A Mobile Laboratory Reservation Platform Based on Multi-Agent

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Summary
In order to improve the utilization of laboratory and support the student to achive the laboratory reservation more conveniently at anytime and anywhere, a novel platform MLRP has been built, which is a Mobile Laboratory Reservation Platform Based on Multi-Agent. Firstly, the key entitys and their actions of mobile reservation were abstracted from the practical request, and the model MLR (Mobile Laboratory Reservation) was constructed based on them. Then, the flexible layered architecture was designed based on MLR. And in order to adapt the dynamic complex mobile environment, the technology of multi-Agent was adopted. After that, the prototype system of the MLRP was implemented. The practice indicates the MLRP platform can support the mobile lab reservation of students very well.
Key words:
Mobile computing, mobile lab reservation, Multi-Agent

1. Introduction

In recent years, the laboratory has an increasingly important role in the teaching and research activities of colleges and universities[1]. It is not only the important part of research and teaching activities, but also the base of quality education and the cradle of talent with innovative and practical capabilities. So, the laboratory should be utilized enough to explode the study ardour of students and inspire the students joining in the research and teaching activities. Thus, how to improve the utilization of laboratory and support the student to achive the laboratory reservation more conveniently at anytime and anywhere is a key issue.

On the other hand, along with the rapid development of internet and the technology of mobile computing [2], all kinds of applications based on internet and mobile computing have been greatly enriched. So, these have offered the possibility of constructing the application of mobile lab reservaiton.

At present, some colleges have the laboratory reservation system based on Web, they can implement the function of self-determination reservation. Such as, reference [3] discussed on the construction of open experimental teaching system, reference [4] narrated practice and

exploration of the opening experimental teaching, and the reference [5] introduced the design and implementation of the opening Lab management system based on Web. . The existed laboratory reservation is limited by the time or the space, or the both of them because of the students must login the Web site by the PC computing, which lieing in some fixed place. Though there are some works based on mobile computing technology, such as reference [6], they only laid in the beginning of study. In order to improve the utilization of laboratory and support the student to achive the laboratory reservation more conveniently at anytime and anywhere, and provide students a strong and complete software system to support them, a novel platform MLRP (The Mobile Laboratory Reservation Platform Based on Multi-Agent), was constructed.

In this paper, the second section gives the logic model of MLR; the third section gives the architechuture of MLRP based on multi-Agent; the fourth section describes the prototype of the MLRP. The fifth section is the final summary of the whole paper.

2. The Logic Model of MLR

Based on the practical request, it is obvious that the core entitys of mobile reservation include the student and Laboratory Manager. The activity of student and laboratory manager mainly include logging in and out the platform system, reserving and managing the Lab and the related experiment devices, and so on. In order to depit the platform system in detail from both sides of function structure and user activity, the use case diagrams and the sequence diagram of MLR are given as follow.

2.1 The Use Case Diagrams of MLR

(i) The Use Case Diagram of Student

In Fig1, the students could log in and log out the system, reserve the Lab and device which they are demanded. And they may query their reserved experiments, and revise their password by the MLRP etc.
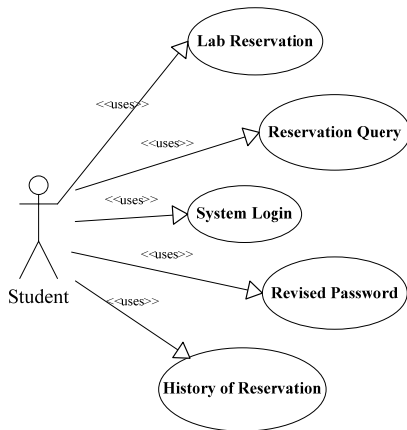
Fig. 1   The Use Case Diagram of Student
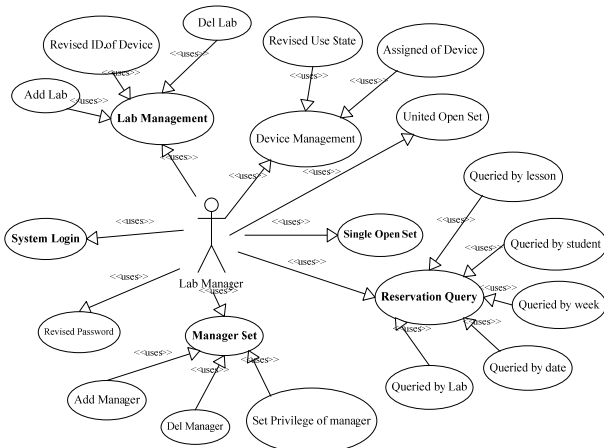
(ii) The Use Case Diagram of Student

Fig. 2   The Use Case Diagram of Lab Manager

In Fig2, the Lab manager could manage the Labs and devices for student experiment, and the reservation information come from students, and so on. Such as, there are Lab management, device managemt, united open set, single open set, reservation query, and so on.

2.2 The Sequence Diagram of MLR

According to the characteristics of university laboratory management, laboratory experiments should not only take the normal course task, but also as much as possible for the students to experiment an appointment after school hours. Therefore, this system uses management practices based on semester. It is said that the information of normal class schedule class time and lab experiments was put into the system based on the arrangements in the beginning of the semester. And the idle time and the rest of the laboratory could be reserved by students except any adjustment classes or equipment failures and so on. In

order to avoid conflict, the experiments and detailed reservation process will be divided into a number of steps, such as select the laboratory, select weeks time, select the day of the week, select the sections, choose the device No. of experiment. Thus, the sequence diagram of student reservation is given as Fig.3 based on them and Fig2.
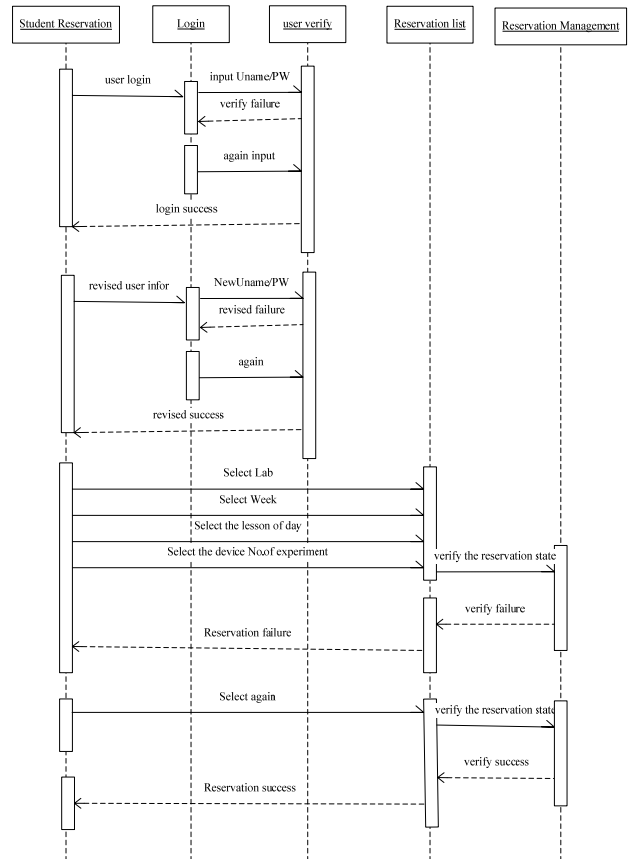

Fig. 3   The Sequence Diagram of Reservation

In Fig3, the students need to log in the platform system before reserving. The user name and user password will be verified at first. Then, the students who pass the verify permit to reserve the Lab and the relation experiment. They may select the Lab, weeks time, the day of week, the sections of day, and the device No. of experiment and so on, based on their desire. And, they may query and revise their reservation information after that.

3. The Reservation Workflow of MLR Platform

In order to narrate the the process of reservation, the reservation workflow of MLR platform is given as follow Fig4.
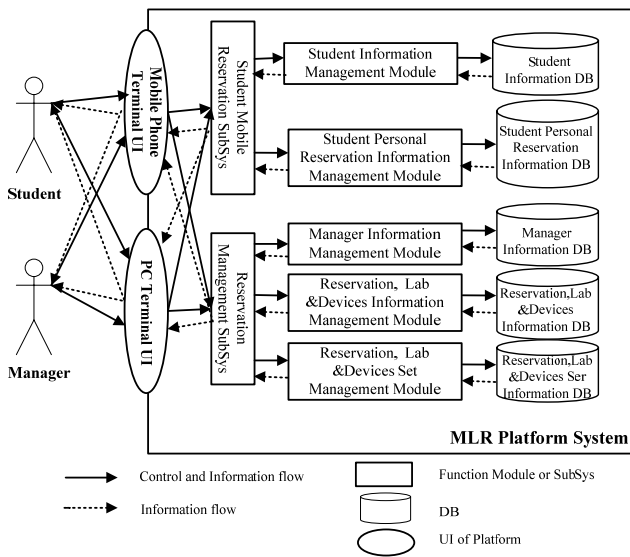
Fig4   The Reservation Workflow of MLR Platform

In Fig4, both the student and manager are the users of platform system, who have defference use priviledge. They may access the platform system by their PC or respective mobile phone. So, the platform system include PC terminal UI and mobile phone terminal UI. And for supporting the reservation function effectively, the platform system also include all kinds of informatin database, such as student information DB, student personal reservation information DB, manager information DB, and so on.

In the platform system, the mobile reservation activity was lanched by student from his mobile terminal. At first, he needs to log in the student mobile reservation sub-system and input his user name and password. Then, he may log in successfully after pass the cheching. If the user name or password wrong, he needs to input again. After that, he may reserve lesson of experement which he need. The description of mobile reservation activity in mobile terminal sub-system in detail is as follow Fig5.

At the same time, the server sub-system of the platform system supervises the user login and access information. It verify the user name and password while it recepted them. These need to read the relation data information from relation database. And, the server sub-system provides all kinds of function modules to support the student reservation activity. The description of these is as follow Fig6.

Accordingly, the experiment course managers need to manage all kinds of experiment course information and relation Lab, device, and so on by the platform system. The process of their student reservation activity management is similar with the student reservation activity. So, the relation description will be omitted here.
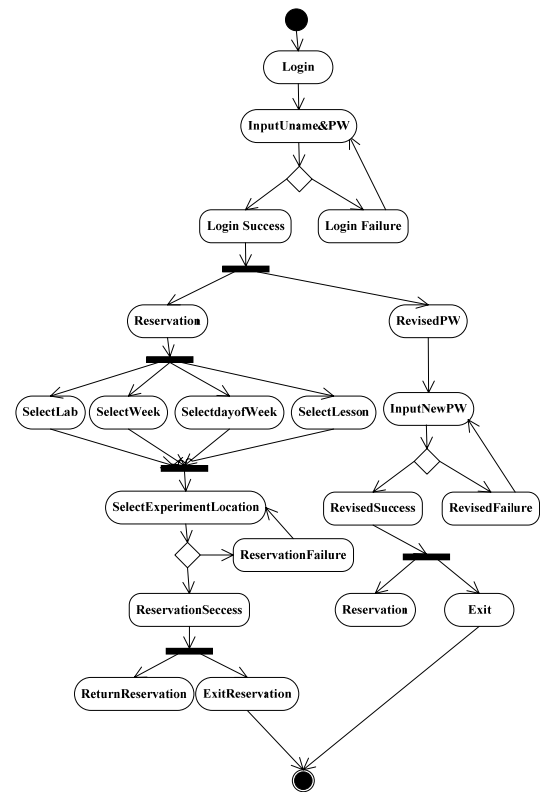

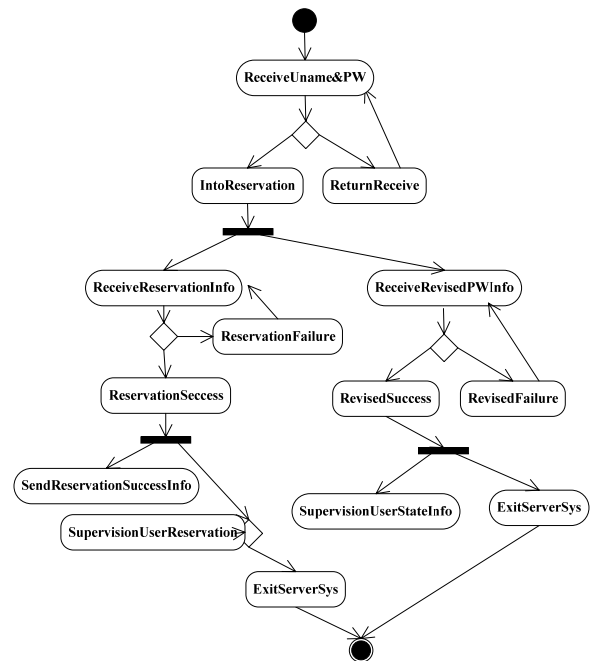Fig 5   Reservation Activity Diagram of the Mobile Teminal SubSys

Fig 6   Reservation Activity Diagram of the Server SubSys

4. The Layered Multi-Agent Stucture of MLRP

In order to take the MLRP to adapt the complex mobile computing environment, the layered multi-Agent structure was adopted. All the Agents of platform were divided in two parts of mobile Lab reservation embedded client subsystem and mobile Lab reservation server subsystem. Each mobile user mapped to a student Agent or manager Agent of mobile Lab reservation embedded client subsystem, and all kinds of function entities of mobile Lab reservation server subsystem, such as information process and storage module, mapped to all kinds of Agents, such as student information management Agent, reservation management Agent, and so on. And, all kinds of data information of platform were stored in all kinds of databases. The multi-Agent system supporting mobile Lab reservation was given as follow fig7.
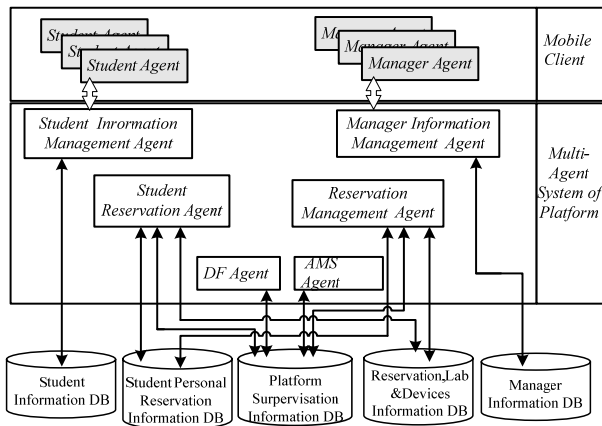

Fig 7   The multi-Agent system supporting mobile Lab reservation

In Fig7,
(1) *Mobile Clinet* includes the student Agents and manager Agents. And, each student Agent stands for a student to complete the reservation process, and each manager Agent stands for a manager to complete all kinds of Lab and experiment management work.
(2) Multi-Agent system of platform includes student information management Agent, manager information management Agent, student reservation Agent, Reservation management Agent, DF Agent, AMS Agent, and student information DB, student personal reservation information DB, platform surpervisation information DB, reservation Lab&devices information DB, manager information DB, and so on.
(3) DF Agent is abbreviation of Directory of File, the other Agent need to record their creating information in DF Agent.

(4) AMS Agent is abbreviation of Agent Management System, and it manages all the Agents of platform.
(5) The student information management Agent accepts the information coming from student Agents while there are the reservations launched by students. Then, it processes and stores them in student information. The reservation action of student will be managed by student reservation Agent, and the information of student personal reservation will be stored to the student personal reservation information DB.
(6) The manager information management Agent accepts the information coming from manager Agents while there are the reservation managements launched by managers. The reservation management action of manager will be managed by manager reservation management Agent, and the information of reservation management will be stored to the reservation management information DB, and so on.

4. Conclusion

As the laboratory has an increasingly important role in the teaching and research activities of colleges and universities, in order to improve the utilization of laboratory and support the student to achive the laboratory reservation more conveniently at anytime and anywhere, a novel platform MLRP has been built in this paper. The platform adopted the layered structure and multi-Agent technology to adapt to the dynamic complex mobile computing environment. And the model of MLR (Mobile Laboratory Reservation) was constucted based on the practical application and request. The result indicates the MLRP platform can support the mobile reservation work for campus. Comparing with non-mobile Lab reservation, the MLRP is important for the campus. Our future research work is: perfect the platform continuously and make it more function.

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