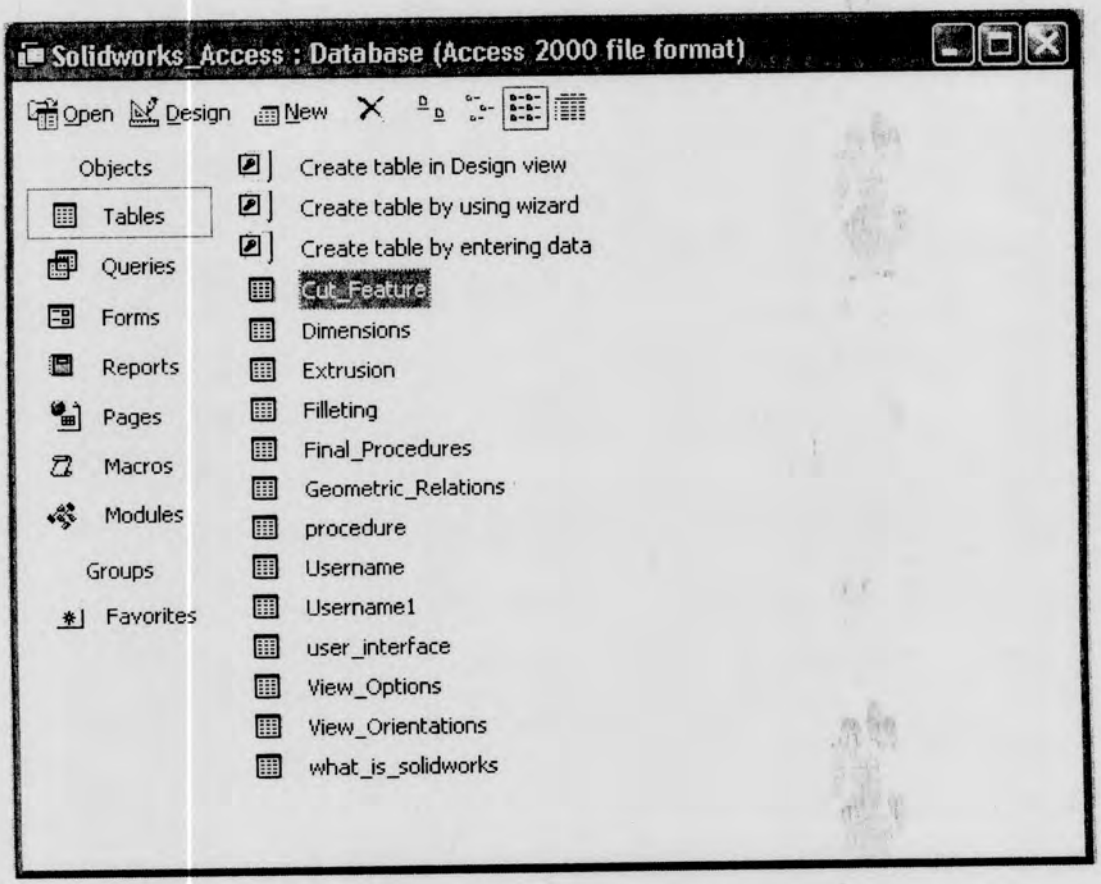

Figure 9. ***Database Tables.*** **This is all the different tables in the database. Each table is broken down into the particular lesson in the multimedia and the database.**

The tables have four main fields. The first is the part ID. This is the unique number that connects the database to the correct part. The second field is the topic. This is the main heading for the part that is to be displayed. The next field is the actual image. This is a bitmap, jpeg, or gif file format that can be viewed in Windows Fax and Viewer mode. This will provide a graphical interface where the user can see what needs to be accomplished to create the part. The final field is the description. This is where the information is stored about each part and how to create it in Solidworks.

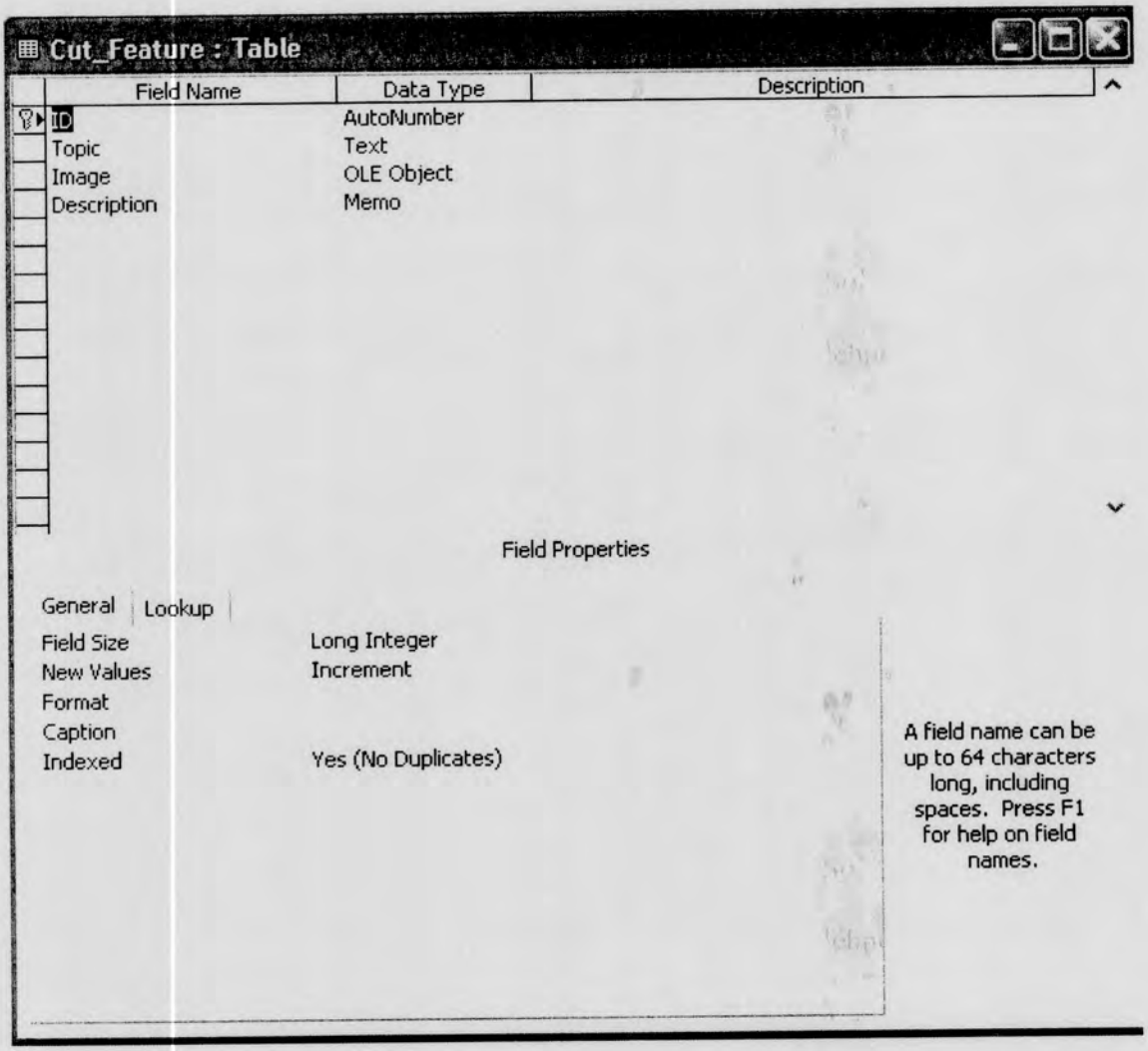

Figure 10. ***Structure of Each Graphical Table.*** **This is the layout of the tables where the user can click on the image and have an image of the procedure or step they are working on in the Solidworks learning tool.**

3 Conclusions and Recommendations

In creating these two products I learned much about multimedia and database programming. In multimedia design I was able to perform many different tasks to complete my deliverables. I was also able to learn how to use Solidworks successfully. Now I am able to teach others about Solidworks. Professor Salehpour has requested that I continue to develop the product for students to be able to test out how to use the software. He has stated that he will write a letter to one of the distinguished Mechanical

Engineering magazines with my product description. This will allow me to be a published developer.

The database product design was difficult. It took me several weeks to have the application perform correctly. I had difficulty with the check boxes in the Access database. Now I am an experienced database developer with the ability to program the storage of images and the creation of check boxes for new and existing users to my program. I am glad that I have this database experience.

If I had more time I would continue to develop the database product. I would include more lessons from the multimedia CD learning tool. This would make a better product that I could sell in the market. Having more lessons would increase the overall feel for the product. Users would be able to move around the product the same way they can navigate through the multimedia product.

The multimedia CD-ROM could be sold on the market as Solidworks learning guide. It has thirteen lessons where the users can see and hear the correct way to perform functionality in Solidworks. They also have help screens that enable them to get a better analysis of how to use the product. This will be good for any new user of the software. It will allow them to use the product to its full capacity. Professor Salehpour can use the CD-ROM in an Independent Study course for students who want to learn Solidworks on their own time.

4 Appendix

4.1 References

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2. Cole, Ryan. Technical Support, Microsolid Solutions. Personal Interview. May 21, 2002.

3. Gibson, Mark. Solidworks Consultant. Ethicon Endo-Surgery. Personal Interview. April 24, 2002.

4. Majeski, Tom. President, Microsolid Solutions. Personal Interview. May 21, 2002.

5. Microsolid Solutions
   CAD/CAM/CAE/PDM
   3600 Park 42 Dr. Suite 120A
   Cincinnati, OH 45241

6. Otterman, Tom. Sales, Microsolid Solutions. Personal Interview. May 21, 2002.

7. Salehpour, Amir. Professor, College of Applied Science (CAS.) Personal Interview. April 27, 2002.

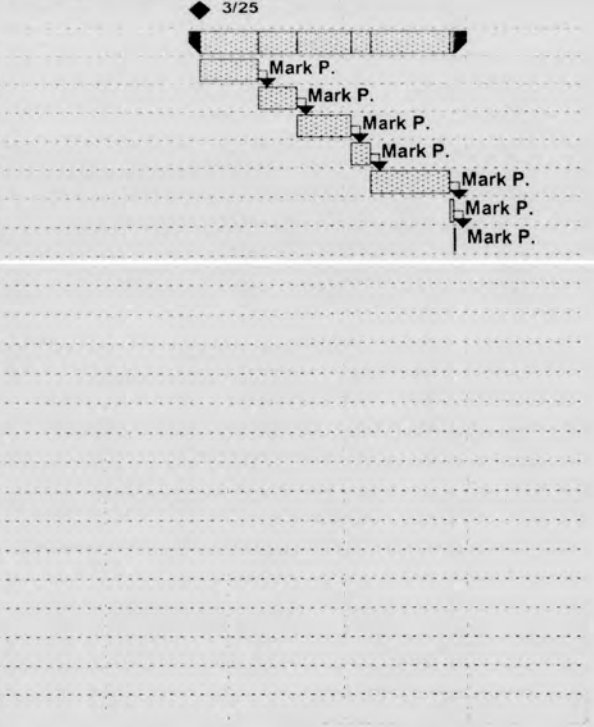
8. *Solidworks 2000 Training Manual*, Solidworks Corporation: December, 2000

9. Solidoworks Customer Representation from Lockhead Martin. "SolidEvents." http://www.solidworks.com/html/news.cfm

4.2 Timeline

Please see the attached chart.

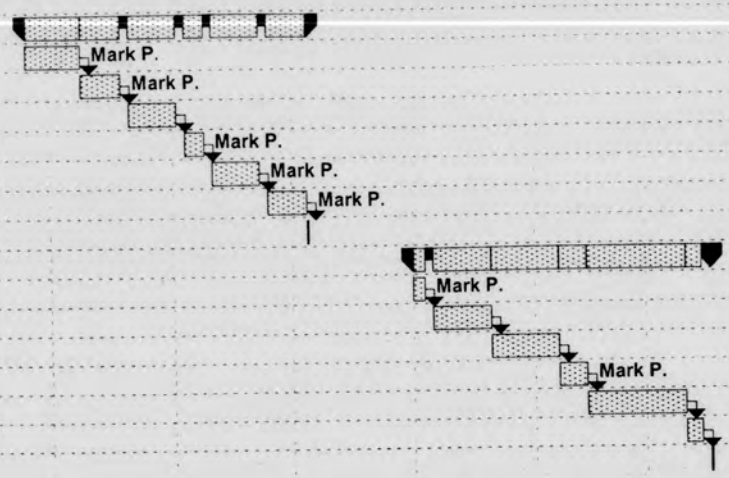
1	**4.2 Timeline**			
2	**Senior Design 1 - Proposal**	**47.25 days**	**Mon 3/25/02**	**Wed 5/29/02**
3	Research Solidworks Software Package	11 days	Mon 3/25/02	Mon 4/8/02
4	Research Laptop computers compatible with Solidworks	8 days	Tue 4/9/02	Thu 4/18/02
5	Gather information required	10 days	Fri 4/19/02	Thu 5/2/02
6	Install Solidworks on Notebook computer	3 days	Fri 5/3/02	Tue 5/7/02
7	More research on Proposal	14 days	Wed 5/8/02	Mon 5/27/02
8	Find out Financial information on products	1 day	Tue 5/28/02	Tue 5/28/02
9	Presentation of Proposal	0.25 days	Wed 5/29/02	Wed 5/29/02
10	**Senior Design 2 - Learning Tool Creation**	**51.5 days**	**Wed 9/25/02**	**Thu 12/5/02**
11	Start of Prototype	10 days	Wed 9/25/02	Tue 10/8/02
12	Multimedia setup with Lectora	8 days	Wed 10/9/02	Fri 10/18/02
13	Create animations with Adobe Animation Shop	10 days	Mon 10/21/02	Fri 11/1/02
14	Image Capure with Paint Shop Pro	5 days	Mon 11/4/02	Fri 11/8/02
15	Testing of Animations and Lectora usefulness	10 days	Mon 11/11/02	Fri 11/22/02
16	Goldwave sound recordings for Lectora	8 days	Mon 11/25/02	Wed 12/4/02
17	Presentation of Proposal	0.5 days	Thu 12/5/02	Thu 12/5/02
18	**Senior Design 3 - Database creation with Visual Basic**	**53.5 days**	**Wed 1/1/03**	**Mon 3/17/03**
19	Analyze comments of Professors on Prototype	3 days	Wed 1/1/03	Fri 1/3/03
20	Revise Prototype of Senior Design 2	11 days	Mon 1/6/03	Mon 1/20/03
21	Generate Database functionality for student and Professor	13 days	Tue 1/21/03	Thu 2/6/03
22	Test database report generated functionality	5 days	Fri 2/7/03	Thu 2/13/03
23	Create Visual Basic form with connection to Database	17 days	Fri 2/14/03	Mon 3/10/03
24	Test Visual Basic form with Database function	4 days	Tue 3/11/03	Fri 3/14/03
25	Presentation of Proposal	0.5 days	Mon 3/17/03	Mon 3/17/03



Project: Software Development
Date: Mon 3/10/03

Task | Summary | Rolled Up Progress | Project Summary
Progress | Rolled Up Task | Split | Group By Summary
Milestone | Rolled Up Milestone | External Tasks

ID	Task Name
1	**4.2 Timeline**
2	**Senior Design 1 - Proposal**
3	Research Solidworks Software Package
4	Research Laptop computers compatible with Solidworks
5	Gather information required
6	Install Solidworks on Notebook computer
7	More research on Proposal
8	Find out Financial information on products
9	Presentation of Proposal
10	**Senior Design 2 - Learning Tool Creation**
11	Start of Prototype
12	Multimedia setup with Lectora
13	Create animations with Adobe Animation Shop
14	Image Capure with Paint Shop Pro
15	Testing of Animations and Lectora usefulness
16	Goldwave sound recordings for Lectora
17	Presentation of Proposal
18	**Senior Design 3 - Database creation with Visual Basic**
19	Analyze comments of Professors on Prototype
20	Revise Prototype of Senior Design 2
21	Generate Database functionality for student and Professor
22	Test database report generated functionality
23	Create Visual Basic form with connection to Database
24	Test Visual Basic form with Database function
25	Presentation of Proposal



Project: Software Development
Date: Mon 3/10/03

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary