Software Engineering Aided By Multimedia and Hypermedia

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Abstract: This paper deals with software engineering aided by multimedia and hypermedia tools. These tools are used in software engineering to make it more interactive. Multimedia and Hypermedia tools are used to make interactive presentations. In this paper we will talk about how such tools can be used in various phases of software engineering. Utilization of multimedia and hypermedia tools in software engineering is important as it makes very easy to communicate with the consumer. The advantages of such tools in software engineering will be discussed briefly in the paper. Also we will discuss the disadvantages and other features provided by multimedia and hypermedia tools in the field of software engineering.

Keywords: Software engineering, Multimedia, Hypermedia, Requirements, Software Development Life Cycle (SDLC), Project Management.

I. INTRODUCTION

The use of multimedia and hypermedia in the process of software development was proposed almost a decade ago. Since then it has been applied to the actual process. Multimedia is the use of various technologies which can make the session interactive. Multimedia tools can be slideshows, videos, audio, video chat, poll, etc. Such tools can help the viewer in clear understanding the issue in concern. Such tools can be used to convey the issue or the message more effectively.
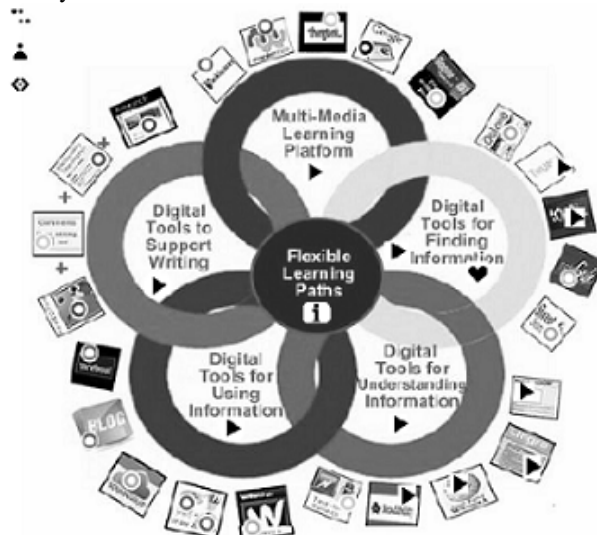

Figure 1: Multimedia Tools

Charts for example can be used to display various information and it can be very easily interpreted. If the consumer is bombarded with statistics printed on a page then it would be very hard to understand for him while a chart will be easily understood. Multimedia tools are made to convey the message which can be easily interpreted.

Hypermedia is the combination of hypertext and multimedia. When we use hyperlinks in multimedia they can be referred as hypermedia. Hypermedia is used when the material to be shown cannot be included in the presentation or any such media. These links provide more information about the issue in concern. These links are provided to give the viewer more in depth knowledge of the topic in discussion.
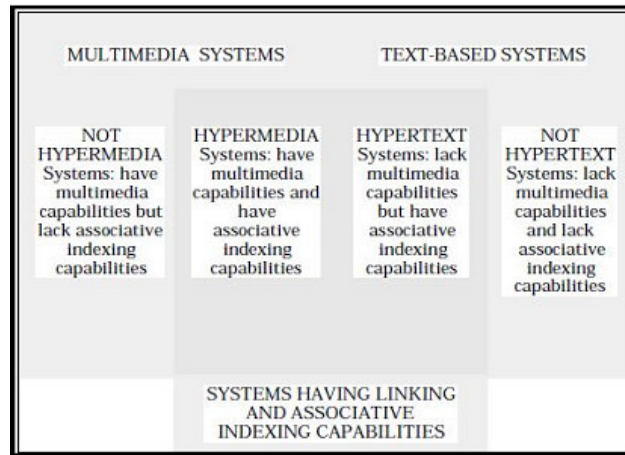
Figure 2: Hypermedia / Text-Based Systems

Software Engineering is the engineering to develop software which are reliable, secure and fulfilling the requirements of the user. Developing a software is not a small task and it requires a lot of planning and management to build the software properly. Software Engineering is the tool which provides the project manager for the planning and managing of the process of development of software. For this Software Development Life Cycle is used which is a timeline of development process of a software. By following the phases given in SDLC, the development of the software can become easily manageable. Usually SDLC is divided in the following six phases:

• Gathering of requirement and analysis: In this phase the requirements of the user are taken and analyzed for further process

• Design: In this phase, the software design is made according to the requirements.

• Development: In this phase the development of software is done according to the design and requirements from the previous phases.

• Testing: In this phase the testing of the software is done if it meets the user requirements.

• Maintenance: This is a continuous phase in which the software is maintained and updated as per the user. Example, user authentication may be represented as an aspect that requests a login name and password. This can be automatically woven into the program wherever authentication is required.
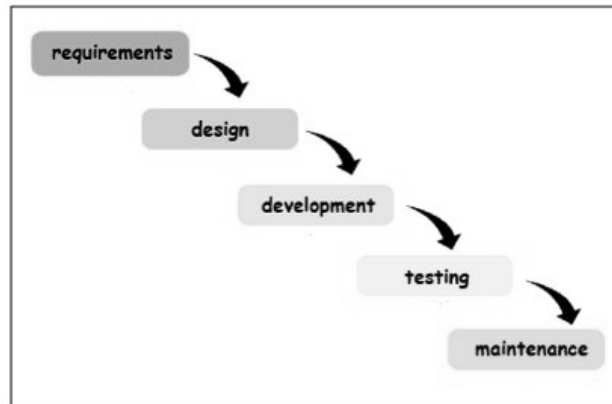

Figure 3: SDLC – Software Development Life Cycle

II. MULTIMEDIA APPROACH FOR REQUIREMENT GATHERING AND ELICITATION

Requirement gathering is the process of collecting all the information concerning the development of software from the communities involved. This process is entirely verbal and can go on for several minutes or hours. This leads to a lot of issues and hence in the bad development of software. Bad development of software will lead to iterations in development and hence increase in cost and time taken to develop the software. Requirement gathering is thus the most important phase of software development life cycle.

The following are the drawbacks of verbal meetings for requirement gathering: [1] [7]

• It is difficult to analyze information because the communities involved use informal and non-structured language.

• The meetings cannot be formalized because that would affect the participants thinking process and the requirement specification will not be proper.

• The informal communication cannot be recorded and hence there is inconsistency in products.

• When this informal information is transformed to formal specifications there is generally loss of data and the traceability is difficult.

• It makes reusability difficult.

• Improper communication between the stakeholders, there is a problem with conflict detection.

The next two sub-sections discuss about existing multimedia and hypermedia solutions to these problems.

SEIM – Software Engineering Modelling Project came up with a prototype called AMORE - Advanced Multimedia Organizer for Requirements Elicitation. They worked on 3-4 projects in U.S to test this prototype. The prototype captures and organizes the requirements using knowledge based search and retrieval, visualization technologies and other multi-media tools. They first categorized the sources of data which is the raw requirements. The data could be notes from informal communication or meetings, proposal requests, work statements, interviews and surveys. [1]

AMORE [11] is different from other such tools as in it the traceability is not lost. The elicitor of requirements is expected to populate the tool's database in form of raw data from formal or informal interviews and videos. The tool in return would group the data according to the requirements. There can be thousands of requirements in an organization and so a structured form is to be provided for the tool. The tool works on data flow diagrams and control flow diagrams. It also supports other hierarchical diagrams. The elicitor through this tool can modify the hierarchy, add and delete branches as necessary.
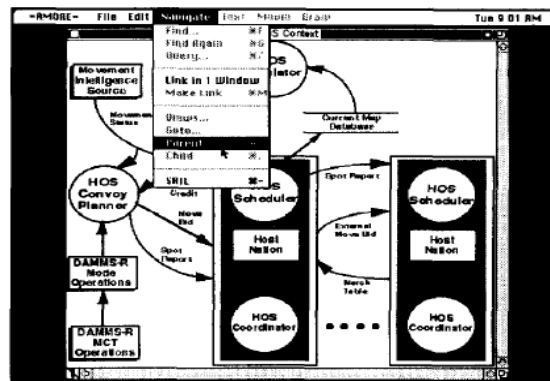

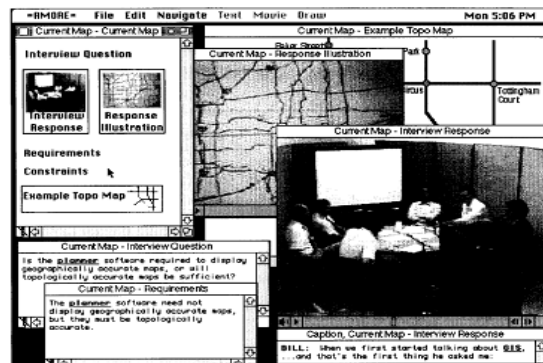Figure 4: Hierarchical flow for requirement.

Figure 5: Different forms of requirement data.

The requirements are at the primitive nodes and the elicitor can anytime add to these requirements to increase the understanding of the requirement. The user can see the requirement in its original format like video clips, charts, notes, etc. AMORE has an extensive database associated with it. The user can then analyse the requirements using knowledge based searching and retrieving. [1] The user can communicate with AMORE as a

repository with a lot of data through GUI or online links or multimedia hyperlinks. There are navigational guides for the search as the requirements increase.

III. HYPERMEDIA FOR SOFTWARE DEVELOPMENT

Hypermedia can be useful for software development in 20 ways which are categorized into 6 categories. The following are the six categories: [2]

1. Systems supporting collaboration based development.
2. Systems for software interface development.
3. Documentation
4. Creation and maintenance of code
5. Reusability
6. Prototyping

Hypermedia system act as glues for interfaces in huge softwares. They are also used as prototype for interfaces. These systems make the integration of existing platforms and traceability and documentation to new environments. They reduce the space and time complexities of the codes. As the components are linked together it results into better retrieval of codes and modules for reusability. There can be reusable codes and structures.

Prototyping is one of the most important part of software development. The documentation behind the prototype is equally important but the documentation may make it less interesting or confusing or less easy to understand. The better approach is to present this documentation as story boards. [6]
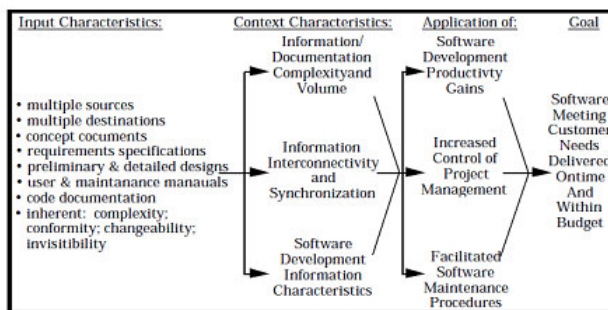

Figure 6: General Software Development.

The following are the difficulties in software development:
• Large volume and complexity of documentation used for development.
• Synchronization and interconnection of information is required as development is an iterative process.
• The documentation is not standardized. Everyone in the team works with different enthusiasm and thus the documentation differs.

These issues are major concerns and research is going on as to how solve these problems. Hypermedia can be useful in solving these problems. Not only does it solve the problem of volume of data but also the capability to store and capture decisions. As hypermedia is closely related to multimedia, videos and images can be used. It can provide links between the requirements so as to make the development process easy.

IV. HYPERMEDIA FOR SDE

SDE - Software Development Environment is the set of processes and programs which provide as platform for the development of software. The process is heterogeneous in nature as various viewers and programmers may have environments of different types. This

heterogeneity can be solved by using hypermedia for the same. The following are the technical requirements for the hypermedia to support heterogeneity in SDE: [3]

- Support for viewer and heterogeneous object editors
- Anchors that are for particular views
- Different object contents and hypermedia information.
- Active, concurrent and multiple view displays
- Linking of heterogeneous managers
- Scalable links and n-ary links

In this section we will discuss about Chimera and the idea of hypermedia for software development environment implemented in this software. The concepts behind this idea and the architecture will also be discussed.
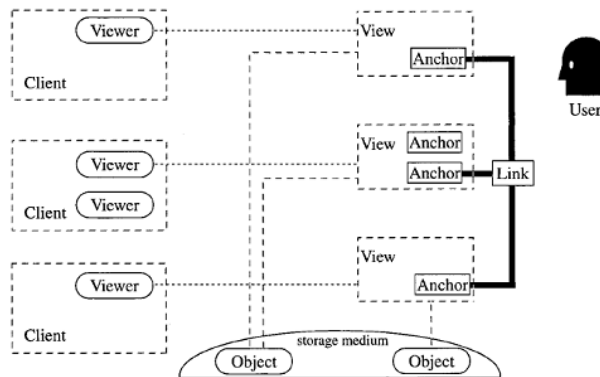

Figure 7: Chimera's concepts for hypermedia

As shown in figure, user can interact with one or more views that are created by the viewer. The storage medium are a database from where the viewers can access objects. The views can then be anchored. One view will have at least one anchor. [2] [6]

Objects are persistent entities. Viewers are active entities. Views are an ordered pair of viewers and objects. Anchors are associated with views and managed by the associated viewer. Links are set of anchors, these anchors in one set are equally related. Users interact with the views available. Clients contain one or more viewers and a Hyper web is the collection of all of these. [3]
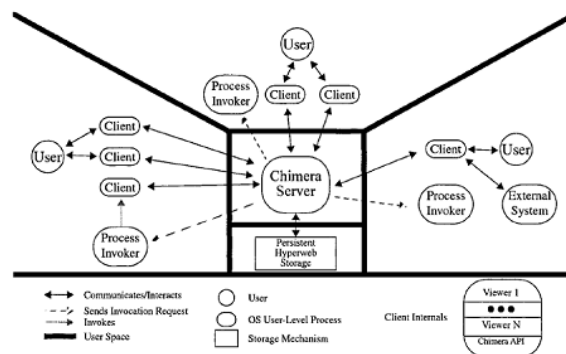

Figure 8: Chimera's architecture for hypermedia in SDE

Chimera follows a client-server architecture. The clients are associated with user and may communicate with the central server or with each other. The process invoker activates the clients that are requested by the user. It

maintains a mapping between clients and viewers. It is not necessary that the process invoker is used every time. The processes that don't require authoring the tasks may not use it.

V. PROJECT MANAGEMENT USING MULTIMEDIA

Project management is the planning and managing the project. It includes various activities like executing the given task, controlling the work force, planning to achieve milestones of the project, etc. Software development is a very long and complex process. To develop software it requires very skilful planning and managing. For this the project management is required which can keep the timeline of project in check with the software development lifecycle. Usually there is a project manager who is responsible for the task of project management. He determines the task to be performed by the project team, the development models and other various tasks related to project management.

Multimedia tools [8] [9] can be implemented on project management using Computer Aided Software Engineering (CASE) tools. Project management has some decisions to be taken. The steps taken are problem identification, finding alternative solutions, select criteria, justification, execute. Multimedia tools help the managers to make the decisions regarding the projects. Words can be used for describing the problem, graphs can be shown to compare various alternative solutions, etc. Also other tools like presentations can be used to show the client the proposed future plans. Also the status of the project, the milestones and other task status can be shown effectively to the client using multimedia. Also Hypermedia can be used to create links between tasks and people who are supposed to perform them. For examples, in Decision-based Hyper-media CASE (DHC) tool, objects are linked on basis of following:
1.   Link to problem or problem space
2.   Link to single document
3.   Link to decision view of document
4.   Timed reference
5.   Link to offline documents

So we can say that multimedia tools are very useful with the task of project management. They can be used to communicate effectively with the client and also the project team. It can also help to link the project internally. In such a way multimedia tools are useful in project management.

VI. PROCESS MODELS AS HYPER-TEXT

Process model is a sequence of processes done during the entire lifetime of a project. These models help in keeping the project on the right track during each phase of its development. There are various process models which are currently used. They are Waterfall model, Spiral, Incremental, Prototype, win-win Spiral, RAD, etc. All these models have different phases which should be followed during the lifecycle of the software development. Management of the project becomes easy by following any of the models.

Hypertext is linking one text to another. Process models can be linked with SDLC using hypertext. The team can be linked to various phases of the process model. The project status can also be linked to the current phase of the process model. Group activities can be collaborated easily using hypertext. If each person of the group is linked to the task, it becomes easy to manage the project team. Also it becomes easy for the team members to know their assigned tasks. Also the source of data is also linked to the task which makes it easy to find the appropriate data. Various phases of process models are linked to the respective teams or team members. In this way process models are used as hypertext.

VII.   SOFTWARE DOCUMENTATION

The standard of Software Documentation has increased because of the use of multimedia tools in the documentation process. For example, Reliable Software Technologies model uses comments the same as standard C comments. Such comments are added in the code to explain the functioning of the given code. The following is also maintained in this model:

•   Concurrent Version System history
•   Document specifying user requirements
•   Architecture Diagram
•   UML Diagrams

Another model is Linux HQ model which specifies the following:

- Code transformed to hypertext
- Functions linked

So by the use of multimedia and hypertext, software documentation has become much more effective.

VIII. SUMMARY

To summarize the paper, we can state that various multimedia and hypermedia tools can be applied to software engineering in n number of phases. The use of hyper and multimedia makes the process more interactive and so the users will be more interested. Institutes and universities can try to include these methodologies in their curriculum to make students more interested in the subject of software engineering.

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