

## Design of the management system of university projects based on UML sequence diagram

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### Abstract

Analysis and design of the management system of university projects is based on UML sequence diagram. It is user-centric. It describes the object from the dynamic point of view and illustrates the interaction process of the objects with the time change. This design can support all intermediate program language. At the same time, the correct use of it will reduce system complexity and improve software development efficiency and portability.

**Keywords:** UML, sequence diagram, management system, university projects.

### Introduction

Unified Modeling Language (UML) is a standardized general-purpose modeling language in the field of software engineering. The standard is managed and was created by the object management group. UML includes a set of graphical notation techniques to create visual models of software-intensive systems. Specifically UML is utilized to specify, visualize, modify, construct and document the artifacts of an object-oriented software intensive system under development. The content of UML can be described as the integrated reflection of static modeling mechanism and dynamic modeling mechanism. Static modeling mechanism can be stated by class diagram, object diagram and used case diagram. The embodiment of dynamic modeling mechanism is including collaboration diagram, interaction diagram and state diagram as well as sequence diagram.

It is well known that many works on the sequence diagram have been done (Watts *et al.*, 2002; Schmuller, 2004; Robert *et al.*, 2005; Arlow & Neustadt, 2006; Hui & Dou, 2008). These studies showed that a sequence diagram in UML is a kind of interaction diagram that shows how processes operate with one another and in what order. A sequence diagram shows as parallel vertical lines (life lines), different processes or objects that live simultaneously and as horizontal arrows the messages exchanged between them in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner. Therefore, the sequence diagram has the ability to describe the order of time. Obviously, the dynamic behavior of object in a certain time is defined by this diagram. This advantage make the sequence diagram has the outstanding capability in the aspect of description of subject dynamic behaviour.

The management system of university projects (MSUP) is a typical example of UML sequence diagram used in system development and design. The project design for university students is very important because it examines the comprehensive use of the basic theory and

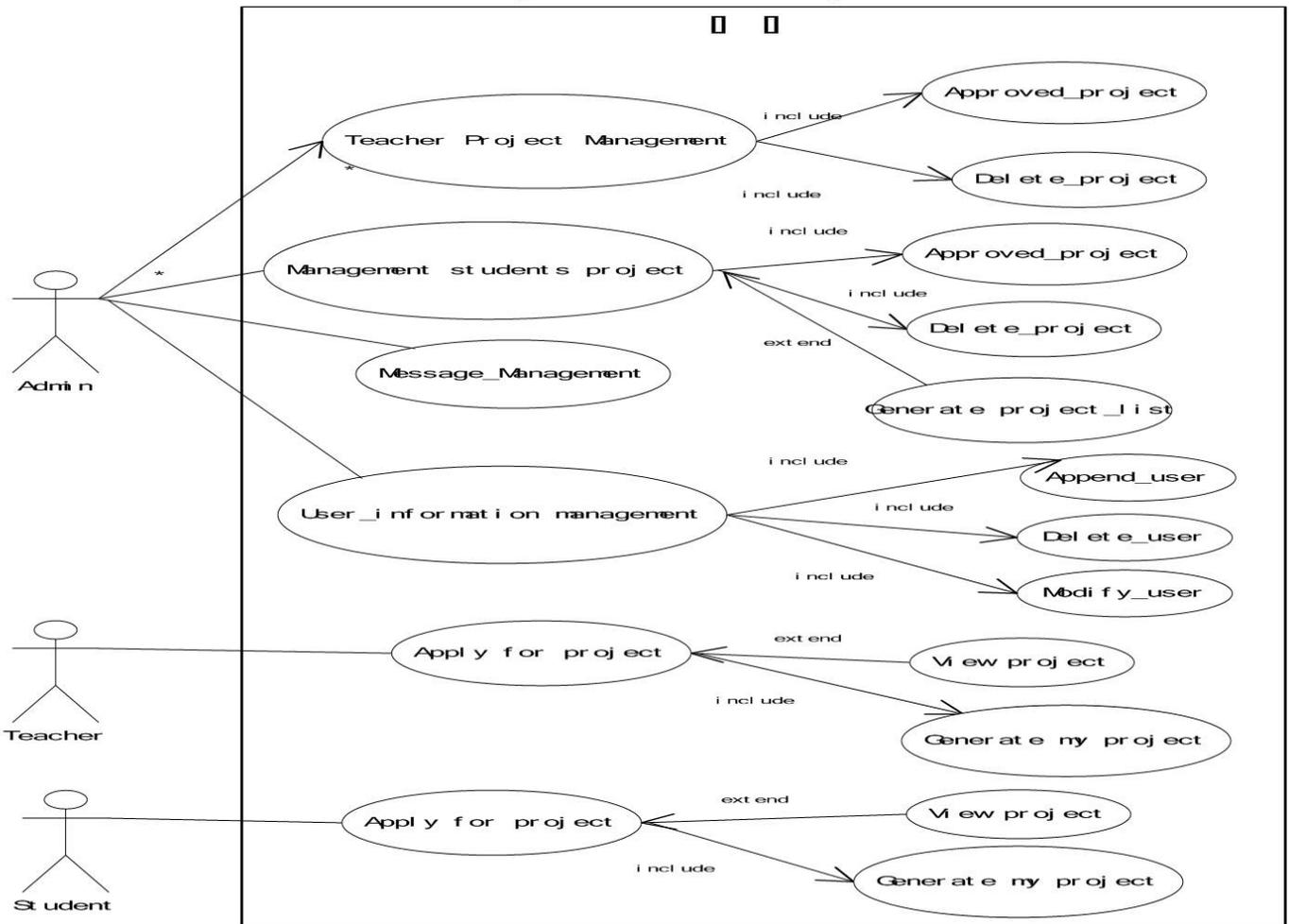
skills as well as the ability of analyzing and solving practical problems independently. It can be said: the quality of the project design is directly related to the teaching quality of higher education, the high-quality projects design includes not only good tutors, good students and good topics but also using effective and scientific management methods. However in recent years many university projects management methods are still using traditional manual mode. The problems of this approach are: low speed, heavy processing burden, low efficiency and high error rate. Moreover, information is not standardized; project selection and project proposal can not be controlled and so on. The MSUP is designed and created to resolve the problems of current systems. It can make projects management more standardized and scientific, and it has become a trend of the projects information management.

Eliens (2003) mentioned some ideas of the development and design of the MSUP and it pointed out it is important to consider the convenience to use and information processing capacity, but I believe that in the existing studies, there are still some problems, including: (1). Lack of immediate guidance for tutors in project selection and for students in satisfactory project selection. (2). Lack of immediate inspection over tutors and students to complete the task planned and dynamic tracking the progress of the whole project design. (3). Lack of periodic inspection and process management for the project quality of the students in different stages. (4). The project selection don't take the interaction between tutor and students into consideration, it is worth noting that in the project designing, project selection and proposal are very important. Unreasonable would make the whole design process very passive. The scientific designing and rational project management should implement a two-way choice between tutors and students. In other words: apply rational allocation strategy to satisfy the wishes of the students in selecting projects, at the same time, it also makes tutors choose students with some foundation or intense interest.

Based on the above problems, comprehensive requirements of the MSUP are: 1) To consider how to make tutors and students select projects more scientifically and how to make it easy and fast, 2) The system should not only complete the tutors' topics giving and the students' topics selection, but also make sure that whether the project has been chosen to avoid errors of manual processing, 3) The system development and design is based on the campus network: It will be able to

data management, tutor project data management, student selection management and message management. Since there is the time order between those function, the sequence diagram is more proper to reflect those time connection and orders. This kind of program is more accurate to describe the information flow between different processes, which benefits the developer and analyzer to understand the relationship between those functions. Meanwhile, it is convenient to

**Fig. 1. Use case diagram of the MUSP**



realize the application, approval, selection and publishing online, so the workflow should be simple and easy to operate and 4). The system should be based on the internet give topics and select the topics through the internet. Therefore, the safety, reliability and scalability of the system must be guaranteed. Design of the MSUP based on UML sequence diagram should help the developer clarify the relationship of subject and the event sequence.

**Describe the system by sequence diagram**

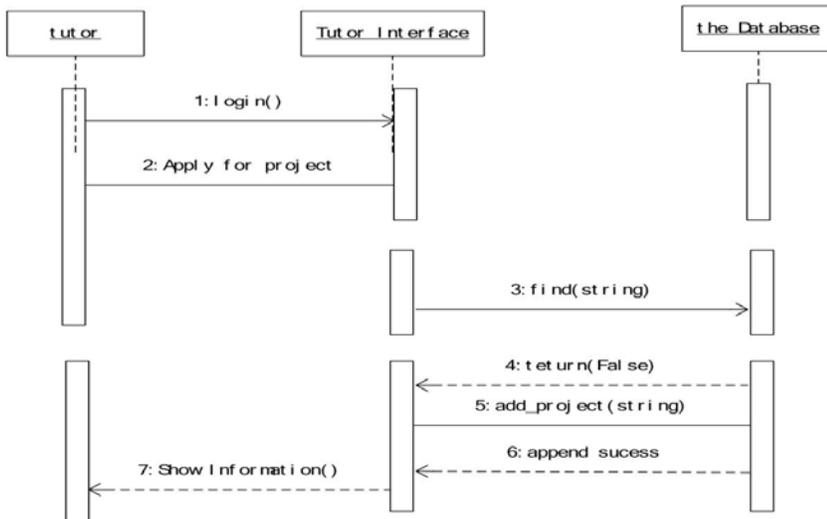
The participator of system is administrator, tutor and student. Thus, it is required four functions, including user

use this diagram to convert the subject into subject model. Following, the model of MUSP and main system function will be illustrated (Fig. 1).

*The diagram of the project application of tutors*

It is one of the main functions of this system. After a tutor logo in the tutor interface and select 'apply for project', fill out the application form and submit to data base for processing (Fig. 2). It is told from the figure the condition of applying for the new project is 'the submitted project does not exist in the current system'. The successful application must be waited for the approval of administrator. They will consider it is a value project or

**Fig. 2. Sequence diagram of the tutors giving new project**



not from the aspect of scientificity, practicability and rationality. It is equal to the traditional investigating process. However, it is more convenient and direct as some parts of process are diminished. After approval the subject will be available for all students (Fig. 2). Fig. 2 will be applied in practice, project application for tutors is very easy in this management mode, tutors will not have to care about when it will be approved and who will receive applications, how to modify and so on. Tutors can focus on considering whether the project is reasonable and scientific to increase transparency in the management. In designing the system we should note that the tutors should be required to briefly explain the project in the page such as basic knowledge, technical requirements, research themes and the results form, etc. Such information will help students understand the topic and correctly grasp research direction and specific requirements of the project.

**The diagram of project selection of students**

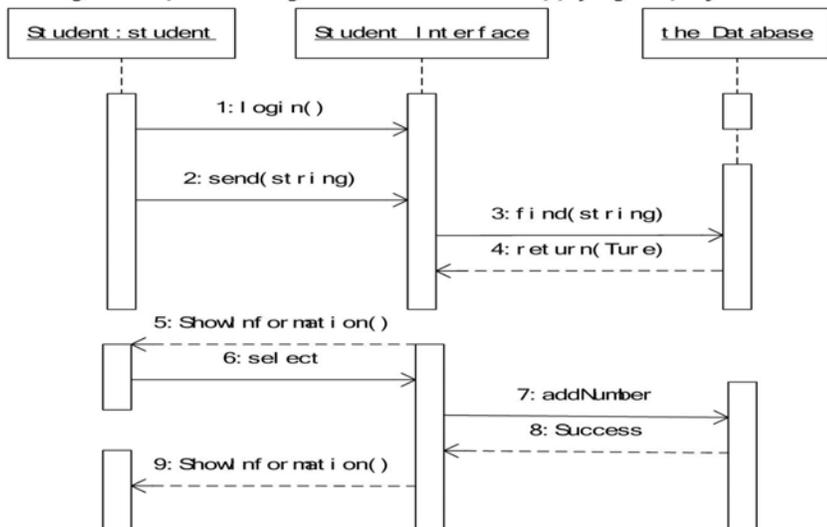
After students log in the student interface, select 'apply for project', fill in the selection willing list including three options. It is shown form Fig. 3 the conditions of applying for the new project are 'the project does exist and the seat of project is still available.' Students will be suggested to browse all projects which are approved by administrator. The information related to tutor introduction, the technology requirement, the seat limit, the number of taken seat and etc. The deadline of selection is set up by administrator. The project is free to change during the deadline in order to avoid the time rush. This kind of operation method is more flexible and free. Especially it embodies the two-way options between tutors and students. It also benefit for the

adjustment of later stage by administrator.

**The diagram of administrator**

Since the administrator have the most priority of over other participators, the main development task focus on them. The rights of administrator include the overall management of project (editing the basic information & project of tutors & students, approve, add & delete). It also contains creating the form of final approved projects. Meanwhile, they are allowed to look over the name list of students and tutors who does not submit the application (Fig. 4). When it operates the behavior of one instance, the inter-transferred information between subjects reflects the class operation of static molding diagram or the triggered events in state machine. The mapping between UML model benefit designers speed up to understand the problems. Therefore, the developing complexity of system will be reduced efficiently.

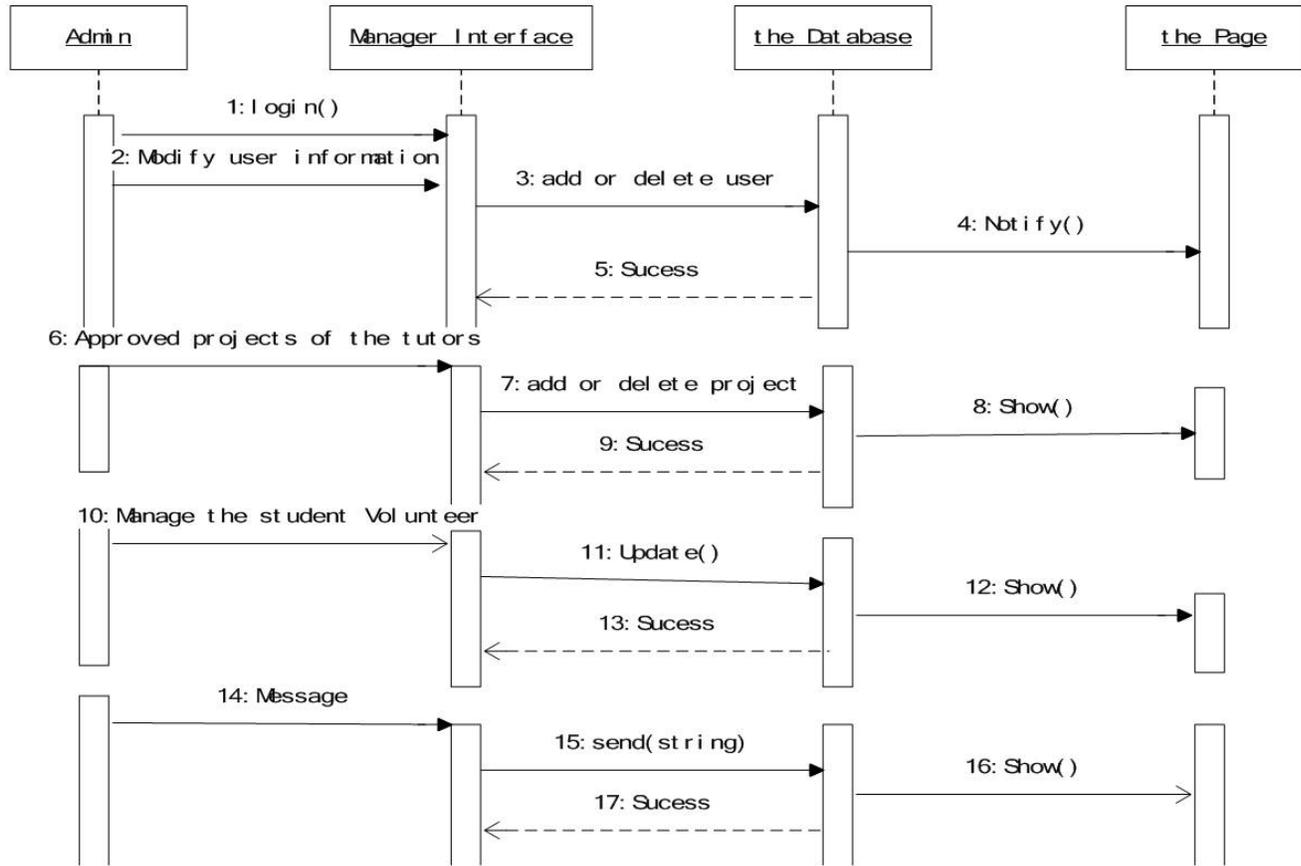
**Fig. 3. Sequence diagram of the students applying for project**



In fact, project selection and proposal are very important in the MSUP, administrators are responsible for monitoring and managing the whole operation, all projects of tutors and students are approved by the administrator (Fig. 4). Therefore, the administrator should be the competent teachers or heads of the department, when approving the projects as long as the project is found to be unsuitable, the administrator can delete it directly and order the tutor or student to rectify through message module. At the same time the key task of the administrator is to adjust the project table of the tutors and students submitted in order to satisfy the needs of all the administrator will have to commit hard work. Once the project is finalized no change can be done. After the project selection the system will automatically generate the final



**Fig. 4. Sequence diagram of the administrator management system**



project table and to publish the results online. The whole process is simple and fast and the results are clear and easy to understand.

**Conclusion**

The MSUP based on sequence diagram aims to describe a dynamic process which shows a subject-oriented software design method how to describe ‘the change of the inter-alternation of subjects with times change’ and also reflects it in the system design. This design can support all intermediate program language. The correct use of it will increase the software developing efficiency and transparent. Currently the design and development of this system has already finished. For the practical trial it is basically satisfied the expected results. Next step the security, reliability and expending ability will be more considered to create a perfect and standard MSUP.

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