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CSILM: Interactive Learning Modules For Computer Science

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Utah State University

CSILM: INTERACTIVE LEARNING MODULES FOR COMPUTER SCIENCE

by

Srinivasa Santosh Kumar Allu

A Plan B report submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Computer Science

Approved:

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Major Professor	Committee Member

Dr. Nicholas Flann, PhD

Committee Member

UTAH STATE UNIVERSITY

Logan, Utah

2014

ABSTRACT

CSILM: INTERACTIVE LEARNING MODULES FOR COMPUTER SCIENCE

by

Srinivasa Santosh Kumar Allu, Master of Science

Utah State University, 2014

Major Professor: Dr. Vicki Allan, PhD

Department: Computer Science

CSILM is an online interactive learning management system designed to help students learn fundamental concepts of computer science. Apart from learning computer science modules using multimedia, this online system also allows students talk to professors using communication mediums like chat and implemented web analytics, enabling teachers to track student behavior and see student's interest in learning the modules,. Integrating social media in to the existing portal also makes it possible for students to share the modules they have created, helping students work together.

(56 Pages)

ACKNOWLEDGEMENTS

Foremost, I would like to extend my sincere gratitude to my advisor, Dr. Vicki Allan, for her support, guidance and valuable suggestions. I am very grateful for her insightful discussions and encouragement on how to approach this project. Without her guidance and help, this report would not have been possible.

I am grateful to my committee members Dr. Daniel Watson and Dr. Nicholas Flann for their valuable guidance and support.

I especially thank my family, Rama Krishna Rao Allu, Padmavathy Allu, Vidya Sagar Allu and my friends for their immense support and care. I would not have made it this far without them.

Srinivasa Santosh Kumar Allu

CONTENTS

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Advances in internet technologies have led universities to utilize the internet for delivering online course materials. Online learning materials are mostly developed as interactive multimedia and are implemented for web delivery. The use of interactive learning has becoming an important component of the online teaching and learning experience. These components of the learning experience seem to be successful and well-liked by students, but one of the major limitations with online learning is that it allows no communication between students and teachers. The teacher does not know the student's level of interest and time spent in learning materials published in the online portal. And also online learning systems do not promote group work. To overcome all the above limitations, Computer Science Interactive Learning Modules (CSILM) provides a way for students to express their questions via chat. The teacher will be able to track student's interest in learning modules using web analytics, and students will be encouraged to engage in group work by sharing with their friends via social media. The design approach used in the newer CSILM helps users to navigate to any learning modules with number of steps.

CSILM is an online interactive learning management system which helps students to learn fundamental concepts of computer science. CSILM is web application developed using front end technologies like HTML, CSS, Ajax, Javascript and JQuery running with an Apache Tomcat server. It uses the Apache Tomcat server to manage and handle the client requests to the server. The user interface is developed using HTML, CSS, JQuery. User Interactive design is achieved using Javascript and Jquery. Communication via chat is achieved by using a chat plug in. Web analytics are implemented using Javascript, Ajax, Google Analytics and integrated social media like Facebook so that users can share with their friends and comment on the modules in the existing system.

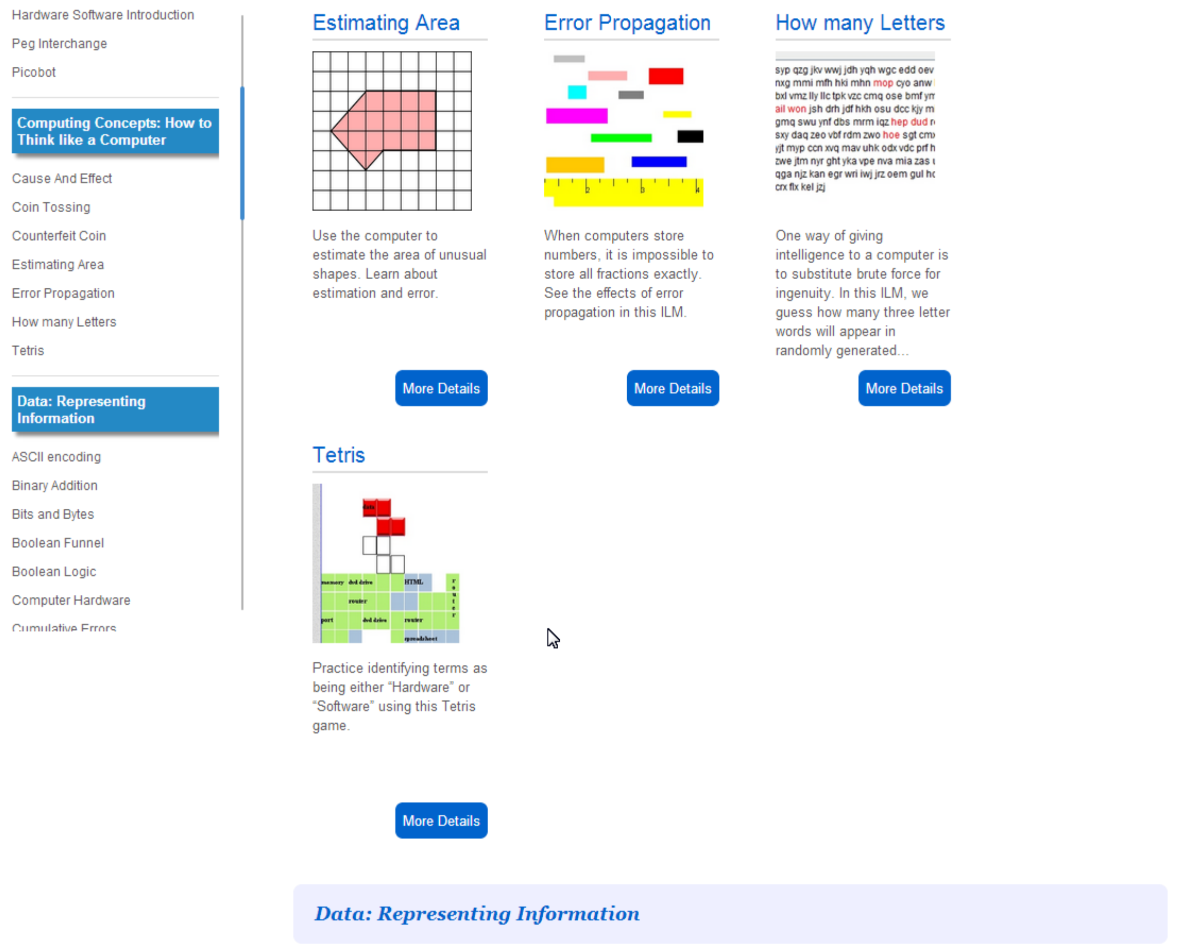
CHAPTER II

PROBLEM ANALYSIS

2.1. User Navigation

Although a previous version of CSILM has been used as an online interactive system for learning fundamental concepts of computer science, one of the problems of the earlier system was that users had to navigate through various modules before reaching the module they wanted. Also, all the online materials, like videos and documents related to a particular module, were placed one after the other so a lot of user navigation was necessary before arriving at a particular module. To make navigation easier, we used either one step or two step navigation, where any module can be reached from a main page where all modules are listed or from a group page displaying sets of topics related to the group.

From the main page the user can navigate to any topic using the left side of the page, which displays all the topics, or from the right side, which lists all the topics with little overview about each. Navigating to any individual topic from main page, leads the user to a topic in group page. In a group page, all the topics related to a particular group are listed. All topic groups are displayed on the left side. In order to navigate a particular module, the user first selects a group, then user is directed to a group page. In the group page, all topics related to the group are listed, making the process a two step navigation. The main page can be reached from any page.


Hardware Software Introduction

Peg Interchange

Picobot

Computing Concepts: How to Think like a Computer

Cause And Effect

Coin Tossing

Counterfeit Coin

Estimating Area

Error Propagation

How many Letters

Tetris

Data: Representing Information

ASCII encoding

Binary Addition

Bits and Bytes

Boolean Funnel

Boolean Logic

Computer Hardware

Cumulative Errors

Estimating Area

Use the computer to estimate the area of unusual shapes. Learn about estimation and error.

More Details

Error Propagation

When computers store numbers, it is impossible to store all fractions exactly. See the effects of error propagation in this ILM.

More Details

How many Letters

One way of giving intelligence to a computer is to substitute brute force for ingenuity. In this ILM, we guess how many three letter words will appear in randomly generated...

More Details

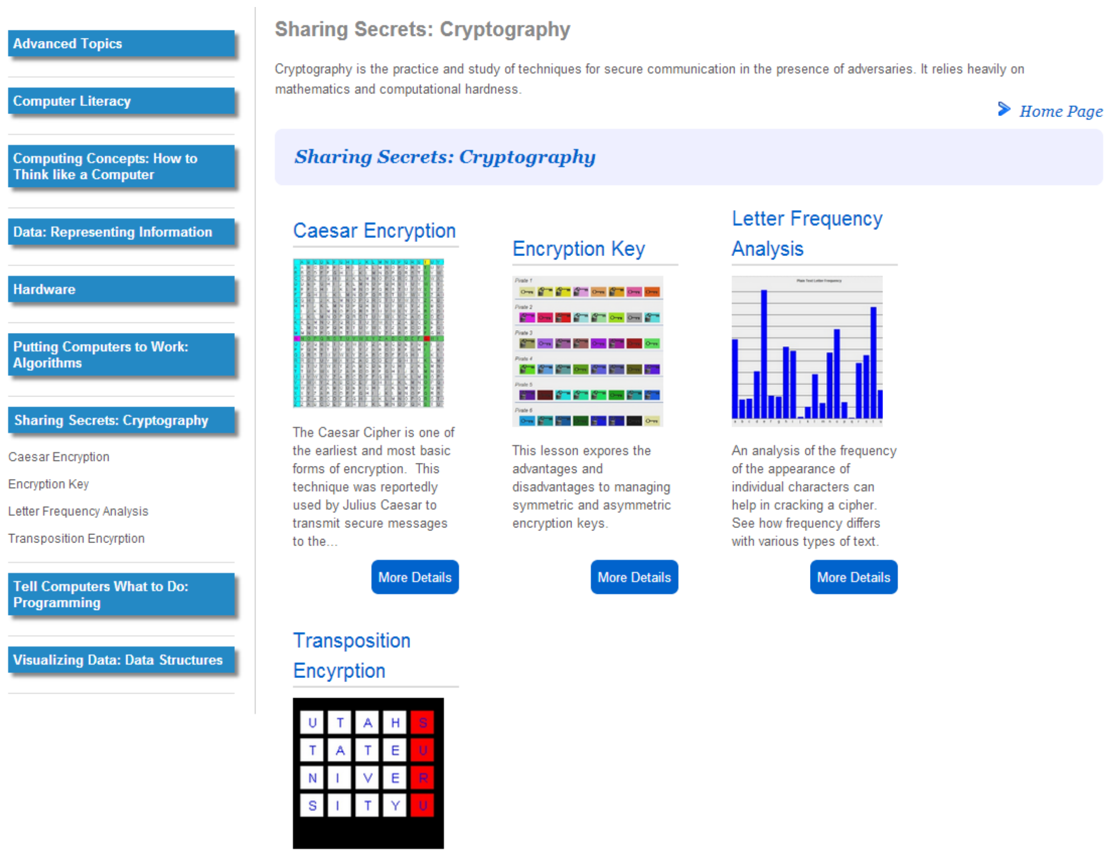
Tetris

Practice identifying terms as being either "Hardware" or "Software" using this Tetris game.

More Details

Data: Representing Information

Figure 1: Main Page Navigation



Advanced Topics
Computer Literacy
Computing Concepts: How to Think like a Computer
Data: Representing Information
Hardware
Putting Computers to Work: Algorithms
Sharing Secrets: Cryptography
Caesar Encryption
Encryption Key
Letter Frequency Analysis
Transposition Encryption
Tell Computers What to Do: Programming
Visualizing Data: Data Structures

Sharing Secrets: Cryptography

Cryptography is the practice and study of techniques for secure communication in the presence of adversaries. It relies heavily on mathematics and computational hardness.

Home Page

Sharing Secrets: Cryptography

Caesar Encryption

The Caesar Cipher is one of the earliest and most basic forms of encryption. This technique was reportedly used by Julius Caesar to transmit secure messages to the...

More Details

Encryption Key

This lesson expores the advantages and disadvantages to managing symmetric and asymmetric encryption keys.

More Details

Letter Frequency Analysis

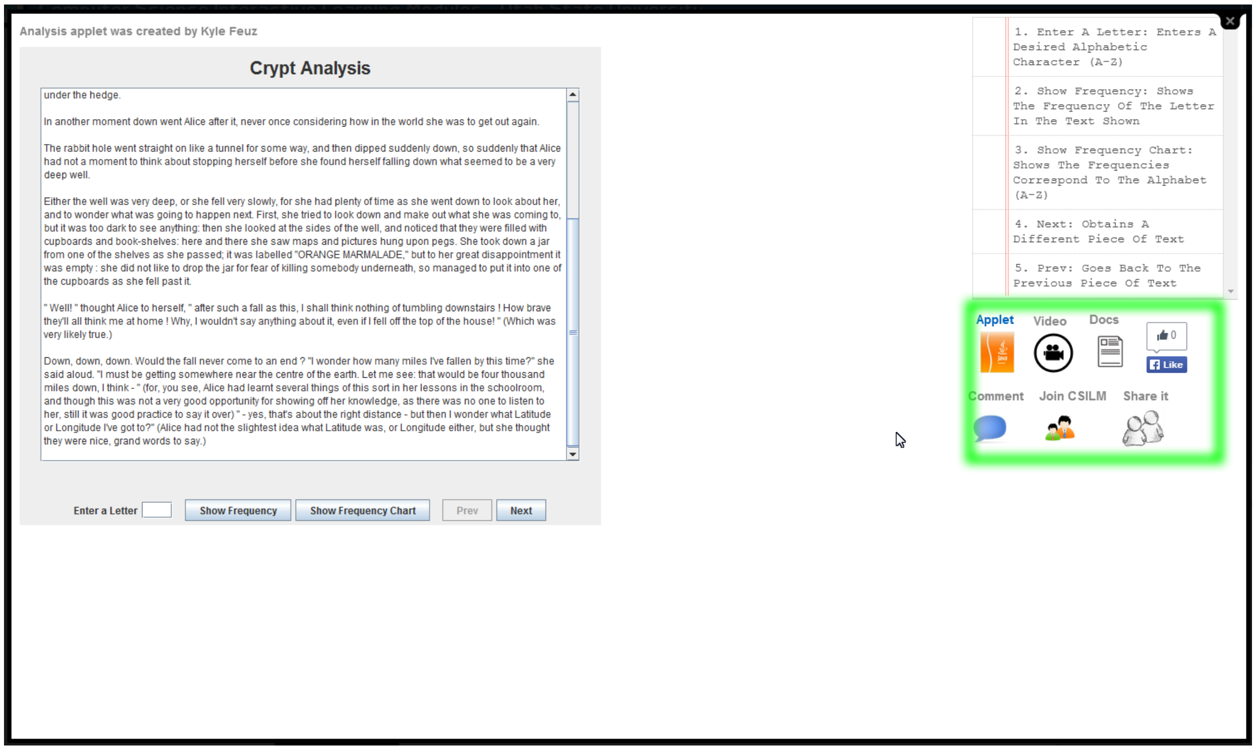
An analysis of the frequency of the appearance of individual characters can help in cracking a cipher. See how frequency differs with various types of text.

More Details

Transposition Encyrption

Figure 2: Group Page Navigation

As previously discussed, all learning materials in the form of videos and documents related to a module are displayed on the same topic page without having to navigating to another page. This is achieved by using AJAX framework where links in the form of icons for videos and documents are displayed in the same page. When a user clicks on one of the video or document icons, the applet content in the same page will be replaced with the content related to video and vice versa. In addition to materials, there are social media icons where users can like or share comments using Facebook.


Analysis applet was created by Kyle Feuz

Crypt Analysis

under the hedge.

In another moment down went Alice after it, never once considering how in the world she was to get out again.

The rabbit hole went straight on like a tunnel for some way, and then dipped suddenly down, so suddenly that Alice had not a moment to think about stopping herself before she found herself falling down what seemed to be a very deep well.

Either the well was very deep, or she fell very slowly, for she had plenty of time as she went down to look about her, and to wonder what was going to happen next. First, she tried to look down and make out what she was coming to, but it was too dark to see anything: then she looked at the sides of the well, and noticed that they were filled with cupboards and book-shelves: here and there she saw maps and pictures hung upon pegs. She took down a jar from one of the shelves as she passed; it was labelled "ORANGE MARMALADE," but to her great disappointment it was empty : she did not like to drop the jar for fear of killing somebody underneath, so managed to put it into one of the cupboards as she fell past it.

" Well! " thought Alice to herself, " after such a fall as this, I shall think nothing of tumbling downstairs ! How brave they'll all think me at home ! Why, I wouldn't say anything about it, even if I fell off the top of the house! " (Which was very likely true.)

Down, down, down. Would the fall never come to an end ? "I wonder how many miles I've fallen by this time?" she said aloud. "I must be getting somewhere near the centre of the earth. Let me see: that would be four thousand miles down, I think - " (for, you see, Alice had learnt several things of this sort in her lessons in the schoolroom, and though this was not a very good opportunity for showing off her knowledge, as there was no one to listen to her, still it was good practice to say it over) " - yes, that's about the right distance - but then I wonder what Latitude or Longitude I've got to?" (Alice had not the slightest idea what Latitude was, or Longitude either, but she thought they were nice, grand words to say.)

1. Enter A Letter: Enters A Desired Alphabetic Character (A-Z)

2. Show Frequency: Shows The Frequency Of The Letter In The Text Shown

3. Show Frequency Chart: Shows The Frequencies Correspond To The Alphabet (A-Z)

4. Next: Obtains A Different Piece Of Text

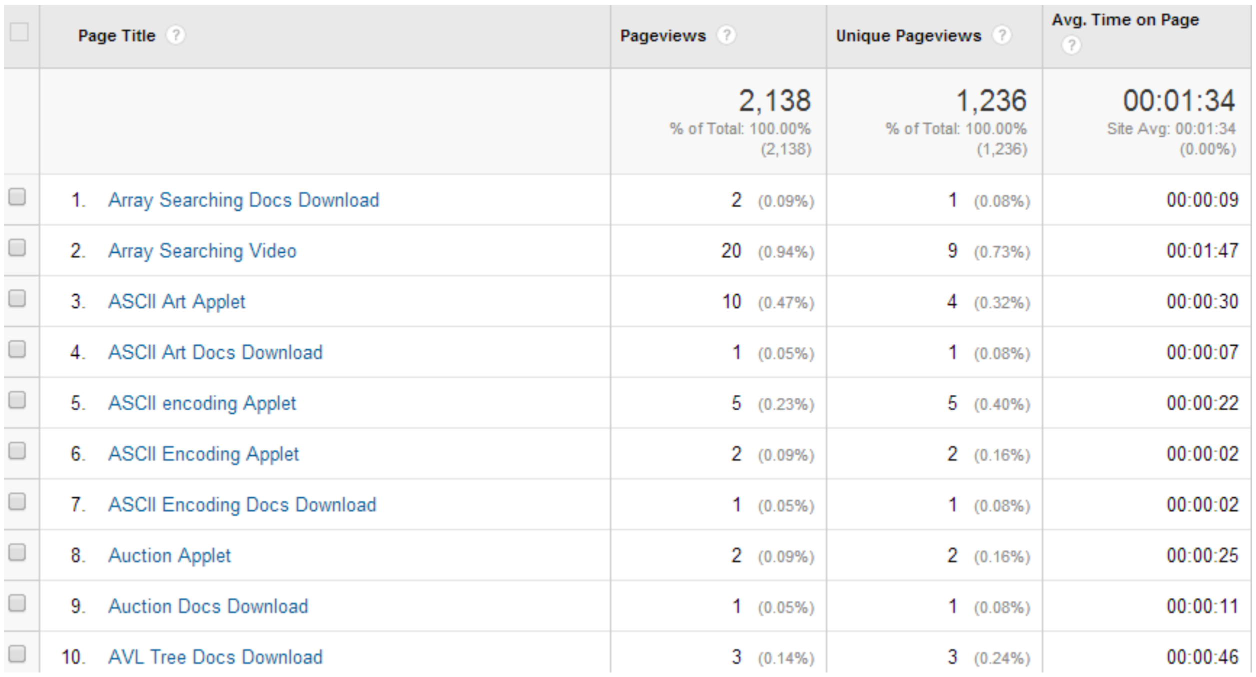
5. Prev: Goes Back To The Previous Piece Of Text

Figure 3: Video and Document Navigation

2.2. Analytics

Because an online education system does not involve direct communication between students and teachers, the teacher does not know how interested the students are in learning the modules and time spent on the modules. We implemented analytics to help the teacher to track student interest levels and preferred methods of learning. This allows tracking which modules students are using, and whether videos and documents related to topic are being utilized, and how much time is spent with the modules. .

In order to achieve the functionalities discussed, the implemented analytics are very detailed. Whenever a user clicks on an applet, video, or document, each event is recorded and sent to Google Analytics. Even page level details are captured. When the user clicks on a module or link, the data is sent asynchronously to Google Analytics server using JAVASCRIPT and Ajax. To see Analytics Information you need to logon to google analytics with user name: csilmuser and password: csilmuser1234.



Page Title	Pageviews	Unique Pageviews	Avg. Time on Page
	2,138 % of Total: 100.00% (2,138)	1,236 % of Total: 100.00% (1,236)	00:01:34 Site Avg: 00:01:34 (0.00%)
1. Array Searching Docs Download	2 (0.09%)	1 (0.08%)	00:00:09
2. Array Searching Video	20 (0.94%)	9 (0.73%)	00:01:47
3. ASCII Art Applet	10 (0.47%)	4 (0.32%)	00:00:30
4. ASCII Art Docs Download	1 (0.05%)	1 (0.08%)	00:00:07
5. ASCII encoding Applet	5 (0.23%)	5 (0.40%)	00:00:22
6. ASCII Encoding Applet	2 (0.09%)	2 (0.16%)	00:00:02
7. ASCII Encoding Docs Download	1 (0.05%)	1 (0.08%)	00:00:02
8. Auction Applet	2 (0.09%)	2 (0.16%)	00:00:25
9. Auction Docs Download	1 (0.05%)	1 (0.08%)	00:00:11
10. AVL Tree Docs Download	3 (0.14%)	3 (0.24%)	00:00:46

Figure 4: Sample Analytics Report of CSILM

Data Sent to the Google Analytics Server

1. URL of the page
2. URL of the module clicked
    - The page URL will be different from the actual URL of the page, just as clicking on a video brings up a different URL than that of the page on which the video is found

although both appear to be on the same page. Ajax displays content in the same page using asynchronous calls. One of the reasons for giving different URLs to the page and individual components is that they will then be distinguishable in the data reports, eliminating confusion between page level details and individual component level details.

3. Title of the module clicked
4. Social Media URL
    - In order to track how many people are coming to the existing portal via social media , a separate URL is used.

2.3. Facebook share

To promote and create opportunities for group work, we used Facebook to allow users to share the modules with their friends or specified groups of people. In the individual display page, there is a small icon for sharing the content related to the applet. When the share button is clicked, the following data is going to be shared to the public, friends, or a specific group of people by posting it on their wall:

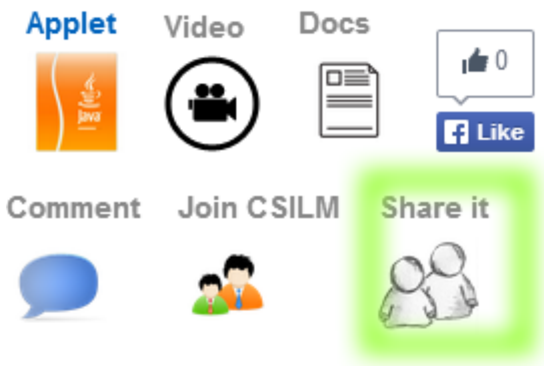
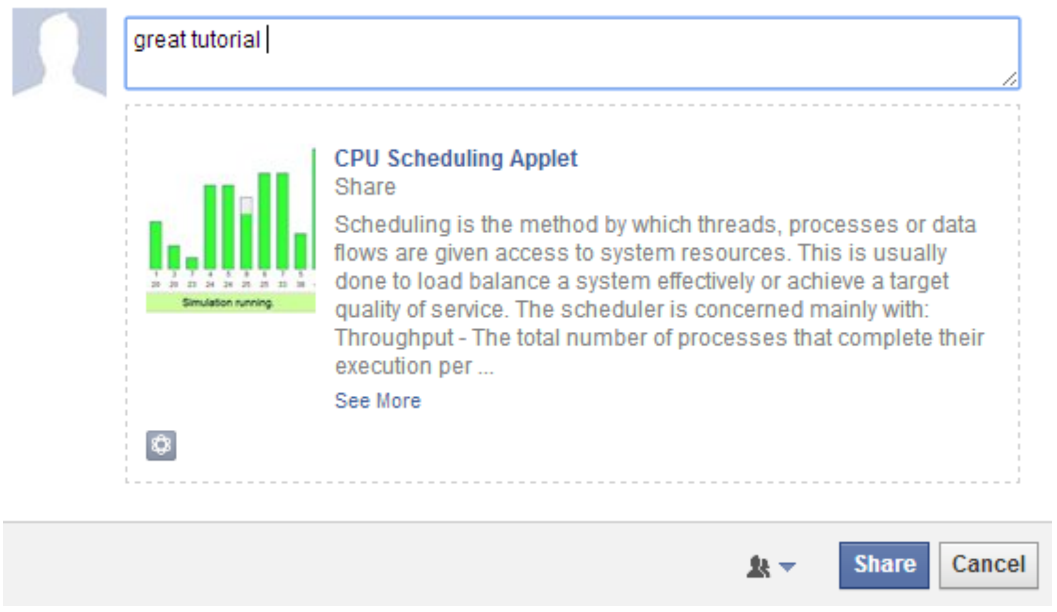


Figure 5: Share Icon

Data Sent to the Facebook Server

1) Redirect URL: Once the link is shared it redirects to the previous page.
2) Link: When the any user clicks the app or link posted on the wall, he is redirected to the page from which the link is shared. By using this share button, CSILM can drive more users into the existing portal. It also promotes group work.
3) Picture Associated with the Applet: Here all the pictures related to the applet are stored in our servers.
4) Name: Generic Title
5) Description: Small description related to the Applet.
6) Caption: The name of the button.
7) Custom message: A box where the user can type a custom message and share it along the Applet and its predefined description will be provided.


great tutorial

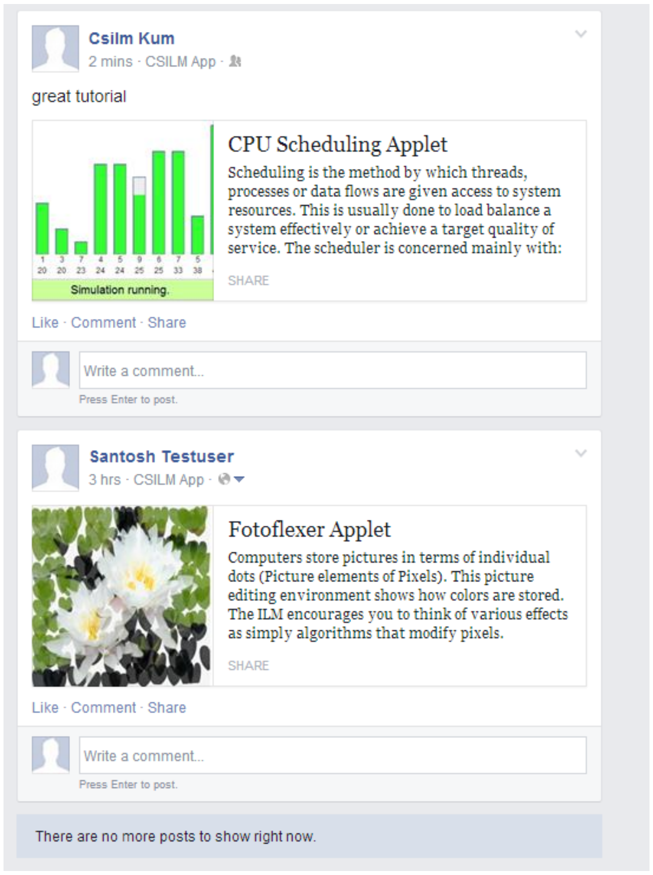
CPU Scheduling Applet

Share

Scheduling is the method by which threads, processes or data flows are given access to system resources. This is usually done to load balance a system effectively or achieve a target quality of service. The scheduler is concerned mainly with: Throughput - The total number of processes that complete their execution per ...

See More

Figure 6: Facebook share



Csilm Kum
2 mins · CSILM App ·

great tutorial

CPU Scheduling Applet
Scheduling is the method by which threads, processes or data flows are given access to system resources. This is usually done to load balance a system effectively or achieve a target quality of service. The scheduler is concerned mainly with:

SHARE

Santosh Testuser
3 hrs · CSILM App ·

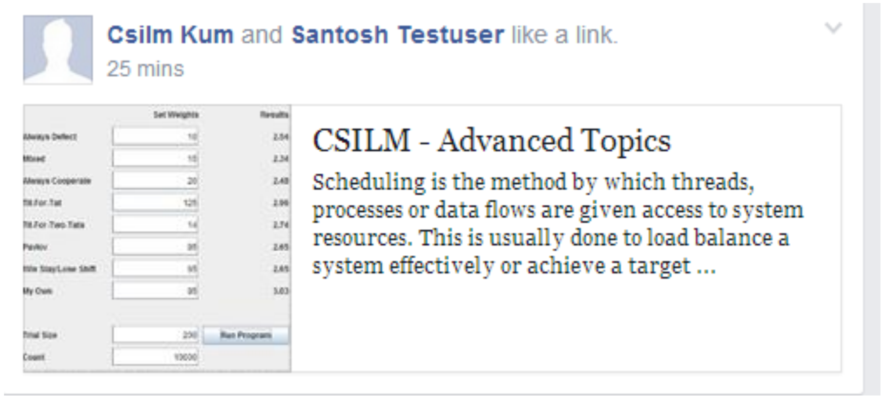
Fotoflexer Applet
Computers store pictures in terms of individual dots (Picture elements of Pixels). This picture editing environment shows how colors are stored. The ILM encourages you to think of various effects as simply algorithms that modify pixels.

SHARE

There are no more posts to show right now.

Figure 7: Content posted in their wall after sharing it on Facebook via CSILM

There is also a similar button that allows users to like modules on Facebook. The content will be then be posted on the user's wall.



Csilm Kum and Santosh Testuser like a link.
25 mins

	Set Weights	Results
Always Defect	10	2.54
Mixed	15	2.34
Always Cooperate	20	2.48
Tit For Tat	125	2.96
Tit For Two Tats	14	2.74
Pavlov	95	2.65
Win Stay/Lose Shift	95	2.65
My Own	95	3.03
Trial Size	200	Run Program
Count	10000	

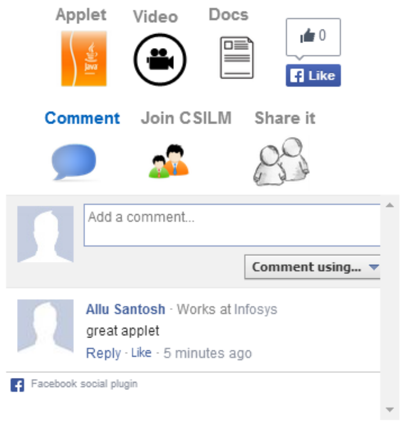
CSILM - Advanced Topics
Scheduling is the method by which threads, processes or data flows are given access to system resources. This is usually done to load balance a system effectively or achieve a target ...

Figure 8: Content Posted on the wall when user likes a link.

Facebook uses an API that maps content between like and share functionalities. The content that is passed in share functionality can also be used in like functionality.

2.4. Facebook Comment

The integrated Facebook Comment plugs into the existing CSILM portal so users can comment on your site's content using their Facebook profile and show it to their friends in news feed. It also contains built-in moderation tools and special social relevance ranking.

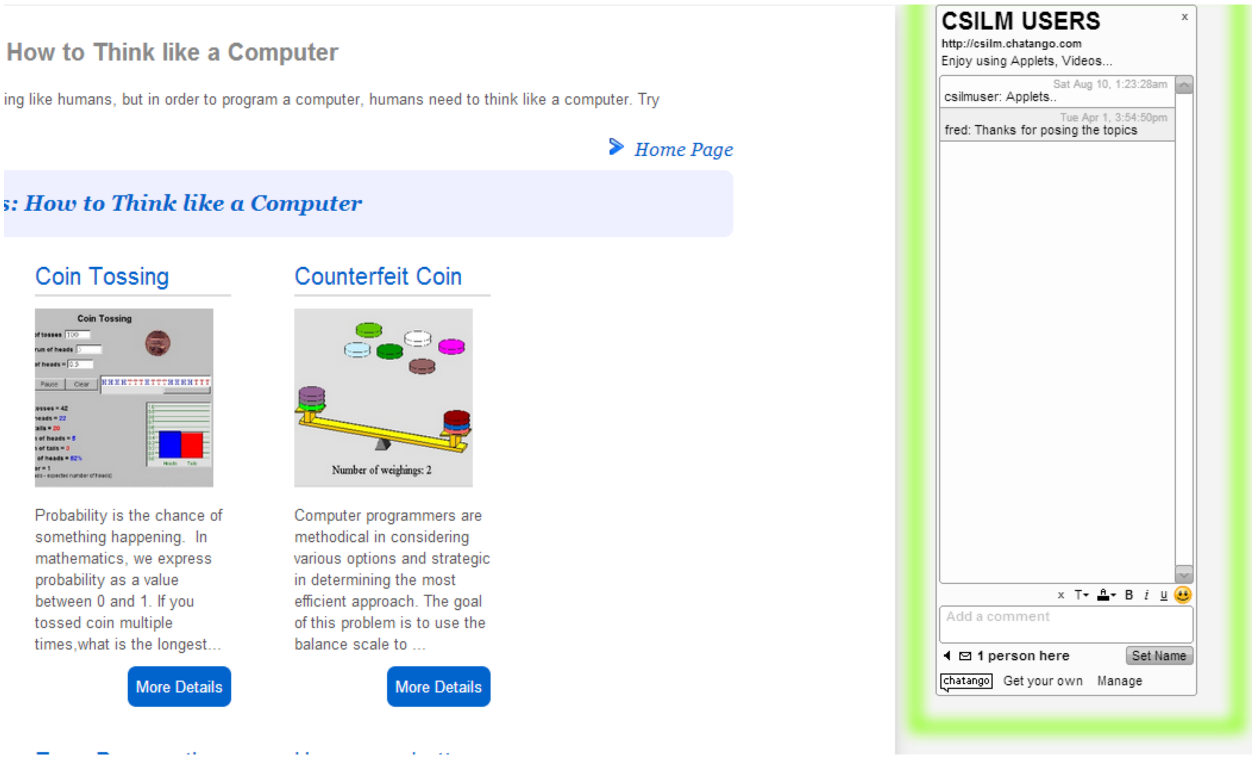


Allu Santosh · Works at Infosys
great applet

Figure 9: Facebook Comment.

2.5. Chat Interface

A chat module is implemented by integrating a chat plug in, Chatango. Chatango is an online chat interface where anyone can chat with each other. By using Chatango as an application chat interface, the program allows students or users to ask questions and get answers instantly.



How to Think like a Computer

ing like humans, but in order to program a computer, humans need to think like a computer. Try

Home Page

s: How to Think like a Computer

Coin Tossing

Probability is the chance of something happening. In mathematics, we express probability as a value between 0 and 1. If you tossed coin multiple times,what is the longest...

More Details

Counterfeit Coin

Computer programmers are methodical in considering various options and strategic in determining the most efficient approach. The goal of this problem is to use the balance scale to ...

More Details

CSILM USERS

http://csilm.chatango.com

Enjoy using Applets, Videos...

Sat Aug 10, 1:23:28am

csilmuser: Applets..

Tue Apr 1, 3:54:50pm

fred: Thanks for posing the topics

Add a comment

1 person here

Set Name

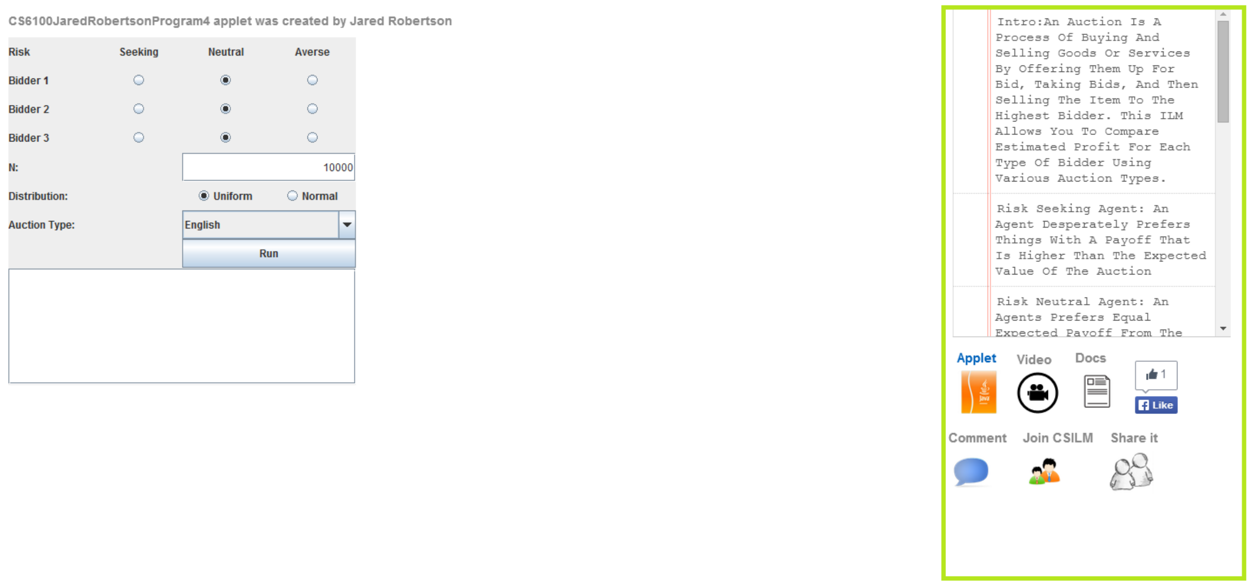
chatango Get your own Manage

Figure 10 : Chat Interface.

2.5. Applet, Video and Documents

Applets, videos, and documents are used as learning materials related to the module. In the previous version of CSILM, the learning materials were placed one after the other, making a greater number of steps necessary to navigate to a particular learning material and preventing the user from skipping the related materials. To overcome this, all the materials were grouped and placed beside the Applet to let the user know there are additional materials related to the module to learn. The content related to modules, like videos or Applets, will be displayed without refreshing the entire page by using Ajax. Now only a part of page will be replaced with the content, leaving the remaining content intact and greatly reducing page load time that might have been wasted in loading other scripts, CSS, and DOM.

Also, a small column is provided on the right hand side that displays the content explaining how to operate the Applet.


CS6100JaredRobertsonProgram4 applet was created by Jared Robertson

Risk	Seeking	Neutral	Averse
Bidder 1	○	●	○
Bidder 2	○	●	○
Bidder 3	○	●	○

N: 10000

Distribution: [✓ Uniform] Normal

Auction Type: English

Run

Intro:An Auction Is A Process Of Buying And Selling Goods Or Services By Offering Them Up For Bid, Taking Bids, And Then Selling The Item To The Highest Bidder. This ILM Allows You To Compare Estimated Profit For Each Type Of Bidder Using Various Auction Types.

Risk Seeking Agent: An Agent Desperately Prefers Things With A Payoff That Is Higher Than The Expected Value Of The Auction

Risk Neutral Agent: An Agents Prefers Equal Expected Payoff From The

Figure 11 : Learning Modules

2.6. User friendly URL’s

All the URLs in the portal are user-friendly, simple and easy to remember. The computer literacy group URL, for example, is csilm2.usu.edu/lms/advancedtopics.html. And this URL’s helps when users directly want to access specific content or when the users login for the first time.

2.7. Functional Requirements

- Students should be able to reach any module in the portal with limited number of steps.
- Students should be able to share the content on Facebook
- Application should be able to track which learning modules are used
- Tracked data should be sent to analytics server so the teacher can analyze the reports from the analytics dashboard.

- Students should be able to comment on modules using Facebook comments boxand like the modules using Facebook like in CSILM .
- Good user Interface design.
- Faster page load times.
- User friendly URL’s

CHAPTER 3

ARCHITECTURAL DESIGN

The two-tier architecture is like a client-server application. Direct communication takes place between the client and the server without any intermediate between them. The CSILM web application was developed using the 2-tier architecture with a client layer and an application layer. The client here is a web browser that only displays the GUI and data. The application layer accepts the requests from the client, processes them, and sends them to the client.

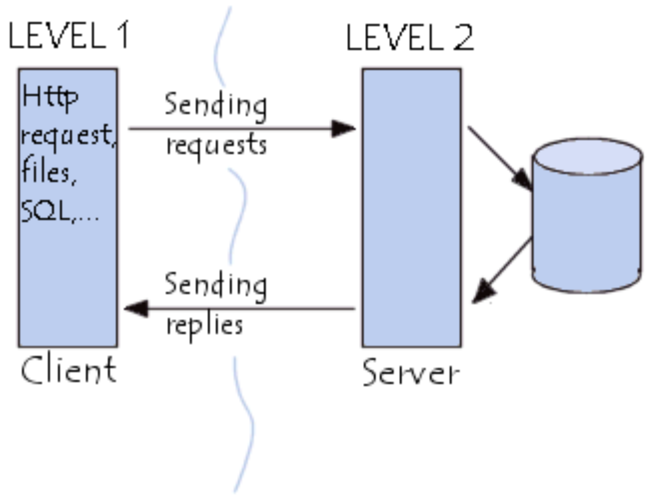


Figure 12 . 2-Tier client/server architecture

The 2-tier architecture offers advantages like scalability. It is much easier to maintain and build because of lower complexity, not to mention less expense. Because this contains static business rules, it is more applicable for homogenous environments.

The primary function of a web server is to store, process, and deliver web pages to clients. Apache Tomcat is employed as a web server to handle client requests and sends back responses to the client. The communication between client and server takes place using the Hypertext Transfer Protocol (HTTP). The pages most frequently delivered are HTML documents, which may include images, style sheets, and scripts (Javascript, JQuery) in addition to text content.

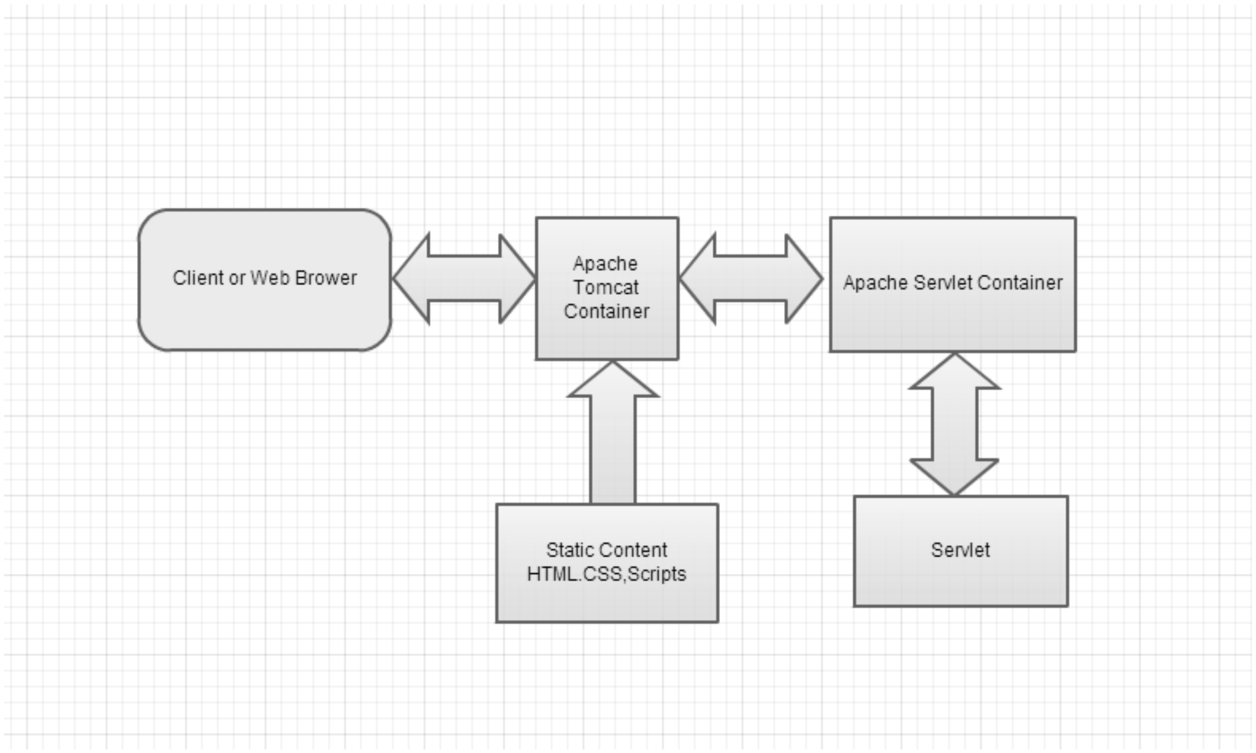
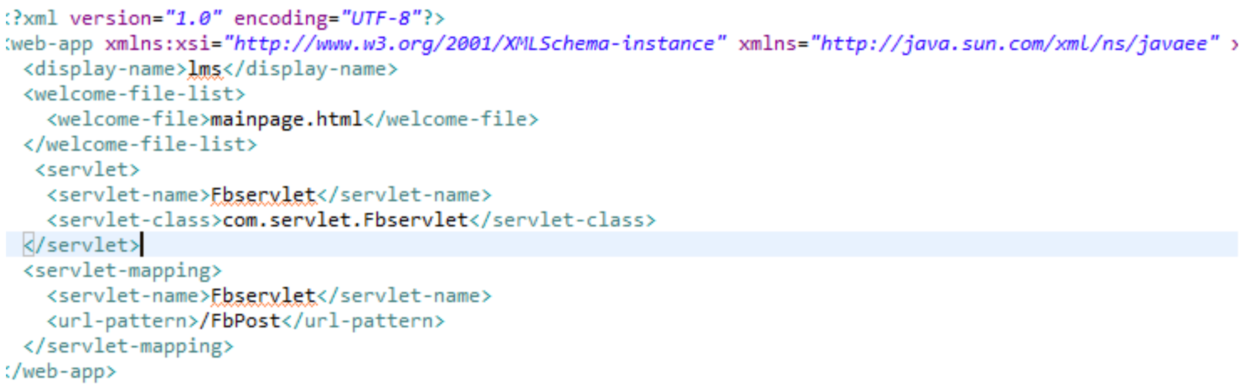


Figure 13. Apache Tomcat Server

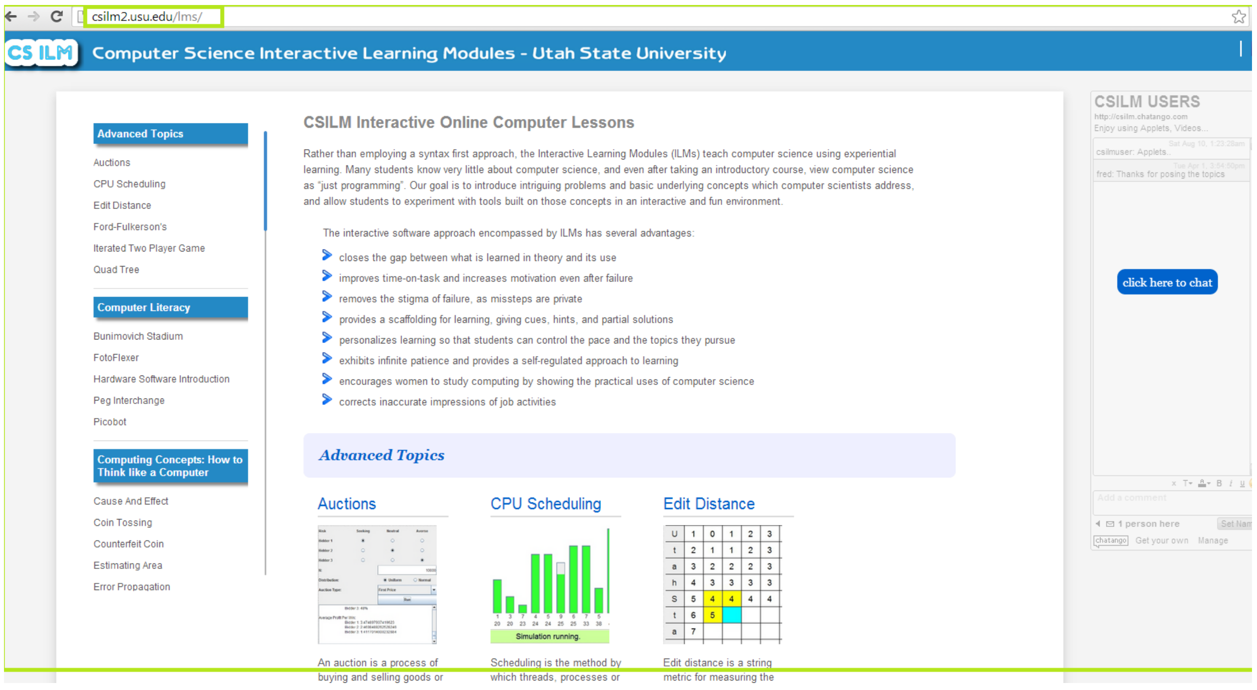
1. The Client or Web browser makes a request for the .html page.
2. Server gets the request and routs to the Apache Tomcat server ,which is running on a particular port number
3. There may be multiple applications running on Apache Tomcat. Apache Tomcat will serve them based on the URL from the user. When the user requests a page, the URL has a specific path like

domain name/application name. When the application name is given, Apache Tomcat will serve the application.

4. This configuration is done in deployment descriptor web.xml.



```xml
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://java.sun.com/xml/ns/javaee" >
  <display-name>lms</display-name>
  <welcome-file-list>
    <welcome-file>mainpage.html</welcome-file>
  </welcome-file-list>
   <servlet>
    <servlet-name>Fbservlet</servlet-name>
    <servlet-class>com.servlet.Fbservlet</servlet-class>
  </servlet>
  <servlet-mapping>
    <servlet-name>Fbservlet</servlet-name>
    <url-pattern>/FbPost</url-pattern>
  </servlet-mapping>
</web-app>
```



csilm2.usu.edu/lms/

Computer Science Interactive Learning Modules - Utah State University

Advanced Topics
Auctions
CPU Scheduling
Edit Distance
Ford-Fulkerson's
Iterated Two Player Game
Quad Tree

Computer Literacy
Bunimovich Stadium
FotoFlexer
Hardware Software Introduction
Peg Interchange
Picobot

Computing Concepts: How to Think like a Computer
Cause And Effect
Coin Tossing
Counterfeit Coin
Estimating Area
Error Propagation

CSILM Interactive Online Computer Lessons

Rather than employing a syntax first approach, the Interactive Learning Modules (ILMs) teach computer science using experiential learning. Many students know very little about computer science, and even after taking an introductory course, view computer science as "just programming". Our goal is to introduce intriguing problems and basic underlying concepts which computer scientists address, and allow students to experiment with tools built on those concepts in an interactive and fun environment.

The interactive software approach encompassed by ILMs has several advantages:

- closes the gap between what is learned in theory and its use
- improves time-on-task and increases motivation even after failure
- removes the stigma of failure, as missteps are private
- provides a scaffolding for learning, giving cues, hints, and partial solutions
- personalizes learning so that students can control the pace and the topics they pursue
- exhibits infinite patience and provides a self-regulated approach to learning
- encourages women to study computing by showing the practical uses of computer science
- corrects inaccurate impressions of job activities

Advanced Topics

Auctions
An auction is a process of buying and selling goods or

CPU Scheduling
Simulation running.
Scheduling is the method by which threads, processes or

Edit Distance
Edit distance is a string metric for measuring the

CSILM USERS
http://csilm.chatango.com
Enjoy using Applets, Videos...
Sat Aug 10, 1:23:28am
csilmuser: Applets..
Tue Apr 1, 3:54:50pm
fred: Thanks for posing the topics

Figure 14. URL Mapping Example

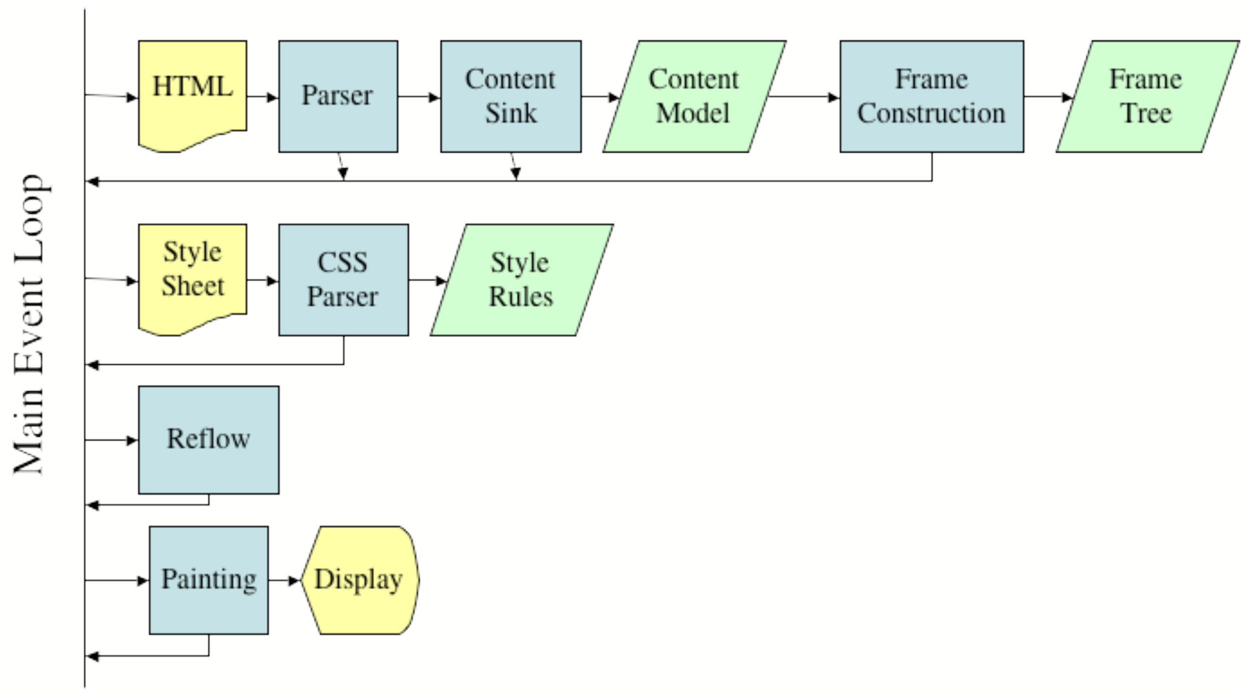
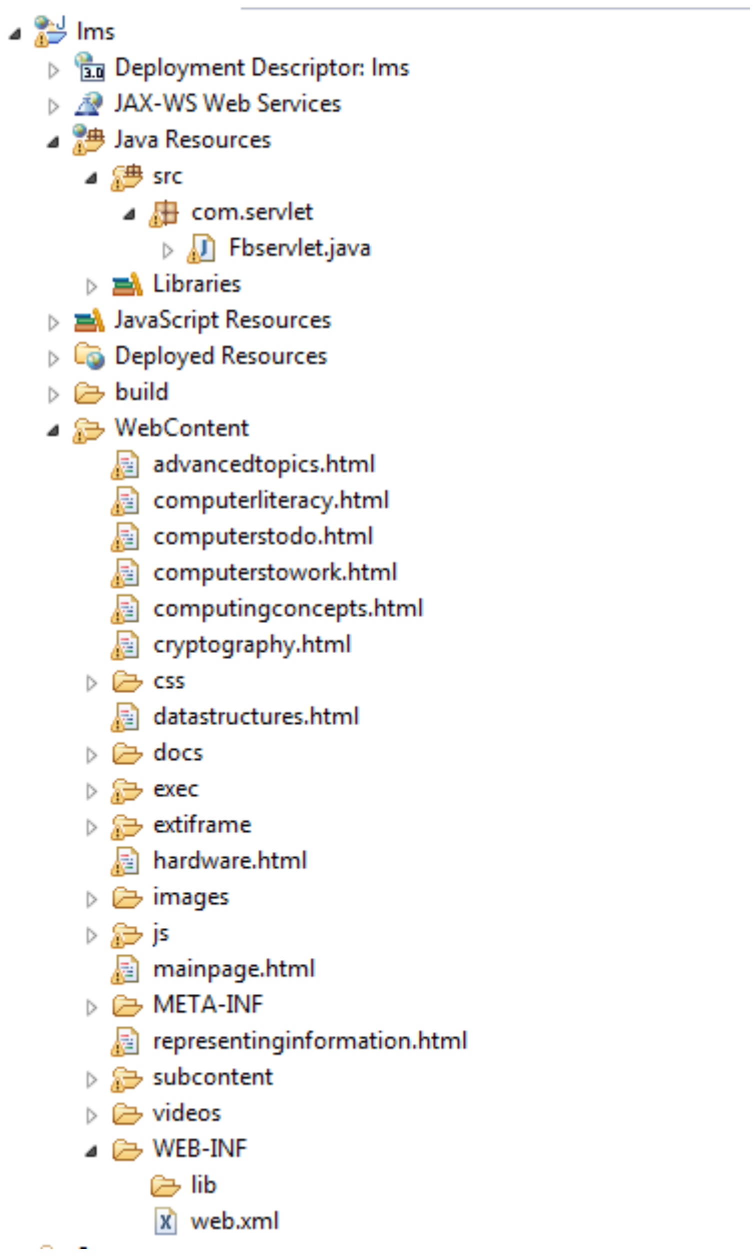


Figure 15: DOM evaluation – CSS

(Figure taken from https://developer.mozilla.org/en-US/docs/Introduction_to_Layout_in_Mozilla)

3.2 File Structure

Appropriate file structure is maintained throughout the application. All document files are placed in a DOC files, images in an images folder, Javascript in a .js folder, Applets in an Exec folder , CSS in CSS folder, and videos in videos folder. File structure layout in this application design is consistent, readable, and as long as appropriate file structure is maintained, it is easy to debug the application.



```
◢ lms
    ▷ Deployment Descriptor: lms
    ▷ JAX-WS Web Services
    ◢ Java Resources
        ◢ src
            ◢ com.servlet
                ▷ Fbservlet.java
        ▷ Libraries
    ▷ JavaScript Resources
    ▷ Deployed Resources
    ▷ build
    ◢ WebContent
          advancedtopics.html
          computerliteracy.html
          computerstodo.html
          computerstowork.html
          computingconcepts.html
          cryptography.html
        ▷ css
          datastructures.html
        ▷ docs
        ▷ exec
        ▷ extiframe
          hardware.html
        ▷ images
        ▷ js
          mainpage.html
        ▷ META-INF
          representinginformation.html
        ▷ subcontent
        ▷ videos
        ◢ WEB-INF
              lib
              web.xml
```

Figure 16: File Structure.

3.2 User Interface Design

The user interface for the entire project was handwritten without using any framework. The user interface was designed using HTML, CSS, Javascript and lightweight library Jquery. All the user interactive animated content overlays were achieved through Jquery. Because inline coding takes longer to load compared to scripts written in external files, the user interface files were written separately and integrated to HTML files for better readability and faster execution time.

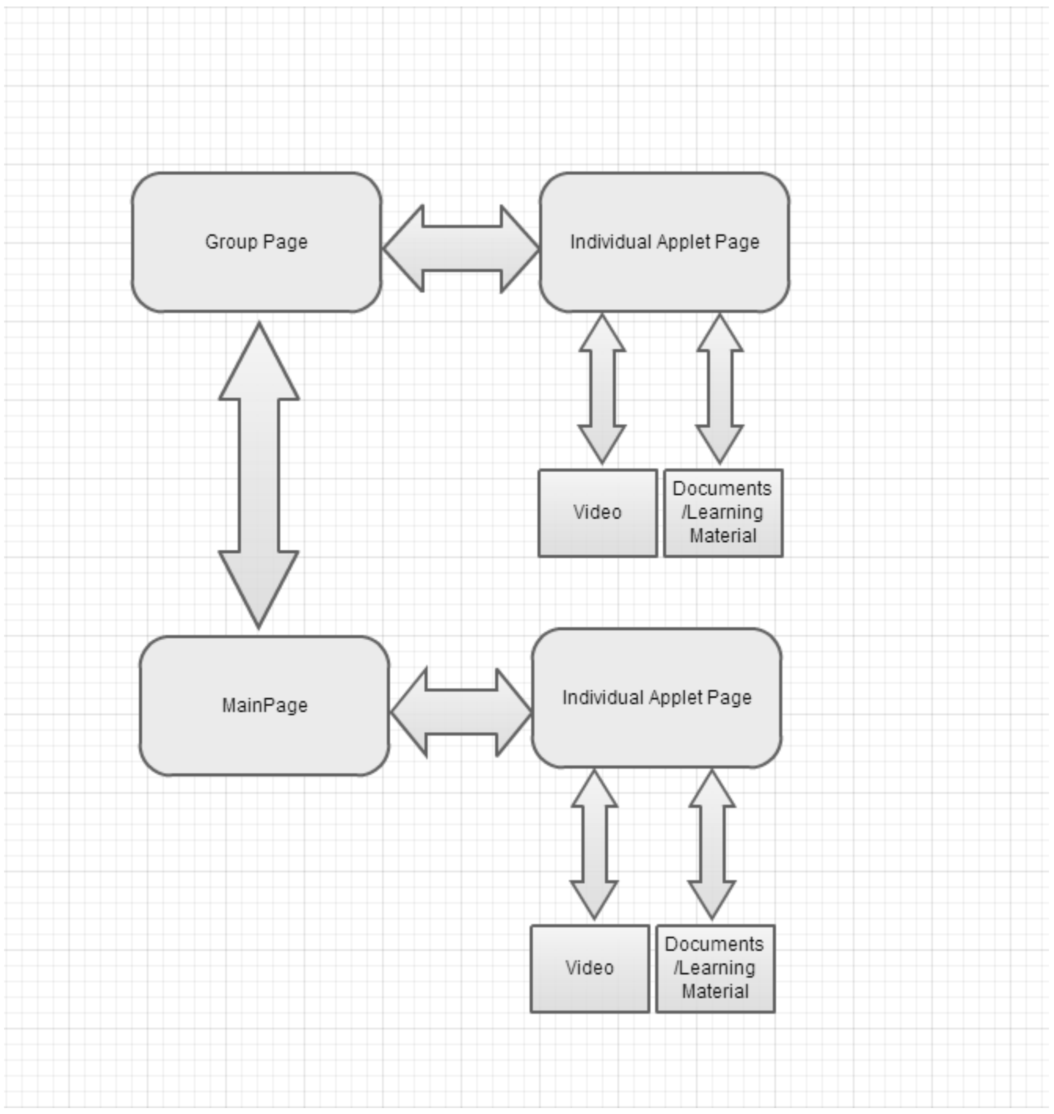


Figure 17: User Navigation

CHAPTER 4

IMPLEMENTATION

4.1 User Interface

The user interface is what is displayed in the browser to the client. Our entire user interface was handwritten by using HTML, CSS, JavaScript and other external JavaScript libraries. Scrolling effects and other animations were achieved using external JavaScript libraries. The structure principle is concerned with overall user interface architecture. The user interface in this application was organized based on clear, consistent models that are simple and familiar to users, grouping related elements together and separating those that are unrelated, differentiating between dissimilar things and making similar things resemble one another. The design is uncomplicated. Common tasks are made easy by using the user's own language and providing good shortcut navigations that are meaning related to navigation which additional number of steps.

When it comes to visibility, the application is designed in such a way that all necessary options and materials for a given task are visible without distracting the user with extraneous or redundant information. CSS and Javascript and Jquery files were placed in external files to reduce redundancy, promote readability and maintainability, and optimize page load times, given that internal scripts load the Document Object Model more slowly than external scripts.

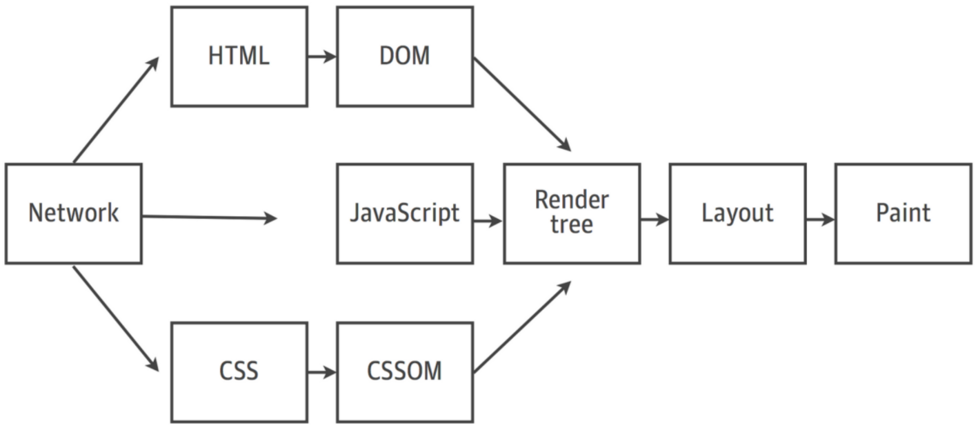


Figure 18: Document Object Model rendering

The animated scrollbar displayed in main page was designed using JQuery. This scroll bar can be controlled using the mouse scroll wheel or by dragging the scroll bar up or down using the left mouse button.

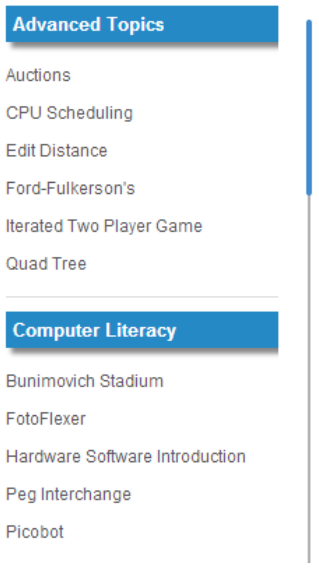
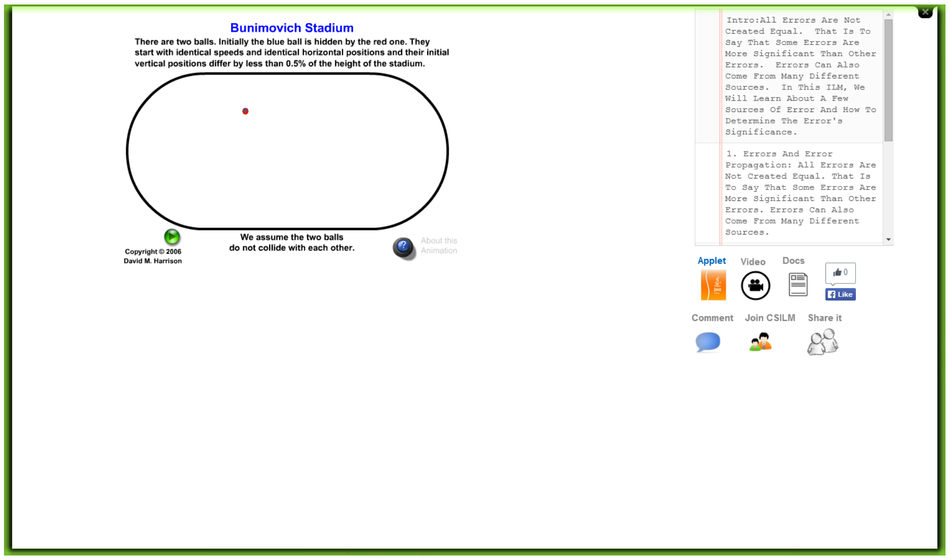


Figure 19: Scroll bar in main page

Individual modules are displayed in an overlay, which was designed using a external lightweight Jquery library. This library was used because it supports Ajax, as featured in our design.


Bunimovich Stadium

There are two balls. Initially the blue ball is hidden by the red one. They start with identical speeds and identical horizontal positions and their initial vertical positions differ by less than 0.5% of the height of the stadium.

We assume the two balls do not collide with each other.

Copyright © 2006 David M. Harrison

Intro:All Errors Are Not Created Equal. That Is To Say That Some Errors Are More Significant Than Other Errors. Errors Can Also Come From Many Different Sources. In This ILM, We Will Learn About A Few Sources Of Error And How To Determine The Error's Significance.

1. Errors And Error Propagation: All Errors Are Not Created Equal. That Is To Say That Some Errors Are More Significant Than Other Errors. Errors Can Also Come From Many Different Sources.

Figure 20: Overlay

Also, this library is lightweight, less than 10KB, facilitating faster page load times. Its appearance can be controlled through CSS and may be extended to call backs and event hookups without altering the source files.

All the Stylings are given through CSS. The Stylings are given in CSS files to separate the document content from document presentation, including elements such as layout, fonts and color.

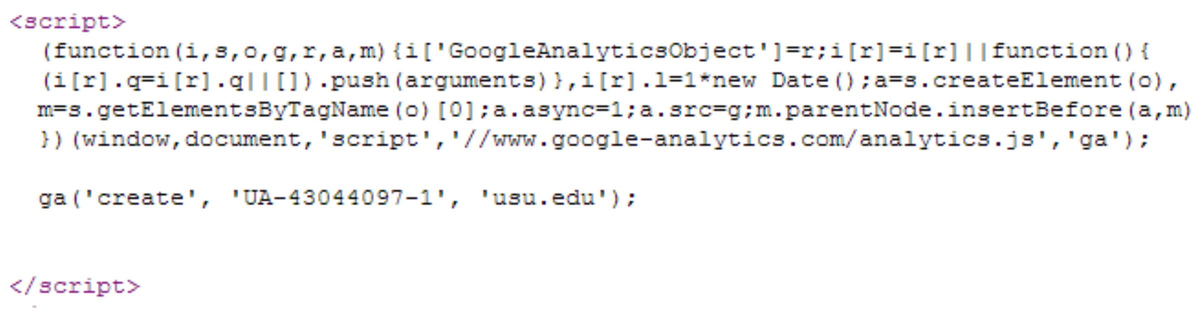
4.2 Analytics:

Analytics is implemented using Javascript, a Google Analytics framework, and Ajax. Ajax is used because some of the content in this portal is dynamically loaded and certain content that is not part of DOM, like the data found in documents, should be sent to the analytics server when students clicks and downloads a document. By using Ajax the data related to the document is sent to the Google Analytics server asynchronously when DOC content is clicked. Similarly, during page loads or content loads like

Applet or video data related to each and every corresponding item is sent asynchronously to the analytics server to ensure that the content is tracked, which helps in compiling accurate reports.

Before going in to more detail, we should discuss integration of Google Analytics with CSILM. Google Analytics is implemented with "page tags." A page tag, in this case called the Google Analytics Tracking Code, is a snippet of JavaScript code that the website owner adds to every page of the website. The tracking code runs in the client browser when the client browses the page (if JavaScript is enabled in the browser), collects visitor data, and sends it to a Google data collection server as part of a request for a web beacon.

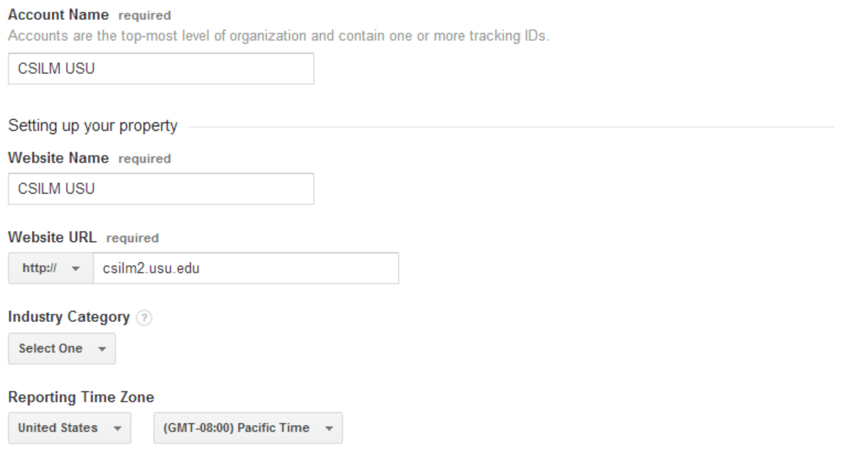
The tracking code loads a larger JavaScript file from the Google web server, then sets variables with the user's account number, although the file does not usually have to be loaded due to browser caching. Assuming caching is enabled in the browser, it downloads ga.js only once, at the start of the visit. Furthermore, as all websites that implement Google Analytics with the ga.js code use the same master file from Google, a browser that has previously visited any other website running Google Analytics will already have the file cached on their machine.



```
<script>
  (function(i,s,o,g,r,a,m){i['GoogleAnalyticsObject']=r;i[r]=i[r]||function(){
  (i[r].q=i[r].q||[]).push(arguments)},i[r].l=1*new Date();a=s.createElement(o),
  m=s.getElementsByTagName(o)[0];a.async=1;a.src=g;m.parentNode.insertBefore(a,m)
  })(window,document,'script','//www.google-analytics.com/analytics.js','ga');

  ga('create', 'UA-43044097-1', 'usu.edu');

</script>
```

Google Analytics Integration

In addition to transmitting information to a Google server, the tracking code sets first party cookies (if cookies are enabled in the browser) on each visitor's computer. These cookies store anonymous information such as whether the visitor has been to the site before (new or returning visitor), the timestamp of the current visit, and the referrer site or campaign that directed the visitor to the page. If cookies are disabled then Google Analytics will not be able to track the requests.


Account Name required
Accounts are the top-most level of organization and contain one or more tracking IDs.
CSILM USU

Setting up your property
Website Name required
CSILM USU

Website URL required
http:// csilm2.usu.edu

Industry Category
Select One

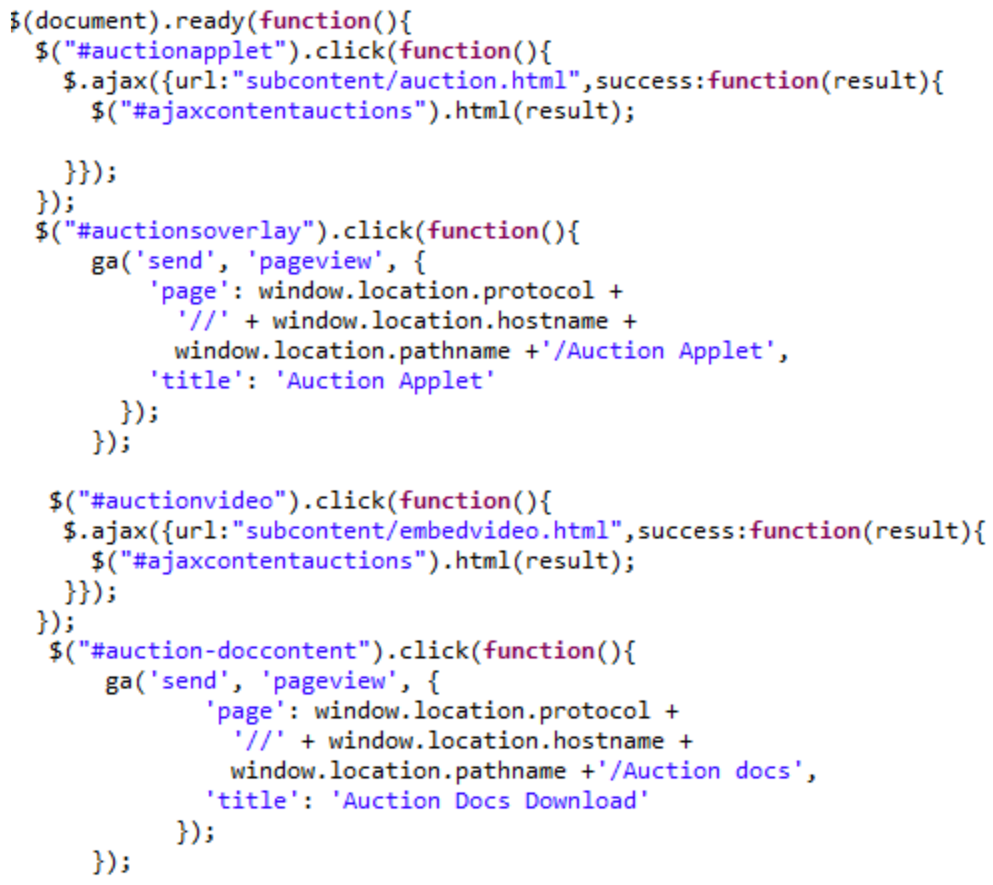
Reporting Time Zone
United States
(GMT-08:00) Pacific Time

Figure 21: Google Analytics Configuration

In addition to ordinary page tracking, a user coming from external websites like Facebook will have a separate URL to be sent to Google Analytics, which will be helpful in tracking users who are referred to CSILM from Facebook.

The below URL is an example on how google detects whether the source is from facebook. In the query parameter there an attribute named “fromfacebookfeed” this attribute is used and bind to an client logic which will help to send third party data to google.

Ex: http://csilm.usu.edulms/advancedtopics.html?openapplet=cpuscheduling&fromfacebookfeed



```
$(document).ready(function(){
  $("#auctionapplet").click(function(){
    $.ajax({url:"subcontent/auction.html",success:function(result){
      $("#ajaxcontentauctions").html(result);

    }});
  });
  $("#auctionsoverlay").click(function(){
      ga('send', 'pageview', {
          'page': window.location.protocol +
            '//' + window.location.hostname +
            window.location.pathname +'/Auction Applet',
          'title': 'Auction Applet'
        });
      });

   $("#auctionvideo").click(function(){
    $.ajax({url:"subcontent/embedvideo.html",success:function(result){
      $("#ajaxcontentauctions").html(result);
    }});
  });
   $("#auction-doccontent").click(function(){
       ga('send', 'pageview', {
              'page': window.location.protocol +
                '//' + window.location.hostname +
                window.location.pathname +'/Auction docs',
              'title': 'Auction Docs Download'
            });
      });
```

Analytics Ajax Implementation

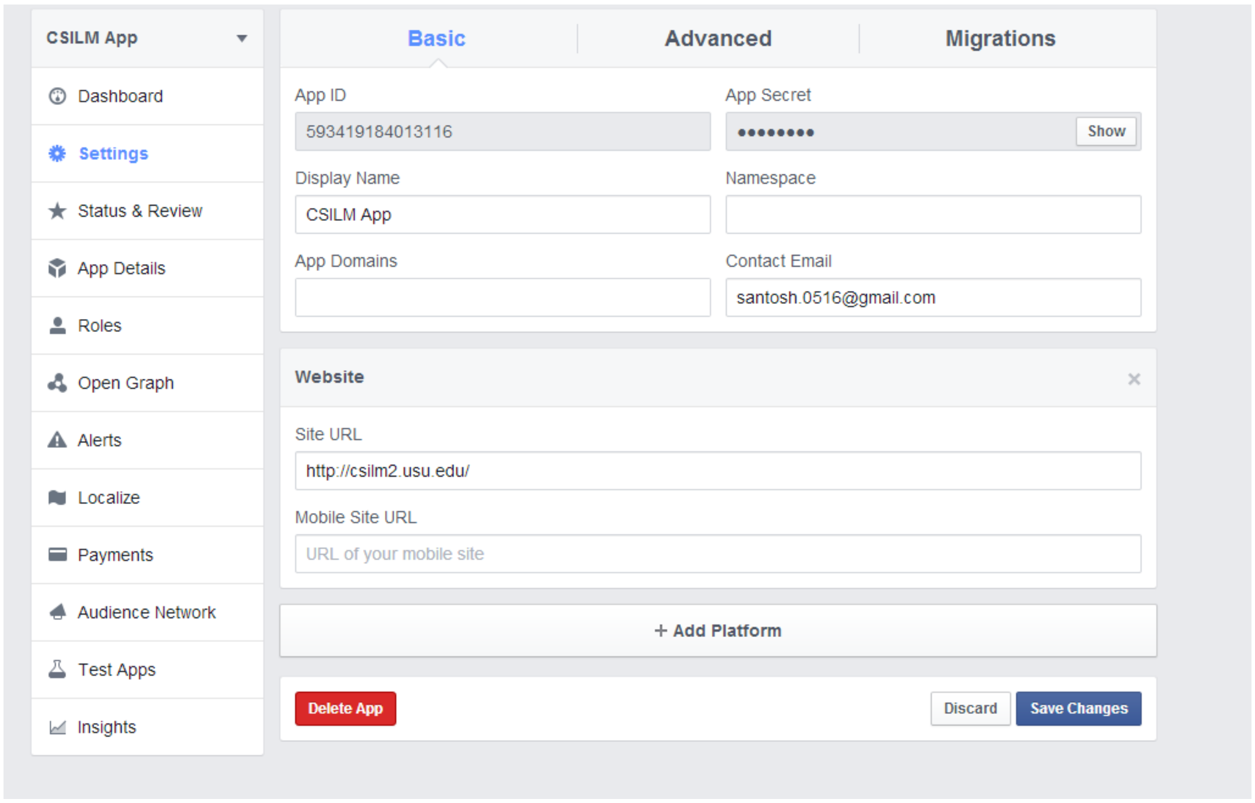
Whenever the user clicks on an Applet or new Module the URL is appended with query parameters based on the query parameters and the appropriate data is sent to the Google Analytics server. Below is a sample of implementation:

```
        var first = getUrlVars()["openapplet"];

        function getUrlVars() {
            var vars = {};
            var parts = window.location.href.replace(/[?&]+([^=&]+)=([^&]*)/gi,
function (m, key, value) {
                vars[key] = value;
            });
            return vars;
        }
```

```
if (first === "auctions") {
    $(".inline").colorbox({
        href: "#auctions_inlinecontent",
        open: true,
        width: "90%"
    });
    ga('send', 'pageview', {
        'page': window.location.protocol +
            '//' + window.location.hostname +
            window.location.pathname + '/Auctions Applet',
        'title': 'Auctions Applet'
    });
}
```

4.3 Facebook Share

Facebook Feed dialog is integrated into CSILM so users can share the content with their friends and promote group work. The Share dialog prompts a person to publish an individual story or an Open Graph story to their timeline. This does not require Facebook Login or any extended permissions, so it is the easiest way to enable sharing on the web. In order to achieve this facebook share functionality first we integrate Facebook Feed dialog into CSILM, and developer creates an app using a Facebook account, then configure the URL of the app to which it is referring, creating a unique app ID. Using this ID, Facebook Feed dialog is mapped in CSILM.



App ID: 593419184013116
App Secret: ••••••••
Display Name: CSILM App
Namespace:
App Domains:
Contact Email: santosh.0516@gmail.com

Website

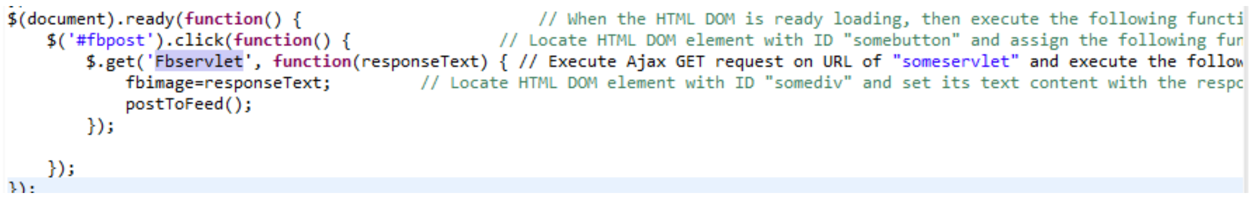
Site URL: http://csilm2.usu.edu/
Mobile Site URL: URL of your mobile site

Figure 22: Facebook feed dialog Configuration

Once the App is created using Facebook. This app ID is integrated with CSILM and the following data is shared in the user’s Facebook account when the share button is clicked.

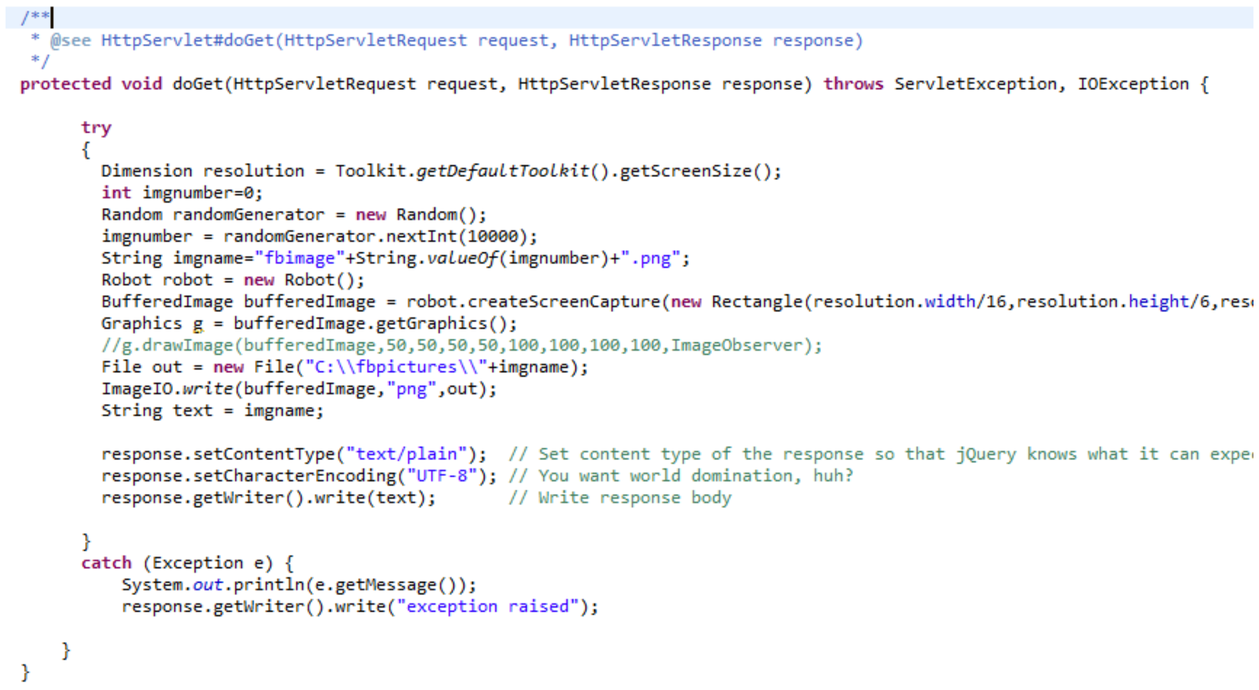
```
<script>
  FB.init({appId: "593419184013116", status: true, cookie: true});

  function postToFeed() {

    // calling the API ...
    var obj = {
      method: 'feed',
      redirect_uri: 'http://csilmtest.usu.edu:8080/csilm/individualpage2.html',
      link: 'http://csilmtest.usu.edu:8080/csilm/individualpage2.html?openapplet=yes&fromfacebookfeed',
      picture: 'http://csilmtest.usu.edu:8080/SimpleProject/images/fbimages/'+fbimage,
      name: 'Complexity Applet',
      caption: 'Solve The Applet',
      description: 'Used to solve complexity Graph.'
    };
   alert(obj.picture);
    function callback(response) {
        }

    FB.ui(obj, callback);
  }

</script>
```

For some of the modules, the image paths are hardcoded, meaning the images are already stored in the repository. When the share button is clicked, an URL with a preloaded image will be sent to the Facebook server.


```
$(document).ready(function() {                              // When the HTML DOM is ready loading, then execute the following functi
    $('#fbpost').click(function() {                         // Locate HTML DOM element with ID "somebutton" and assign the following fur
        $.get('Fbservlet', function(responseText) {  // Execute Ajax GET request on URL of "someservlet" and execute the follow
            fbimage=responseText;              // Locate HTML DOM element with ID "somediv" and set its text content with the respc
            postToFeed();
        });

    });
});
```

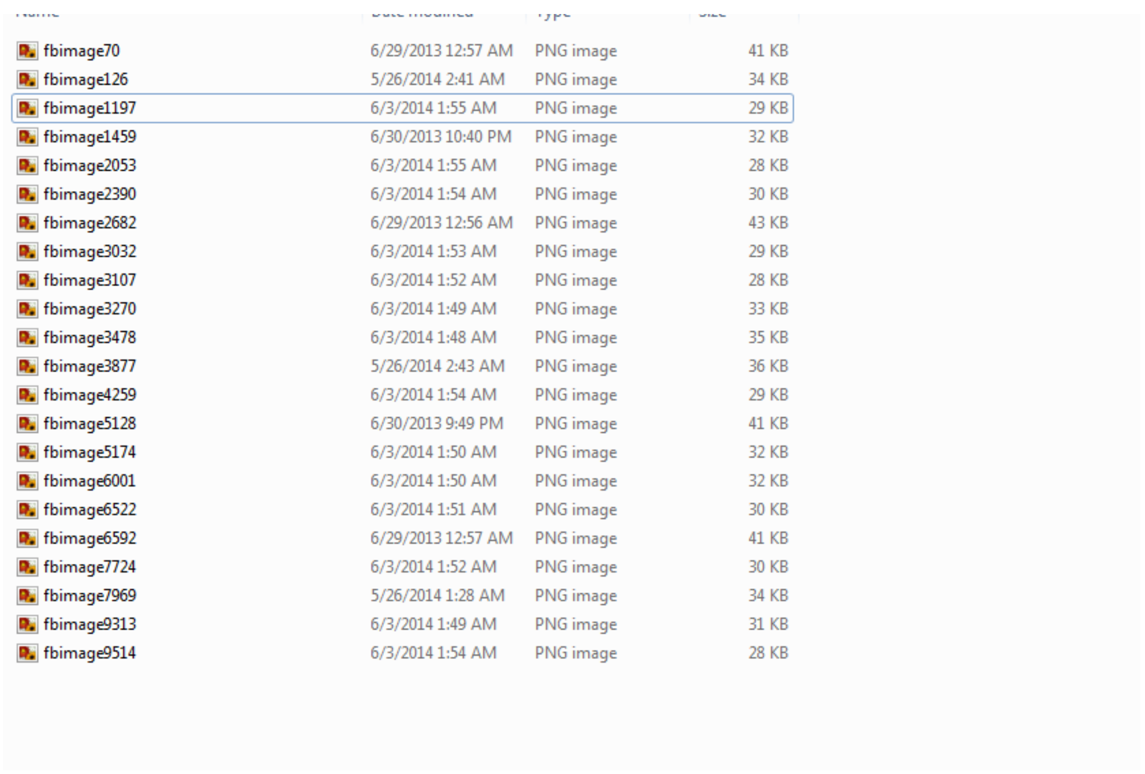
Facebook servlet Ajax call

For some modules, the image paths are not hardcoded. The images are dynamically generated and stored in a folder when share button is clicked and the path for the dynamically generated image is sent to the Facebook server. Due to security issues, this feature is been removed in live environments. To dynamically capture the image, Java Robot and Java Swings is used. When the share button is clicked, it makes an Ajax call to the servlet where it calls a doGet method. In this method, a Dimension class is called which encapsulates the width and height of a component (in integer precision) in a single object. The class is associated with certain properties of components. Several methods defined by the Component class and the LayoutManager interface return a Dimension object. After capturing screen dimensions, Java Robot is used to capture the screen with dimensions as a parameter. After the image is captured it is stored as a .PNG file in the server. The image's URL is then sent to Facebook .



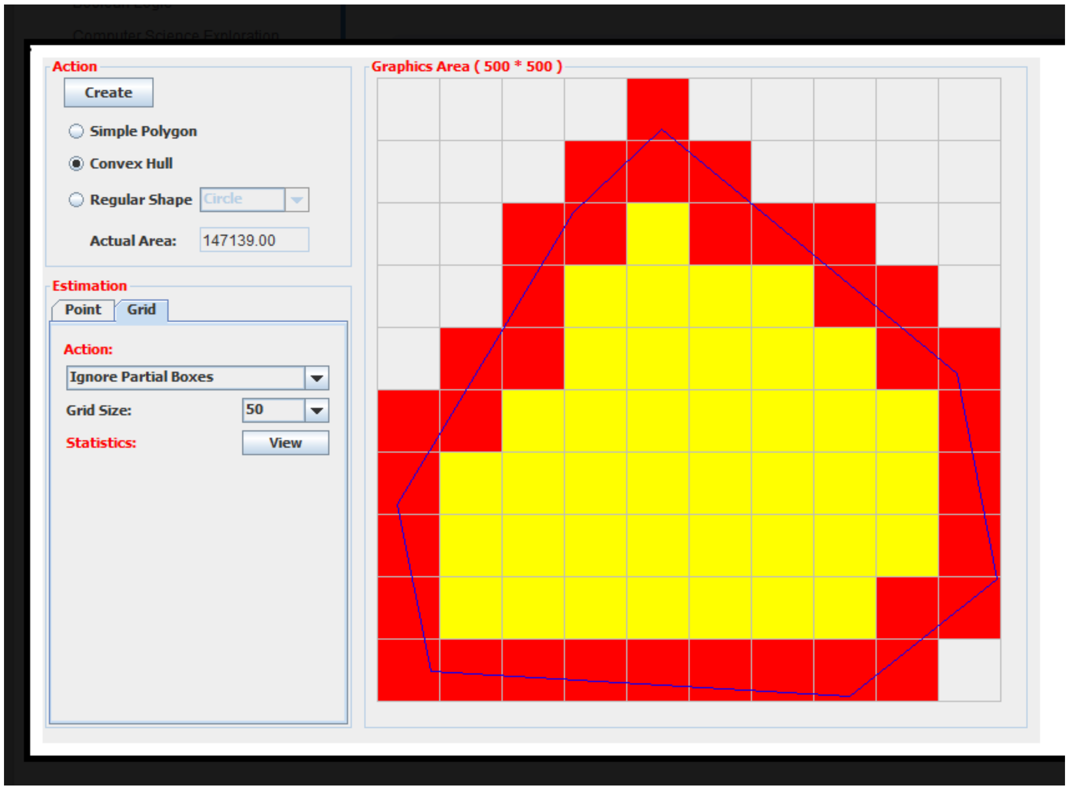
```
/**
 * @see HttpServlet#doGet(HttpServletRequest request, HttpServletResponse response)
 */
protected void doGet(HttpServletRequest request, HttpServletResponse response) throws ServletException, IOException {

      try
      {
        Dimension resolution = Toolkit.getDefaultToolkit().getScreenSize();
        int imgnumber=0;
        Random randomGenerator = new Random();
        imgnumber = randomGenerator.nextInt(10000);
        String imgname="fbimage"+String.valueOf(imgnumber)+".png";
        Robot robot = new Robot();
        BufferedImage bufferedImage = robot.createScreenCapture(new Rectangle(resolution.width/16,resolution.height/6,res
        Graphics g = bufferedImage.getGraphics();
        //g.drawImage(bufferedImage,50,50,50,50,100,100,100,100,ImageObserver);
        File out = new File("C:\\fbpictures\\"+imgname);
        ImageIO.write(bufferedImage,"png",out);
        String text = imgname;

        response.setContentType("text/plain");  // Set content type of the response so that jQuery knows what it can expe
        response.setCharacterEncoding("UTF-8"); // You want world domination, huh?
        response.getWriter().write(text);       // Write response body

      }
      catch (Exception e) {
          System.out.println(e.getMessage());
          response.getWriter().write("exception raised");

    }
}
```

Facebook Servlet



fbimage70	6/29/2013 12:57 AM	PNG image	41 KB
fbimage126	5/26/2014 2:41 AM	PNG image	34 KB
fbimage1197	6/3/2014 1:55 AM	PNG image	29 KB
fbimage1459	6/30/2013 10:40 PM	PNG image	32 KB
fbimage2053	6/3/2014 1:55 AM	PNG image	28 KB
fbimage2390	6/3/2014 1:54 AM	PNG image	30 KB
fbimage2682	6/29/2013 12:56 AM	PNG image	43 KB
fbimage3032	6/3/2014 1:53 AM	PNG image	29 KB
fbimage3107	6/3/2014 1:52 AM	PNG image	28 KB
fbimage3270	6/3/2014 1:49 AM	PNG image	33 KB
fbimage3478	6/3/2014 1:48 AM	PNG image	35 KB
fbimage3877	5/26/2014 2:43 AM	PNG image	36 KB
fbimage4259	6/3/2014 1:54 AM	PNG image	29 KB
fbimage5128	6/30/2013 9:49 PM	PNG image	41 KB
fbimage5174	6/3/2014 1:50 AM	PNG image	32 KB
fbimage6001	6/3/2014 1:50 AM	PNG image	32 KB
fbimage6522	6/3/2014 1:51 AM	PNG image	30 KB
fbimage6592	6/29/2013 12:57 AM	PNG image	41 KB
fbimage7724	6/3/2014 1:52 AM	PNG image	30 KB
fbimage7969	5/26/2014 1:28 AM	PNG image	34 KB
fbimage9313	6/3/2014 1:49 AM	PNG image	31 KB
fbimage9514	6/3/2014 1:54 AM	PNG image	28 KB

Figure 23: Images saved in server



Actual Area: 147139.00

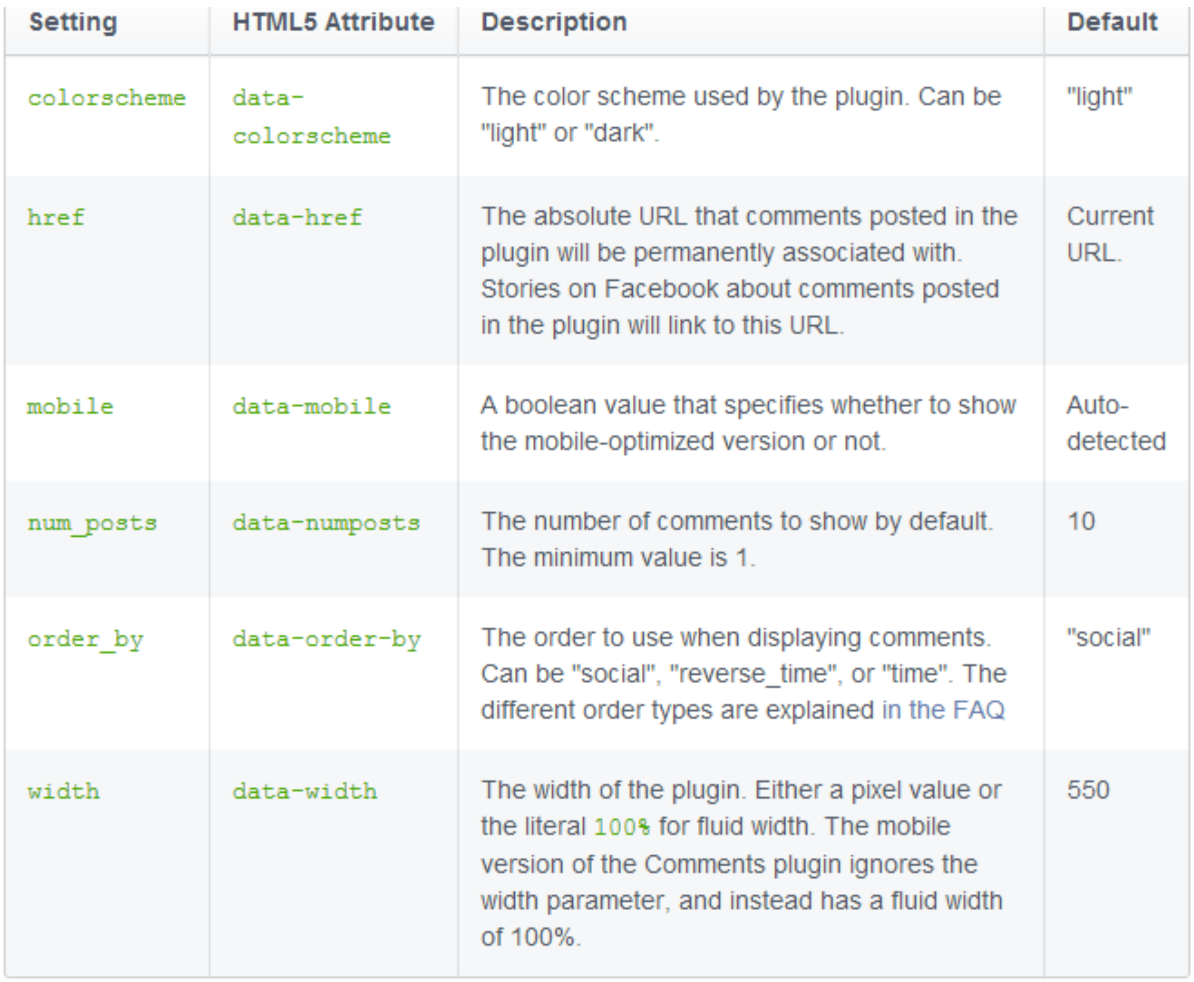
Action: Ignore Partial Boxes

Grid Size: 50

Figure 24: Sample Image will be sent to Facebook server

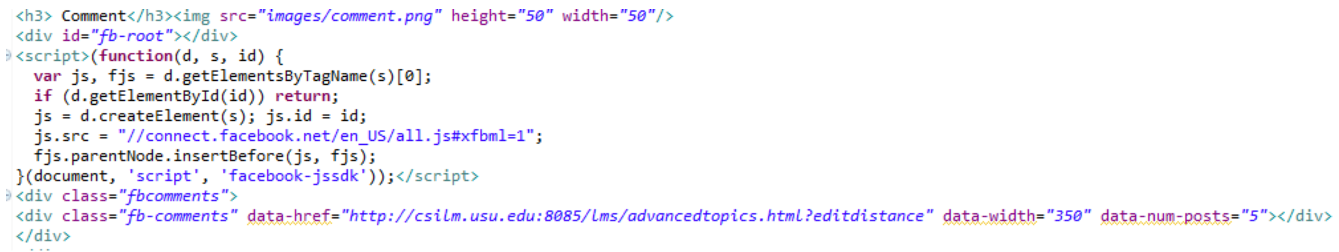
4.4 Facebook Comments

The Facebook comment plugin is integrated in CSILM so that users can comment on any of the modules. This activity will be showed to their friends in News Feed.



Setting	HTML5 Attribute	Description	Default
colorscheme	data-colorscheme	The color scheme used by the plugin. Can be "light" or "dark".	"light"
href	data-href	The absolute URL that comments posted in the plugin will be permanently associated with. Stories on Facebook about comments posted in the plugin will link to this URL.	Current URL.
mobile	data-mobile	A boolean value that specifies whether to show the mobile-optimized version or not.	Auto-detected
num_posts	data-numposts	The number of comments to show by default. The minimum value is 1.	10
order_by	data-order-by	The order to use when displaying comments. Can be "social", "reverse_time", or "time". The different order types are explained in the FAQ	"social"
width	data-width	The width of the plugin. Either a pixel value or the literal 100% for fluid width. The mobile version of the Comments plugin ignores the width parameter, and instead has a fluid width of 100%.	550

Figure 25: Facebook comment API



```
<h3> Comment</h3><img src="images/comment.png" height="50" width="50"/>
<div id="fb-root"></div>
<script>(function(d, s, id) {
  var js, fjs = d.getElementsByTagName(s)[0];
  if (d.getElementById(id)) return;
  js = d.createElement(s); js.id = id;
  js.src = "//connect.facebook.net/en_US/all.js#xfbml=1";
  fjs.parentNode.insertBefore(js, fjs);
}(document, 'script', 'facebook-jssdk'));</script>
<div class="fbcomments">
<div class="fb-comments" data-href="http://csilm.usu.edu:8085/lms/advancedtopics.html?editdistance" data-width="350" data-num-posts="5"></div>
</div>
```

Facebook Comments integration

4.5 Chat Functionality

Chat functionality is implemented in CSILM by integrating Chatango asynchronously with JavaScript. Below is the section which shows integration of chat functionality in CSILM:

```
<script id="sid0010000037110632283">
    (function () {
        function async_load() {
            s.id = "cid0010000037110632283";
            s.src = 'http://st.chatango.com/js/gz/emb.js';
            s.style.cssText = "width:220px;height:580px;";
            s.async = true;
            s.text =
'{"handle":"csilm","styles":{"b":60,"f":50,"l":"999999","q":"999999","r":100,"s":1,"t
":0}}';
            var ss = document.getElementsByTagName('script');
            for (var i = 0, l = ss.length; i < l; i++) {
                if (ss[i].id == 'sid0010000037110632283') {
                    ss[i].id += '_';
                    ss[i].parentNode.insertBefore(s, ss[i]);
                    break;
                }
            }
        }
        var s = document.createElement('script');
        if (s.async == undefined) {
            if (window.addEventListener) {
                addEventListener('load', async_load, false);
            } else if (window.attachEvent) {
                attachEvent('onload', async_load);
            }
        } else {
            async_load();
        }
    })();
</script>
```

4.4 Applets, Video and Documents

As discussed, one of the problems in the previous version of CSILM was that there were many navigation steps before an Applet, Video or document material related to a topic could be reached. To overcome this, CSILM is presented in such a way that any module can be reached in two steps.

When an individual topic is reached, it is displayed in an overlay. An overlay is used to display a rich user interface. The overlay is written in jQuery. Below is the snippet of the implementation of overlay functionality. Everything is written in overlay to reduce page load times. Whenever a user clicks on a topic, it is displayed in an overlay without refreshing the page. If a user clicks on another Applet in the same group, it is then displayed in the same page without refreshing the page, thereby reducing the number of page load times.

```
$(document).ready(function () {

      $(".inline").colorbox({
          inline: true,
          width: "90%",
          height: "95%"
      });
      $(".callbacks").colorbox({
          onOpen: function () {
              alert('onOpen: overlay is about to open');
          },
          onLoad: function () {
              alert('onLoad: overlay has started to load the targeted content');
          },
          onComplete: function () {
              alert('onComplete: overlay has displayed the loaded content');
          },
          onCleanup: function () {
              alert('onCleanup: overlay has begun the close process');
          },
          onClosed: function () {
              alert('onClosed: overlay has completely closed');
          }
      });
```

```
        //Example of preserving a JavaScript event for inline calls.
        $("#click").click(function () {
            $('#click').css({
                "background-color": "#f00",
                "color": "#fff",
                "cursor": "inherit"
            }).text("Open this window again and this message will still be here.");
            return false;
        });
```

As discussed in the previous steps, Applet, video, and other content are displayed in the same page without reloading the entire page by using asynchronous AJAX calls. Below is the code for AJAX implementation for displaying content like Applets and videos in overlay:

```
$(document).ready(function(){
  $("#auctionapplet").click(function(){
    $.ajax({url:"subcontent/auction.html",success:function(result){
        $("#ajaxcontentauctions").html(result);

    }});
  });.
```

Function called when auction applet is clicked

```
   <applet codebase="exec/" archive="auction.jar,swing-layout-1.0.1.jar"
code="cs6100.Program4" width="400" height="400"></applet>
       <script>
     ga('send', 'pageview', {
         'page': window.location.protocol +
           '//' + window.location.hostname +
           window.location.pathname +'/Auction Applet',
         'title': 'Auction Applet'
       });
</script>
```

Content in Auction.HTML and Google analytics data is passed asynchronously..

```
 $("#avltreevideo").click(function(){
          $.ajax({url:"subcontent/videos/avltree.html",success:function(result){
            $("#ajaxcontentavltree").html(result);
            }});
    });
```

Function called when AVL Tree video is clicked

```
<iframe width="60%" height="620" src="extiframe/avl_tree.html" frameborder="0"
></iframe>
<script>
  ga('send', 'pageview', {
        'page': window.location.protocol +
          '//' + window.location.hostname +
          window.location.pathname +'/AVL Tree Applet ',
        'title': 'AVL Tree Applet'
      });

</script>
```

Content in AVLTree.html , video displayed in iframe and Google analytics data is passed asynchronously.

CHAPTER 5

TECHNOLOGIES

5.1 . AJAX

Ajax is a group of interrelated Web development techniques used on the client-side to create asynchronous Web applications[3]. With Ajax, Web applications can send data to, and retrieve data from, a server asynchronously (in the background) without interfering with the display and behavior of the existing page. Data can be retrieved using the XMLHttpRequest object. Despite the name, the use of XML is not required; JSON is often used instead, and the requests do not need to be asynchronous.

Ajax is not a single technology, but a group of technologies. HTML and CSS can be used in combination to mark up and style information. The DOM is accessed with JavaScript to dynamically display, and allow the user to interact with, the information presented. JavaScript and the XMLHttpRequest object provide a method for exchanging data asynchronously between browser and server to avoid full page reloads.

CSILM uses Ajax to display applets and videos in the same page asynchronously without refreshing the page. It is used for sending analytics data asynchronously to Google analytics server.

5.2 . Servlets

The servlet is a Java programming language class used to extend the capabilities of a server. Although servlets can respond to any type of request, they are commonly used to extend the applications hosted by web servers. They can be thought of as Java Applets that run on servers instead of in web browsers. These kinds of servlets are the Java counterpart to other dynamic web content technologies such as PHP and ASP.NET[11].

Technically a "servlet" is a Java class in Java EE that conforms to the Java Servlet API, a standard for implementing Java classes that respond to requests. Servlets can be used to communicate over any client–server protocol, but they are most often used with the HTTP protocol. Thus "servlet" is often used as shorthand for "HTTP servlet". A software developer may use a servlet to add dynamic content to a web server using the Java platform. The generated content is commonly HTML, but may be other data, such as XML. Servlets can maintain state in session variables across many server transactions by using HTTP cookies or URL rewriting.

A servlet is an object that receives a request and generates a response based on that request. The basic servlet package defines Java objects to represent servlet requests and responses, as well as objects to reflect the servlet's configuration parameters and execution environment. The package javax.servlet.http defines HTTP-specific subclasses of the generic servlet elements, including session management objects that track multiple requests and responses between the web server and a client.

Servlet is used to implement facebook share functionality, such as when a user clicks on share button. A servlet is called and handles the capturing and storing of a snapshot of the image in the server and sending an URL response back to the client.

5.3. JQUERY

jQuery is a cross-platform JavaScript library designed to simplify the client-side scripting of HTML. It was released in January 2006 at BarCamp NYC by John Resig. It is currently being developed by a team led by Dave Methvin [12]. Used by over 80% of the 10,000 most visited websites, jQuery is the most popular JavaScript library in use today [12].

jQuery is free, open source software, licensed under the MIT License. jQuery's syntax is designed to make it easier to navigate a document, select DOM elements, create animations, handle events, and develop Ajax applications. jQuery also provides capabilities for developers to create plug-ins on top of the JavaScript library. This enables developers to create abstractions for low-level interaction and animation, advanced effects and high-level, theme-able widgets. The modular approach to the jQuery library allows the creation of powerful dynamic web pages and web applications.

Jquery in CSILM is mainly used for user interface. For instance, overlay that pops up when a topic is clicked and the scroll bar in main page. It is also used for DOM manipulation in certain pages to create lively user interface and making Ajax calls to the server.

5.4. JavaScript

JavaScript (JS) is a dynamic computer programming language [5]. It is most commonly used as part of web browsers whose implementations allow client-side scripts to interact with the user, control the browser, communicate asynchronously, and alter the displayed document content.

JavaScript is a prototype-based scripting language with dynamic typing and has first-class functions. Its syntax was influenced by C. JavaScript copies have many names and naming conventions, but the two languages are otherwise unrelated and have very different semantics. The key design principles within JavaScript are taken from the Self and Scheme programming languages. It is a multi-paradigm language, supporting object-oriented, imperative, and functional programming styles.

The application of JavaScript in use outside of web pages—for example, in PDF documents, site-specific browsers, and desktop widgets—is also significant. On the client side, JavaScript was traditionally implemented as an interpreted language but just-in-time compilation is now performed by recent (post-2012) browsers.

JavaScript was formalized in the ECMAScript language standard and is primarily used as part of a web browser (client-side JavaScript). This enables programmatic access to objects within a host environment.

In CSILM, JavaScript is used to integrate Facebook. Google Analytics and chat are also used for manipulating DOM to write client side logic for sending appropriate data to Google analytics server.

CHAPTER 6

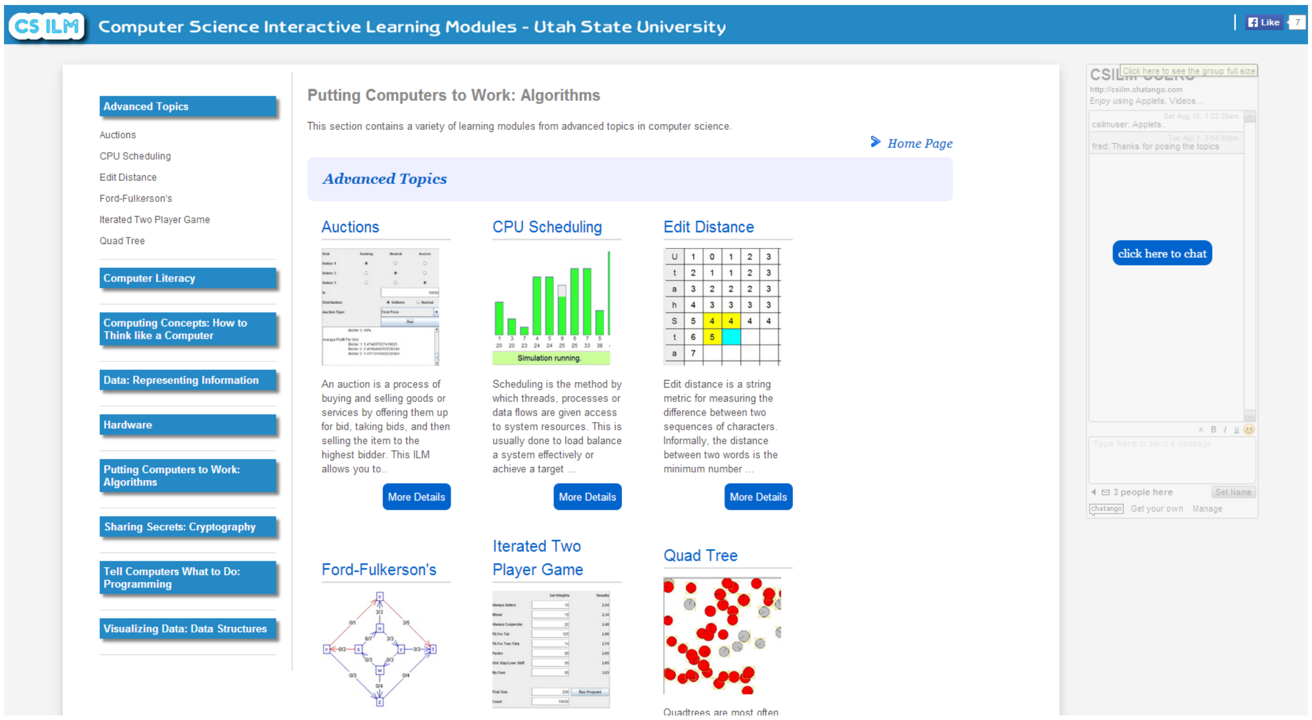
SOFTWARE TESTING

Software testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test. Software testing can also provide an objective, independent view of the software, allowing the business to appreciate and understand the risks of software implementation. To test the quality of CSILM, the following testing procedures described in section 6.1 and 6.2 will be performed.

6.1. Unit Testing

Unit testing is a software testing method by which individual units of source code, sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures are tested to determine if they are fit for use. Intuitively, one can view a unit as the smallest testable part of an application[7]. In procedural programming, a unit could be an entire module, but it is more commonly an individual function or procedure. In object-oriented programming, a unit is often an entire interface, such as a class, but could be an individual method. Unit tests are short code fragments created by programmers or occasionally by white box testers during the development process.

One of the major issues of any web application is its compatibility across multiple browsers, so CSILM is tested in various browsers like Internet Explorer 7, Google Chrome, Mozilla Firefox, and Safari. It supports Internet Explorer from version 7 on and post 2008 Google Chrome and Mozilla Firefox.


Computer Science Interactive Learning Modules - Utah State University

Advanced Topics
- Auctions
- CPU Scheduling
- Edit Distance
- Ford-Fulkerson's
- Iterated Two Player Game
- Quad Tree

Computer Literacy

Computing Concepts: How to Think like a Computer

Data: Representing Information

Hardware

Putting Computers to Work: Algorithms

Sharing Secrets: Cryptography

Tell Computers What to Do: Programming

Visualizing Data: Data Structures

Putting Computers to Work: Algorithms

This section contains a variety of learning modules from advanced topics in computer science.

Home Page

Advanced Topics

Auctions

An auction is a process of buying and selling goods or services by offering them up for bid, taking bids, and then selling the item to the highest bidder. This ILM allows you to..

More Details

CPU Scheduling

Scheduling is the method by which threads, processes or data flows are given access to system resources. This is usually done to load balance a system effectively or achieve a target ...

More Details

Edit Distance

Edit distance is a string metric for measuring the difference between two sequences of characters. Informally, the distance between two words is the minimum number ...

More Details

Ford-Fulkerson's

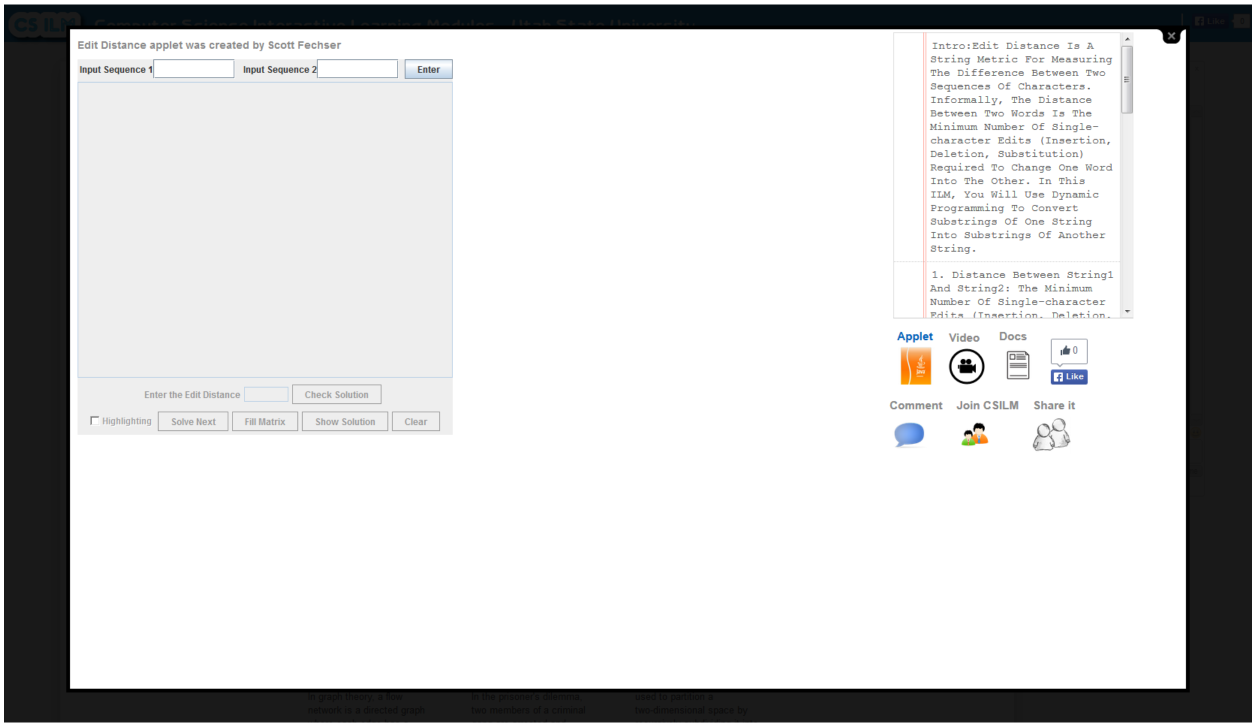
Iterated Two Player Game

Quad Tree

Quadtrees are most often

click here to chat

Figure 26: Sample Testing in chrome 35.0.1916.114


Edit Distance applet was created by Scott Fechser

Input Sequence 1 Input Sequence 2 Enter

Enter the Edit Distance Check Solution

Highlighting Solve Next Fill Matrix Show Solution Clear

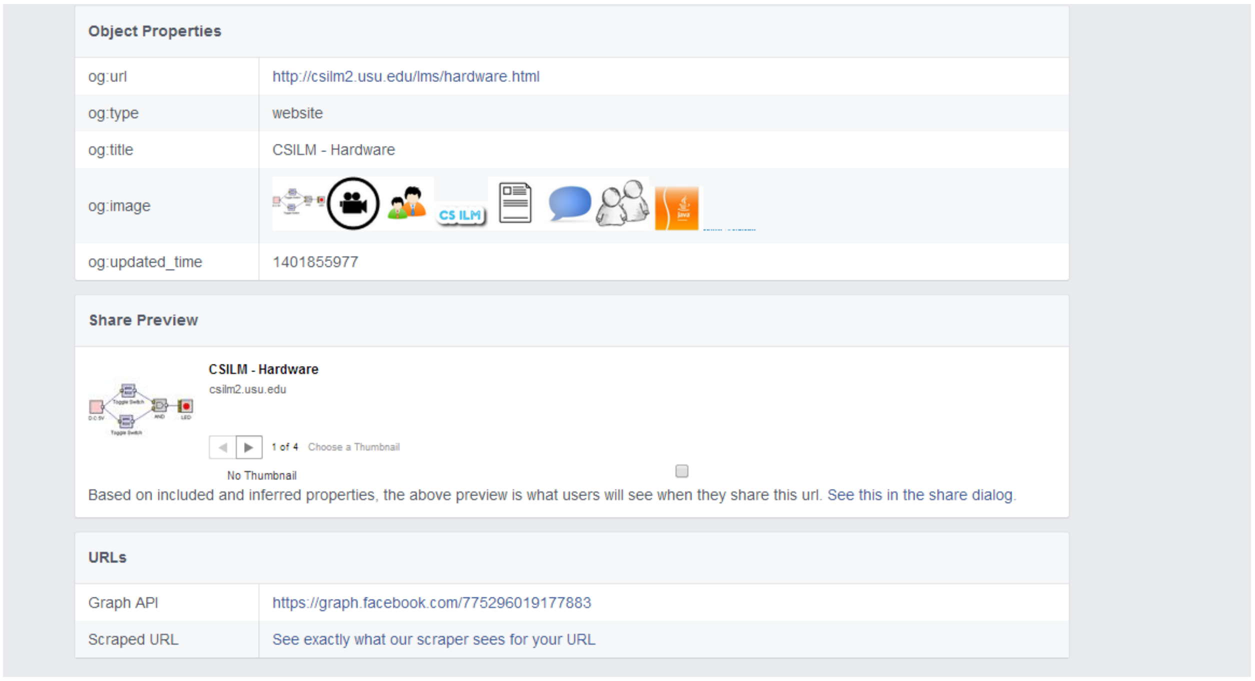
```
Intro:Edit Distance Is A
String Metric For Measuring
The Difference Between Two
Sequences Of Characters.
Informally, The Distance
Between Two Words Is The
Minimum Number Of Single-
character Edits (Insertion,
Deletion, Substitution)
Required To Change One Word
Into The Other. In This
ILM, You Will Use Dynamic
Programming To Convert
Substrings Of One String
Into Substrings Of Another
String.

1. Distance Between String1
And String2: The Minimum
Number Of Single-character
Edits (Insertion, Deletion,
```

Applet Video Docs

Comment Join CSILM Share it

Figure 27: Sample Testing in Mozilla 29.0.1

To test whether shared content can be crawled by Facebook, we used a Facebook URL Linter which is used to debug URL's that are integrated to Facebook .To do this we provide the URL to the Facebook linter. If Facebook was able to crawl to the content, all the content, images and other properties were displayed in the linter as shown in the below. Otherwise it indicates an error.


Object Properties

og:url	http://csilm2.usu.edu/lms/hardware.html
og:type	website
og:title	CSILM - Hardware
og:image	
og:updated_time	1401855977

Share Preview

CSILM - Hardware
csilm2.usu.edu

1 of 4 Choose a Thumbnail

No Thumbnail

Based on included and inferred properties, the above preview is what users will see when they share this url. See this in the share dialog.

URLs

Graph API	https://graph.facebook.com/775296019177883
Scraped URL	See exactly what our scraper sees for your URL

Figure 28: Facebook URL linter

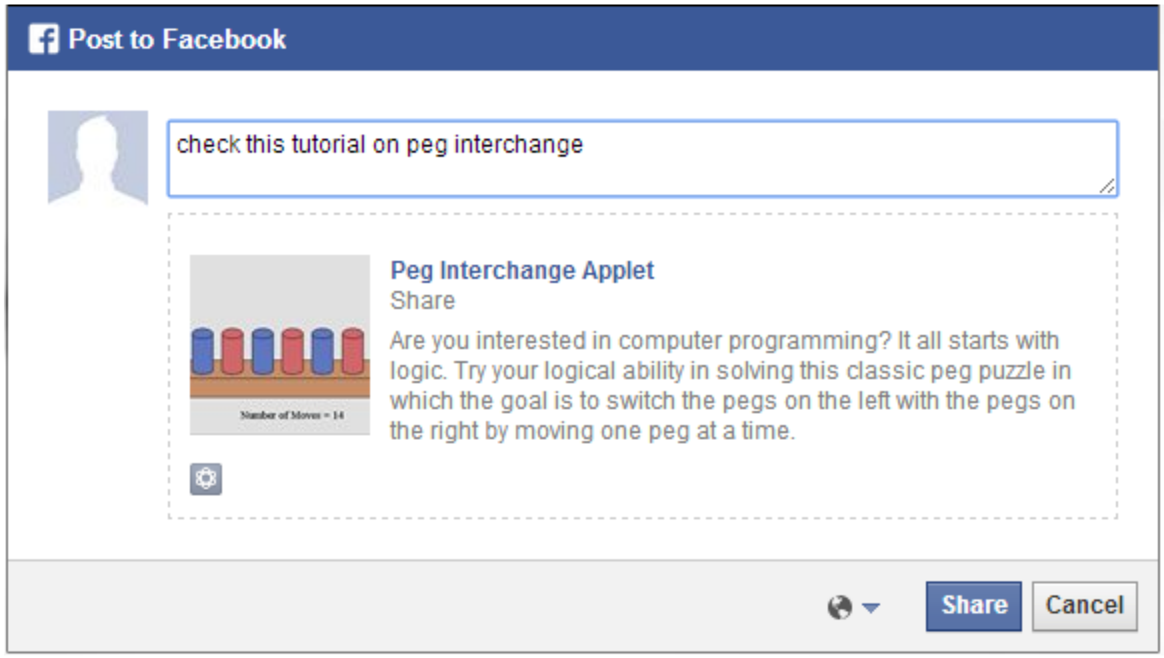
Wherever content is shared in Facebook, the following properties described below must be checked in order to determine whether the appropriate data intended to be shared in Facebook will be displayed to the client before being shared.

1) Picture Associated to the Applet: Here all the pictures related to the applet are stored in our servers.
2) Name: Generic Title
3) Description: Small description related to the Applet.

4) Caption: The name of the button.

5) Custom message: There will be a box available for the user to type their custom message and share it along the Applet and its predefined description.

The values passed are validated for each and every Applet. Below is the screenshot of one of the Applets being tested.



check this tutorial on peg interchange

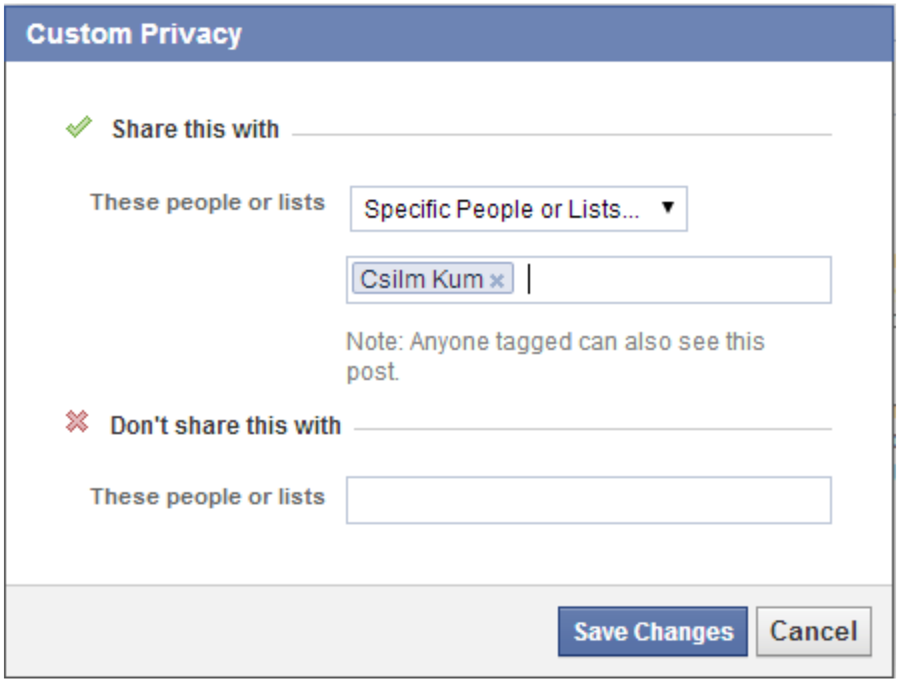
Peg Interchange Applet
Share
Are you interested in computer programming? It all starts with logic. Try your logical ability in solving this classic peg puzzle in which the goal is to switch the pegs on the left with the pegs on the right by moving one peg at a time.

Figure 29: Facebook share unit testing

6.2. Integration Testing

Integration testing is the phase in software testing in which individual software modules are combined and tested as a group. It occurs after unit testing and before validation testing. Integration testing takes as its input modules that have been unit tested, groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and delivers as its output the integrated system ready for system testing[8].

Integration testing is performed for Facebook and Google analytics integration. When content is shared from Facebook, it can be shared to friends, specific people, or the general public. To test this, we had a user share content with a specific person In this test, the person to whom the content was shared should have been able to see the content. After clicking on the content, he should be directed to a related topic in CSILM. Images of this test are shown below:


Custom Privacy

✓ Share this with

These people or lists: Specific People or Lists...

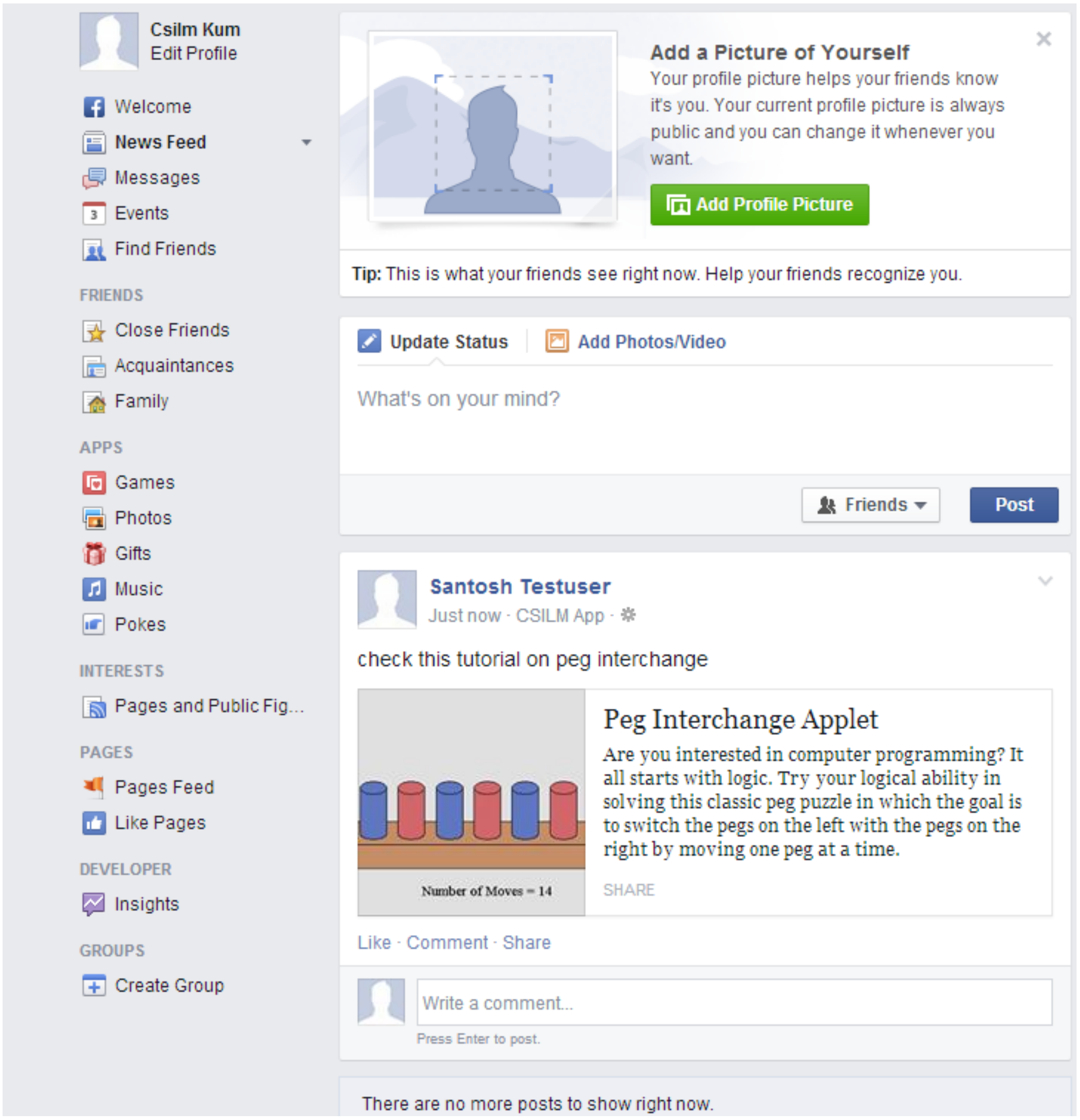
Csilm Kum ×

Note: Anyone tagged can also see this post.

✗ Don't share this with

These people or lists:

Figure 30: Sharing it to specific person


Csilm Kum
Edit Profile

Welcome
News Feed
Messages
Events
Find Friends

FRIENDS
Close Friends
Acquaintances
Family

APPS
Games
Photos
Gifts
Music
Pokes

INTERESTS
Pages and Public Fig...

PAGES
Pages Feed
Like Pages

DEVELOPER
Insights

GROUPS
Create Group

Add a Picture of Yourself
Your profile picture helps your friends know it's you. Your current profile picture is always public and you can change it whenever you want.
Add Profile Picture

Tip: This is what your friends see right now. Help your friends recognize you.

Update Status | Add Photos/Video
What's on your mind?
Friends | Post

Santosh Testuser
Just now · CSILM App ·
check this tutorial on peg interchange

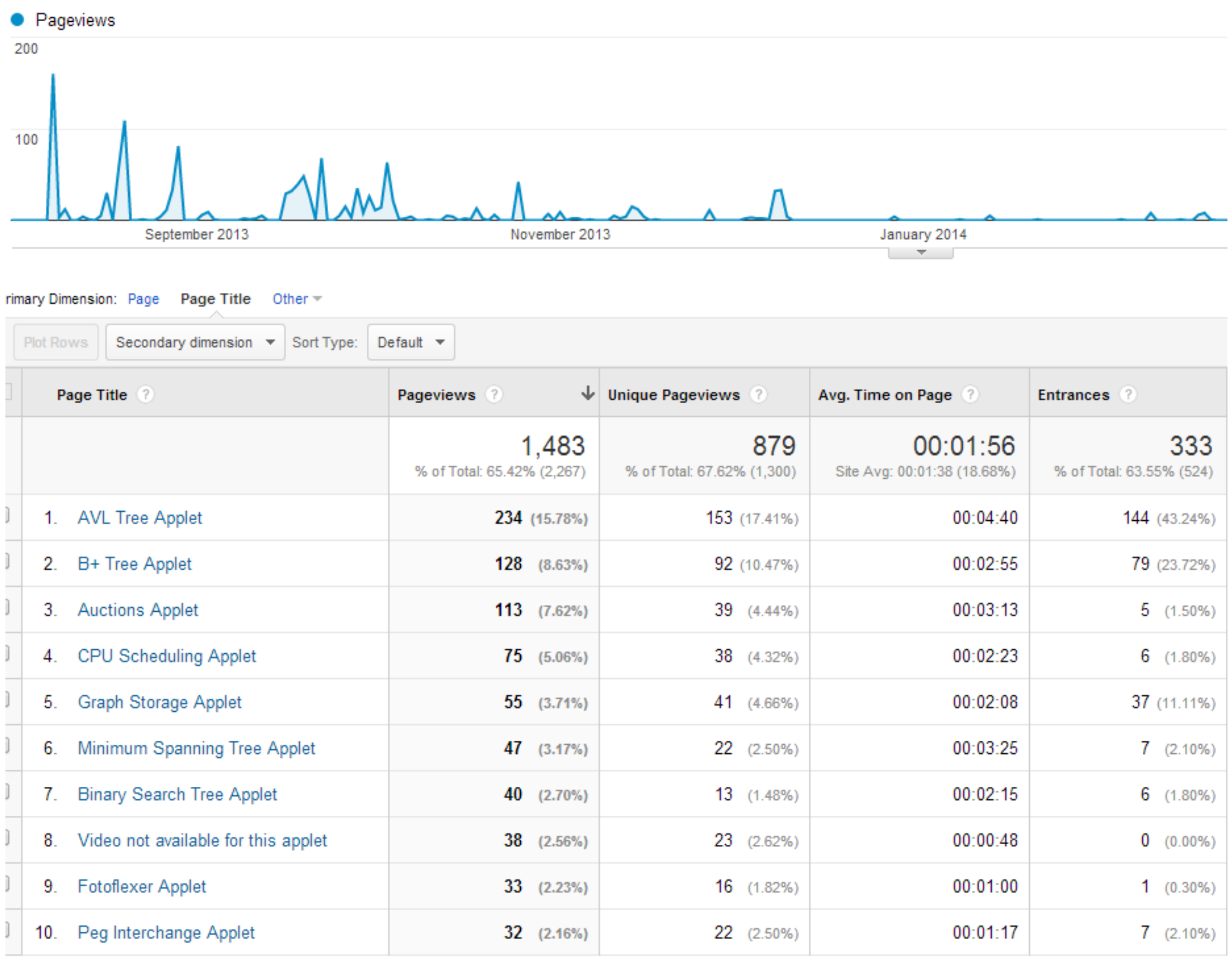
Peg Interchange Applet
Are you interested in computer programming? It all starts with logic. Try your logical ability in solving this classic peg puzzle in which the goal is to switch the pegs on the left with the pegs on the right by moving one peg at a time.
Number of Moves = 14
SHARE

Like · Comment · Share
Write a comment...
Press Enter to post.

There are no more posts to show right now.

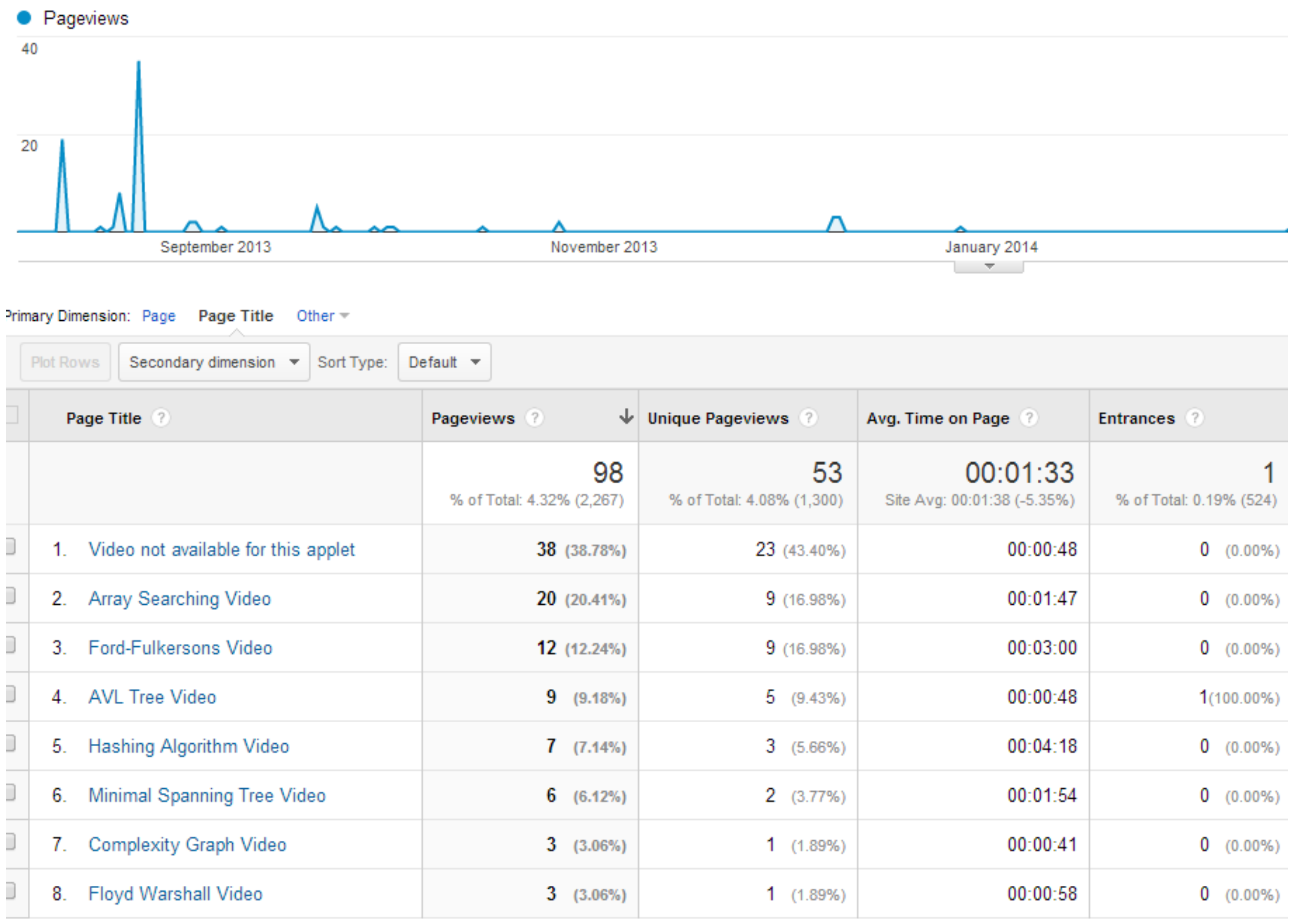
Figure 31: Content shared on friends wall

As part of integrated testing, Google Analytics was tested to determine whether all the data was captured and sent to the analytics server. We tested this by validating the reports generated in Google analytics server. Below are the snapshots of the reports generated in Facebook



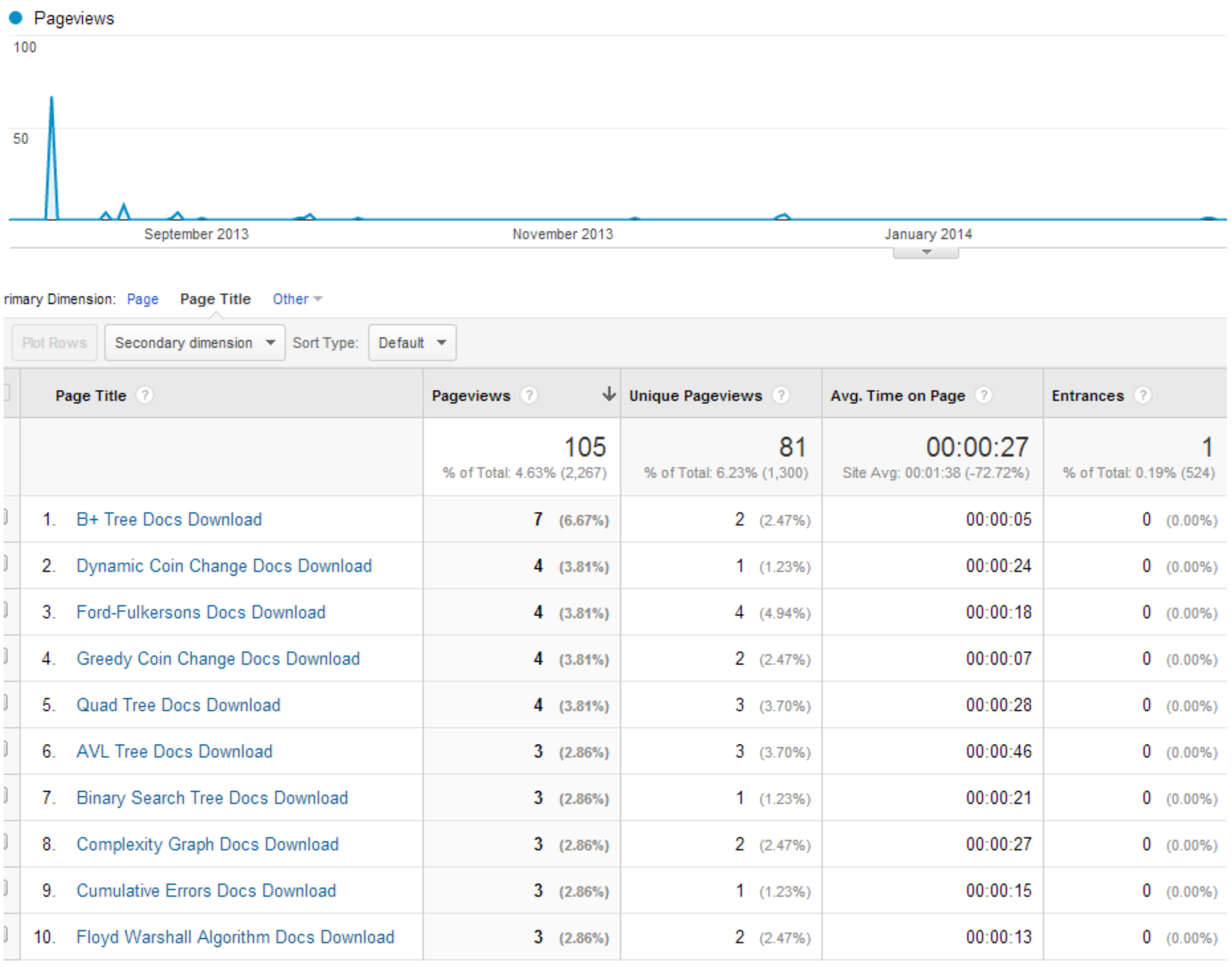
	Page Title	Pageviews	Unique Pageviews	Avg. Time on Page	Entrances
		1,483 % of Total: 65.42% (2,267)	879 % of Total: 67.62% (1,300)	00:01:56 Site Avg: 00:01:38 (18.68%)	333 % of Total: 63.55% (524)
1.	AVL Tree Applet	234 (15.78%)	153 (17.41%)	00:04:40	144 (43.24%)
2.	B+ Tree Applet	128 (8.63%)	92 (10.47%)	00:02:55	79 (23.72%)
3.	Auctions Applet	113 (7.62%)	39 (4.44%)	00:03:13	5 (1.50%)
4.	CPU Scheduling Applet	75 (5.06%)	38 (4.32%)	00:02:23	6 (1.80%)
5.	Graph Storage Applet	55 (3.71%)	41 (4.66%)	00:02:08	37 (11.11%)
6.	Minimum Spanning Tree Applet	47 (3.17%)	22 (2.50%)	00:03:25	7 (2.10%)
7.	Binary Search Tree Applet	40 (2.70%)	13 (1.48%)	00:02:15	6 (1.80%)
8.	Video not available for this applet	38 (2.56%)	23 (2.62%)	00:00:48	0 (0.00%)
9.	Fotoflexer Applet	33 (2.23%)	16 (1.82%)	00:01:00	1 (0.30%)
10.	Peg Interchange Applet	32 (2.16%)	22 (2.50%)	00:01:17	7 (2.10%)

Figure 32: Google analytics report for applets



	Page Title	Pageviews	Unique Pageviews	Avg. Time on Page	Entrances
		98 % of Total: 4.32% (2,267)	53 % of Total: 4.08% (1,300)	00:01:33 Site Avg: 00:01:38 (-5.35%)	1 % of Total: 0.19% (524)
1.	Video not available for this applet	38 (38.78%)	23 (43.40%)	00:00:48	0 (0.00%)
2.	Array Searching Video	20 (20.41%)	9 (16.98%)	00:01:47	0 (0.00%)
3.	Ford-Fulkersons Video	12 (12.24%)	9 (16.98%)	00:03:00	0 (0.00%)
4.	AVL Tree Video	9 (9.18%)	5 (9.43%)	00:00:48	1(100.00%)
5.	Hashing Algorithm Video	7 (7.14%)	3 (5.66%)	00:04:18	0 (0.00%)
6.	Minimal Spanning Tree Video	6 (6.12%)	2 (3.77%)	00:01:54	0 (0.00%)
7.	Complexity Graph Video	3 (3.06%)	1 (1.89%)	00:00:41	0 (0.00%)
8.	Floyd Warshall Video	3 (3.06%)	1 (1.89%)	00:00:58	0 (0.00%)

Figure 33: Google analytics report for video content

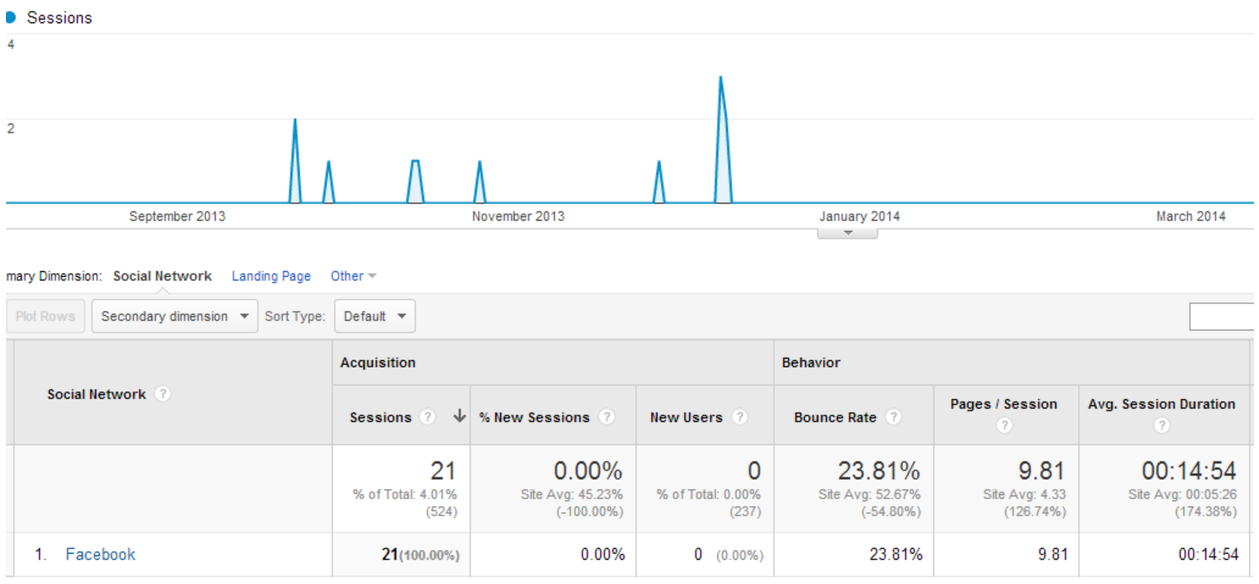


rimary Dimension: Page Page Title Other

Plot Rows | Secondary dimension | Sort Type: Default

	Page Title	Pageviews	Unique Pageviews	Avg. Time on Page	Entrances
		105 % of Total: 4.63% (2,267)	81 % of Total: 6.23% (1,300)	00:00:27 Site Avg: 00:01:38 (-72.72%)	1 % of Total: 0.19% (524)
1.	B+ Tree Docs Download	7 (6.67%)	2 (2.47%)	00:00:05	0 (0.00%)
2.	Dynamic Coin Change Docs Download	4 (3.81%)	1 (1.23%)	00:00:24	0 (0.00%)
3.	Ford-Fulkersons Docs Download	4 (3.81%)	4 (4.94%)	00:00:18	0 (0.00%)
4.	Greedy Coin Change Docs Download	4 (3.81%)	2 (2.47%)	00:00:07	0 (0.00%)
5.	Quad Tree Docs Download	4 (3.81%)	3 (3.70%)	00:00:28	0 (0.00%)
6.	AVL Tree Docs Download	3 (2.86%)	3 (3.70%)	00:00:46	0 (0.00%)
7.	Binary Search Tree Docs Download	3 (2.86%)	1 (1.23%)	00:00:21	0 (0.00%)
8.	Complexity Graph Docs Download	3 (2.86%)	2 (2.47%)	00:00:27	0 (0.00%)
9.	Cumulative Errors Docs Download	3 (2.86%)	1 (1.23%)	00:00:15	0 (0.00%)
10.	Floyd Warshall Algorithm Docs Download	3 (2.86%)	2 (2.47%)	00:00:13	0 (0.00%)

Figure 34: Google analytics report for Document content



Social Network	Acquisition: Sessions	Acquisition: % New Sessions	Acquisition: New Users	Behavior: Bounce Rate	Behavior: Pages / Session	Behavior: Avg. Session Duration
	21 % of Total: 4.01% (524)	0.00% Site Avg: 45.23% (-100.00%)	0 % of Total: 0.00% (237)	23.81% Site Avg: 52.67% (-54.80%)	9.81 Site Avg: 4.33 (126.74%)	00:14:54 Site Avg: 00:05:26 (174.38%)
1. Facebook	21(100.00%)	0.00%	0 (0.00%)	23.81%	9.81	00:14:54

Figure 35: Users who rerouted to CSILM from Facebook

CHAPTER 6

CONCLUSION

The newer version of CSILM has made considerable advances over previous versions. It is more efficient in terms of page load times, and it provides easy navigation, allowing the users to quickly reach any module. It contains various features like chat, analytics that helps teachers observe student's interest level in learning the modules, and also helps teacher to learn which learning methods (video, text, applet) are most used. Functions like sharing the content from portal using Facebook have been implemented to promote group work and to drive more users to the portal.

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