Project OSCAR: Open Source Courseware

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Abstract: The internet has become an accepted medium of instruction for distance education and independent learning. However, there is still a lack of appropriate course material. Even when the material is available, it is often highly priced, of uncertain quality and very rarely in local languages. Hence, there is a need for good quality, cost effective courseware available in multiple languages, with large scale dissemination. With this perspective, Project OSCAR (Open Source Courseware Animations Repository) aims to create a large repository of web-based, interactive animations of various concepts and technologies. This paper intends to highlight the development methodology and the efforts in making these animations available.

1. Introduction

With the internet becoming a medium of instruction for distance education and independent learning, technology is being extensively explored as a means of supporting various education methodologies. However, there is still a lack of appropriate course material. The typical courseware available is monolithic set of web-based or video lectures. Most of the times, it is difficult for teachers to adapt them into their own courses, since they may be interested in only some sub-part of the entire content. It is difficult to extract the sub-parts from monolithic course material. The material available, is often highly priced and of uncertain quality. In the educational scenario, there is a lack of motivation, the students are seldom attracted to the mundane study materials provided to them. Such materials are developed in a routine manner, without keeping in view the individual needs of the students. Hence, there is a need for (i) good quality, cost effective courseware, including an interactive environment for students to access educational material and assimilate it at their own pace, and (ii) large scale dissemination of this courseware.

Keeping in view the above perspective; Project OSCAR (Open Source Courseware Animations Repository) a repository whose contents are:

- Open sourced. and freely downloadable.
- Searchable web based interactive animations for teaching various concepts and technologies.
- Allow students to access the educational material in an interactive environment; at their own pace.

The auxiliary goals of the project are:

- Provide training opportunities to large number of project students.
- Empower rural communities.
- Translate the materials developed above into local languages.

At present there are about 110 animations which include concepts in many areas ranging from high school subjects to advanced topics. Large scale dissemination is achieved by releasing the animations in open source under creative commons license. A few animations are translated to local languages. The repository contains animations developed in-house, as well as animations contributed from other sources. Fig.1 shows Project OSCAR portal with the user interface.

Animations in the repository provide fine-grain modularity of topics and allow teachers to search for animations relevant to their course and incorporate them into their own lectures. Each animation is typically a Java Applet that focuses on one concept and provides the following through a platform-independent, web-interface:

i. A brief description of the concept including relevant references,
ii. An inbuilt animation to explain the concept,
iii. An interactive animation, wherein the user defines the parameters,
iv. Download of the source code for 'local' use /study /modification.

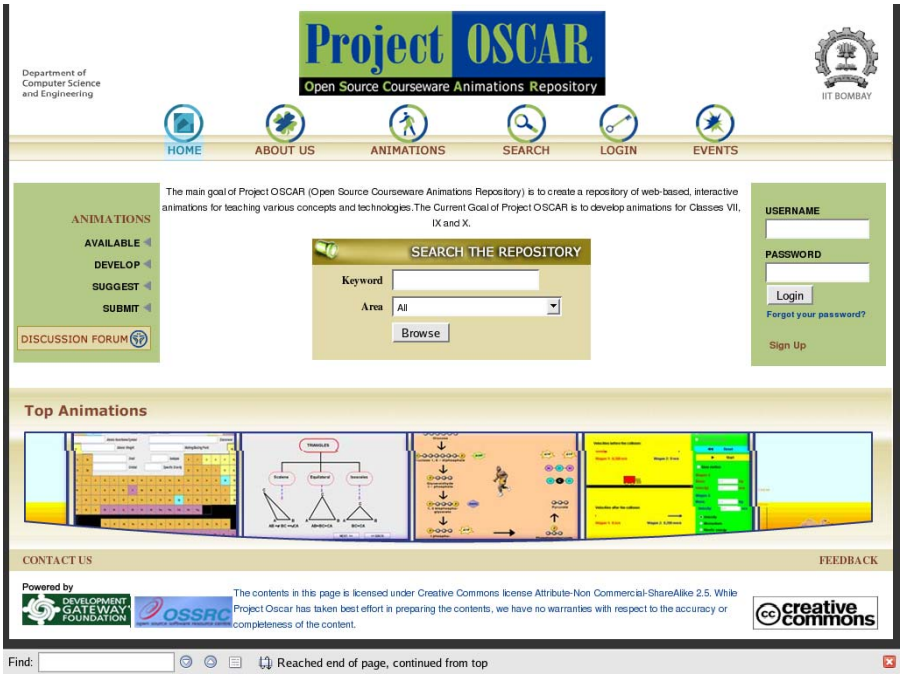

Fig.1 Screenshot of Project OSCAR portal

The interactive nature of these Java applets is what differentiates it from other types of animations. The following fig.2 shows the screenshot of an applet available in the OSCAR repository.

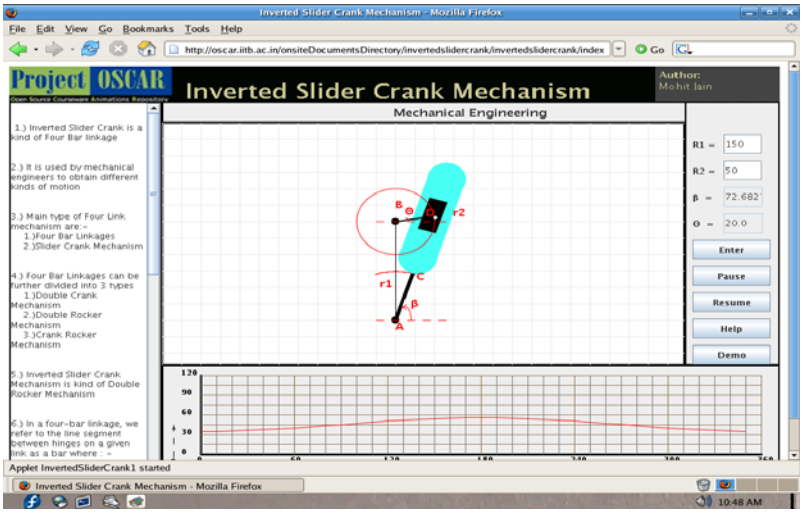

Fig.2: Screenshot of an applet in the repository

2. Development methodology

Project OSCAR methodology mainly involves two groups: i) developers and ii) mentors who register and interact through the portal. Students and programmers register as Developers with Project OSCAR and take up projects suggested by the Mentors through the website. Mentors who are teachers, course instructors or experts of different subjects suggest and supervise the development of the animations. Applet development life cycle involves three phases:

i. Concept specification phase
ii. Applet implementation phase
iii. Testing phase.

Concept specification phase: A brief literature survey is conducted to understand the different approaches in teaching and explaining concepts, specifically the approaches using animations and simulations, for courseware, independent and distance learning. The developer then selects, understands and analyzes the concept. The mentor then guides the developer to design the concept explanations using a demo, and exploration of the various properties of the concept through user interactions. A template for the applet is designed. The sequence and flow of each event on the applet is explained through a prototype built using slide presentations. Testing parameters are defined for user interactions and concept exploration. A snapshot of the interactions between mentor and developer is given in fig.3

Image formation by Spherical Mirrors

Mirror conceptualization slides - mirror.pdf

Response from Ms. Anitha

Dear Dhanya

I have gone through the module and noticed the following :

The pole in the case of a convex mirror should be shown in front of the reflecting surface and not behind the mirror. The sign convention shown here and the sign convention given in the 10 text book is different.In the text book the distances are measured from the pole to the focus or object or the image.The distances in the direction of the incident ray of light is taken as positive. So the focal length in case of the convex mirror is positive,virtual image is positive ….

If I come across any more things to be changed I will let you know.

Bye Anitha

Dear Dhanya

The write up on "rules of reflection for curved mirrors" is a little confusing. It can be written as:

The rays parallel to the principal axis reflected from a concave surface, passes through the focus.In the case of a convex surface on the other hand,the reflected ray diverges out and appears to come from the focus.

The incident ray passing through the focus (or moving towards the focus), is reflected parallel to the principal axis.

The incident ray passing through the centre of curvature (or moving towards it), will fall on the curved surface normally and hence be reflected along the same path.

Anitha

Lens conceptualization slides - lens.pdf

Design slides sphericalmirrors.pdf

Fig. 3 Screenshot of interactions between developer and mentor

Applet implementation phase: Developer follows the software engineering life cycle to implement the applet that has been designed. The tool/language that best suits the designed applet is selected by undertaking a survey of the open source tools/languages available. Detailed design is provided with use cases, sequence diagrams and pseudo code and the applet is implemented with the selected tool/language. Software documentation and experience report provided by the developer enable further enhancements to the applet. An overview of the phases is given in Fig. 4

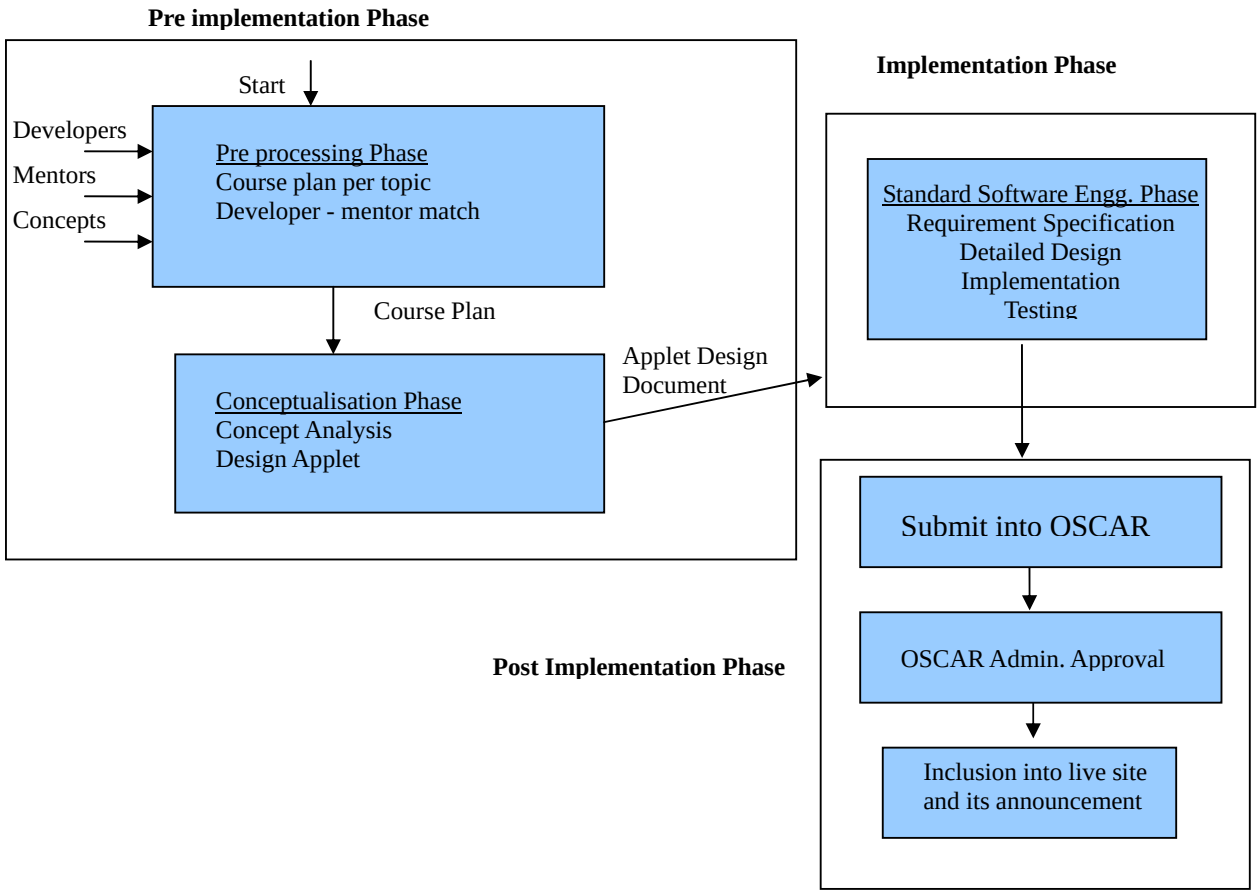

Fig.4: Applet development life cycle – A flowchart

Testing phase: The completed animation is put through two phases of testing. i) The code execution without errors is tested by the applet tester available on the site, ii) The correctness of the animated concept is evaluated by an expert in the domain. The evaluated applet is included in the repository. User feedback is obtained for further refinement with respect to usability of the developed animations. The animations and courseware in the repository are periodically published and released on a CD for distribution to interested schools and colleges.

3. Usability and the effectiveness of Project OSCAR animation repository

Project OSCAR team participated in e-learning seminars and events, conducted workshops for students and teachers to showcase the animations and recieve feedback. The response of the users comprising mainly teachers and students of different schools showed that animations enhance understanding of a concept, supplement black board teaching by allowing the students to explore the underlying concepts. Teachers expressed interest in use of the animations not only for better understanding, exploration and experimentation but also to increase the percentage of achievers as the portal allows the user to learn at one's own pace. Statistics (fig.5) of the project hosted at the site http://oscar.iitb.ac.in indicate the increasing number of users of the repository.

Area	Level	No. of animations	Avg. no. of downloads
Biology	UG	2	354
Chemistry	8-10	1	77
Data structures and algorithms	11-12	1	8
Maths	8-12	31	1231
Mechanical simulations	UG	5	544
Networking	UG/PG	28	1169
Physics	8-12	65	3120

Fig. 5: Project OSCAR statistics

4. Translation to local languages

It is a well-established fact that the Internet is an excellent resource for all kinds of information, but most of the infomation available on the web are in english language. There are many schools where the medium of instruction is in local language. Translation of the content to local languages has recently been attempted for the benefit of these students not only in urban areas but also in the rural areas. Currently eight animations have been translated to two of the local languages.

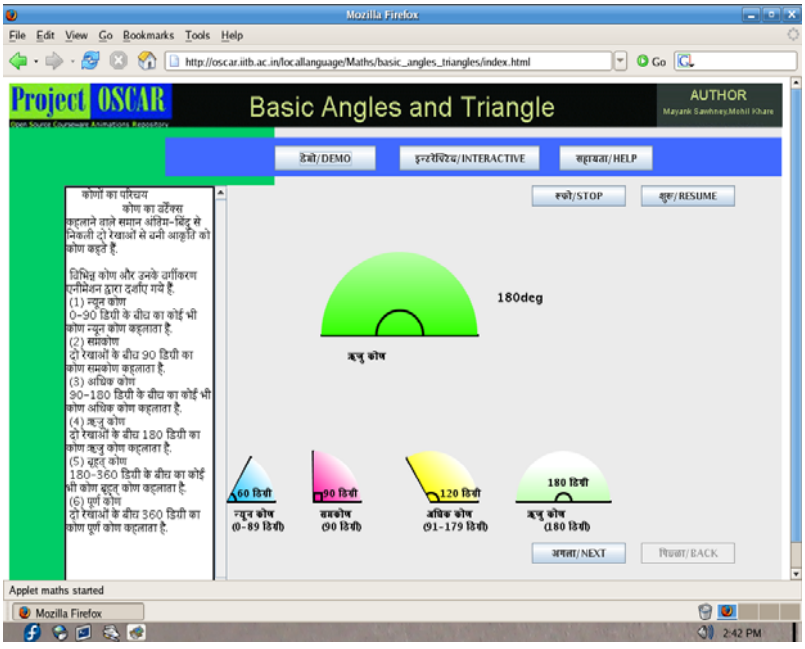

Fig. 6: Snapshot of a local language applet

5. Conclusions

Project OSCAR continues its ongoing effort in providing more animations in the repository. Once enough number of animations are developed on a particular topic they can be sequenced into a logical course. The project also aims to

extend the animations by supporting the testing of knowledge gained, thus expanding it into an independent learning system. Audio integration of traslated content with animations is also being considered and a feasibility study is being undertaken.

Teachers are encouraged to use the developed animations in their course material and participate in our efforts by registering as mentors.

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