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Course Project: Job Finding Agent System

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**Agent Based Software Engineering
(SENG 609.22)**

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1. Intention

This main purpose of this project is to experiencing and evaluating the multiple agent system development methodology. The methodology followed by this project is Prometheus[1]. The major steps are taken. Couple minor steps are omitted on purpose.

2. Business Case

Job finding is a conventional vocation that involves a lot of routine work such as client account management, data sorting and information exchanging between agents and clients. Improving the efficiency of this routine work is necessary. This job finding agent system(JFAS) is designed just for replacing this routine work.

The clients who use JFAS are called users. The users are categorized into two types. One type of user is called non-registered user who does not have an account in JFAS. The other kind of user is called registered user who has an account in JFAS.

Both kinds of users should be able to search JFAS for job. While searching the jobs, users must provide certain criteria to JFAS in order to find the jobs relative to their requirements. The found jobs should be displayed to the users.

For the registered users, they can receive some advanced services compared to the un-registered users. While users register into JFAS, they are required to provide a user name and password to JFAS and this user name must be unique in the current system. After the account is created, JFAS must provide the management service to the user's account. The user account should include user personal profile, resume, job application history and email notification subscription.

After the registered users find the jobs they want and they have logged into JFAS, they can apply for them. Otherwise, they should be required to log in immediately. They should be required to attach their resume with application. After the job application is sent by users, the user's account should keep this application in record.

Registered users should be able to store their resume in their accounts. And they should be able to update the resume whenever they log in their account.

Registered users can subscribe to the email notification service while they have logged in JFAS already.

3. System Overall Specification

In this section, the overall system specification will be captured.

3.1 Functional and Non-functional requirements

From the description of business case, the functional requirements can be extracted from it. At the same time, the non-functional requirements are considered as well in this section. The following are the descriptions of the functional and non-functional requirements:

- R1. JFAS provides all users the job searching services. Users do not need log in for this service. This service should be available for users to use in the welcome page. Three criteria are provided to users to use for searching. They are “Keyword, Location and Job Category”. Users could specify none, one or more of the three criteria. After the users start the searching with any criteria, JFAS should display the result back to the users. The result shall include job post date, job title, company name and city of the company. And users shall be able to look at the details of the jobs through the name of the job title.
- R2. Non-registered users can register to JFAS by creating an account in JFAS. JFAS shall provide the service to users in the welcome page. In order to successfully create an account, non-registered users shall provide a unique username, a password and personal information. Whether the username is unique or not shall be checked by JFAS. Users are required to change username if it is not unique in JFAS. The times to change to a unique username are unlimited. The personal information users shall provide includes full name, home address and work years, job title and education level.
- R3. Users can log in JFAS. This service shall be available in the welcome page. Users are required to provide their usernames and passwords to log in. Users can log in only if their usernames and passwords are both correct. Otherwise JFAS will prompt users to retry. The maximum times of try are 3.
- R4. Users can apply for the job displayed to them. JFAS will prompt the users to log in if they have not logged in yet. JFAS shall require the users to attach their resumes. The attached resume must be the one stored in users’ profile. After the job application is sent by the user, a confirmation shall be displayed to user. And JFAS shall store this application in the job application history of users’ account, which shall include the date, job title and company name.
- R5. Users can update their profiles if they logged in already. This service shall be available in the welcome page after users log in. The profile contents include full name, home address and work years, job title, education level, username and password.

- R6. Users can post or update their resumes if they logged in already. This service shall be available in the welcome page after users log in. Users can store their resumes in their accounts if the users do not have a resume stored before. JFAS will prompt users to attach their resumes from their local storage when users issue this service. If the users already have a stored resume, the resume will be displayed to users to change.
- R7. Users can subscribe the job email notification or change the information of this service if they logged in already. This service shall be available in the welcome page after users log in. Users can fill in the required information by this service, which include keywords, job category, location and time when users want to receive the email.
- R8. JFAS shall send the relative job information email to the subscribed users at their specified time.
- R9. JFAS shall allow the administrator to input job new job information into it. The job information shall include job posted, job title, location, company and detailed description. And the system shall store the job information.
- R9. JFAS should be on 24-7.
- R10. The services provided by JFAS should be free.
- R11. The JFAS shall keep the client account profile as confidential.

3.2 Use cases

The functionalities of the requirements, relations among them and the interactions of the system with the environment can be briefly captured in the use case diagram that is shown in Figure 1. The notations used in the diagram are the standard notation of UML[2]. The use case descriptors are omitted since the purpose of this project is to focus on experiencing the Prometheus process.

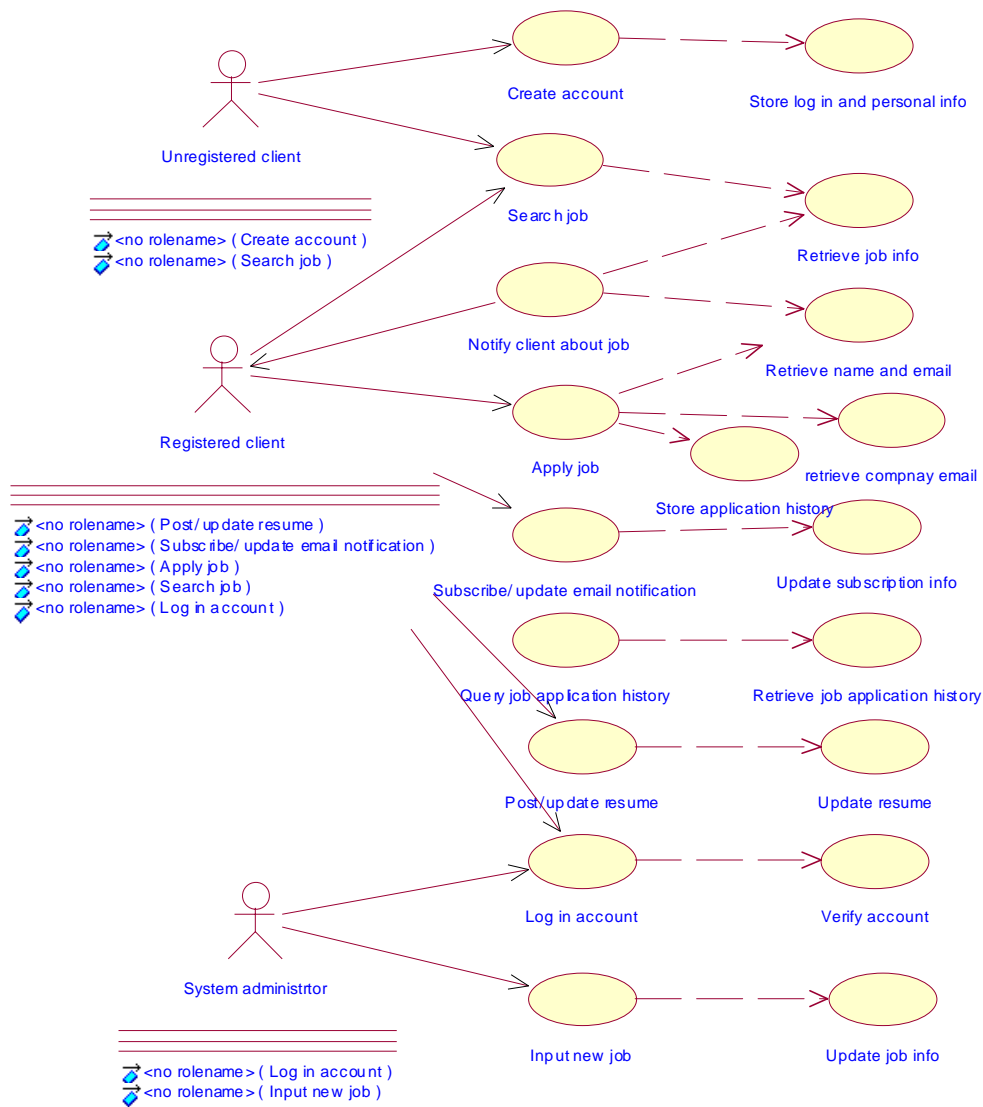


Figure 1. JFAS Use Case Diagram

4. System Architecture

In this section, the functionalities will be grouped and assigned to the identified agents. For the uses description in section 2, we can find that some uses cases use the same data. We can group the uses cases that use the same data together and assign these functionalities to an agent. The purpose to do this is to reduce the interaction between agents.

The user account data is used by the use cases *Store log in and personal info*, *Retrieve name and email*, *Store application history*, *Update subscription info*, *Retrieve job application history*, *Update resume* and *Verify account*. They all use

the data store in the user account database. They can be grouped and assigned to the Account Management Agent(**AMA**).

The job data is used by the use cases *Retrieve job info* and *Update job info*. They all use the data store in the job database. They can be grouped and assigned to the Job Management Agent(**JMA**).

The job notification is fulfilled by the Job Notification Agent(**JNA**) which basically requests the username, email and job information from the AMA and JMA and use these information to compose an email to user.

The job application is fulfilled by the Job Application Agent(**JAA**) which basically requests the username, email and company email from the AMA and JMA and use these information to compose an email to the company.

For other use cases, basically they fulfill the interface to/from the environment such as non-registered and registered users and administrator. These use cases are *Create account*, *Search job*, *Notify client about job*, *Apply job*, *Subscribe/update email notification*, *Query job application history*, *Post/update resume*, *Log in account* and *Input new job*.

The Figure 2 gives a architectural picture of what the system looks like and interactions among major components of system. The notations used in this diagram are defined in [1].

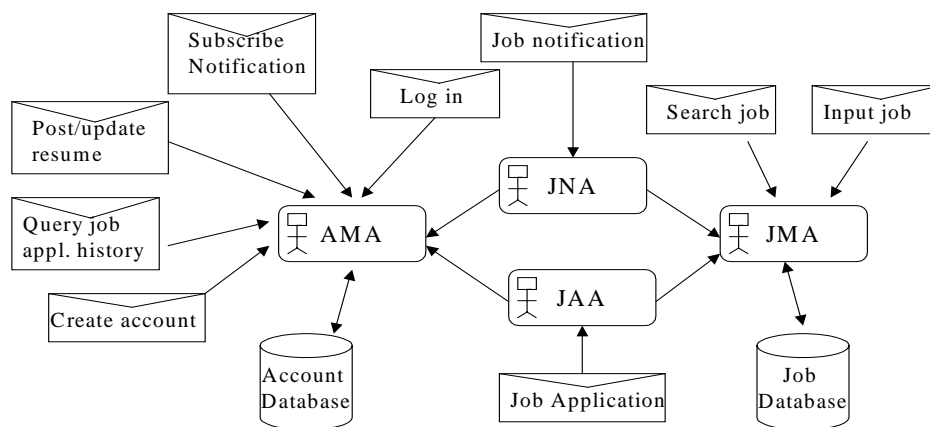


Figure 2. JFAS System overview diagram

5. Detailed Design

In this section, the identified agents will be designed in detail.

5.1 Agent overview diagram

The agent overview diagram is a good representation of the internal structure of agent. The letter envelope icon represents the requests to the agent. The round corner rectangle icon represents the capability of agents. Figure 3, 4, 5, 6 are the agent overview diagrams of agents AMA, JMA, JNA and JAA.

The AMA agent has the several capabilities to deal with different request. These capabilities include *Create Account*, *Post/Update Resume*, *Retrieve Job Application History*, *Update Subscription Info*, *Verify Account*, *Store Application History* and *Retrieve Name and Email*.

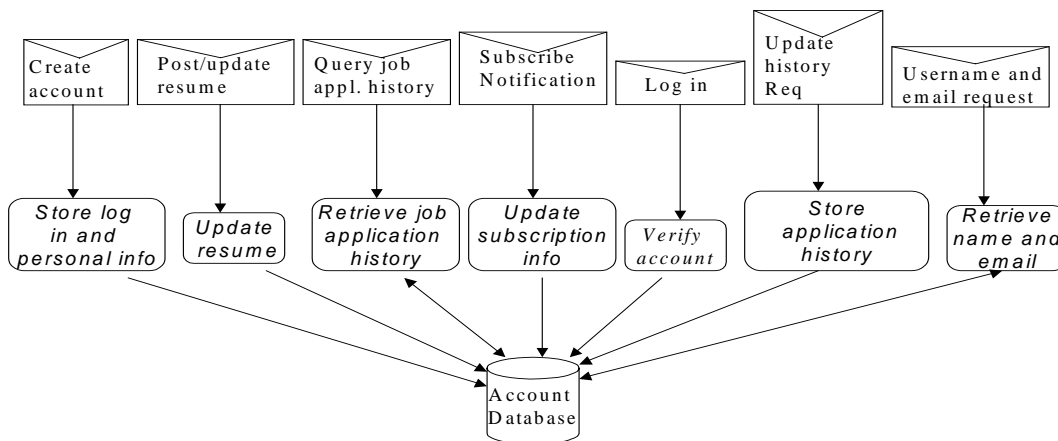


Figure 3. AMA agent overview diagram

The JMA agent has the several capabilities to deal with different request. These Capabilities include Update Job Info, Retrieve Company Info and Retrieve Job Info.

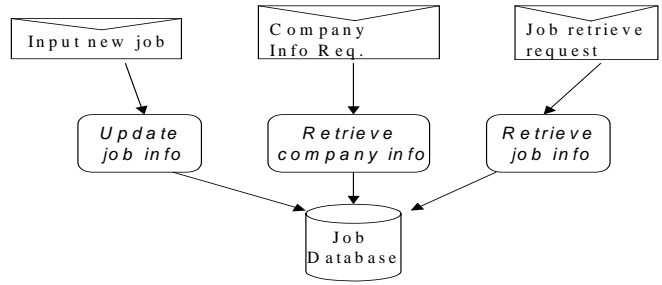


Figure 4. JMA agent overview diagram

The JNA agent has the several capabilities to deal with different requests. These Capabilities include Compose Notification, Retrieve Username and Retrieve Job Info.

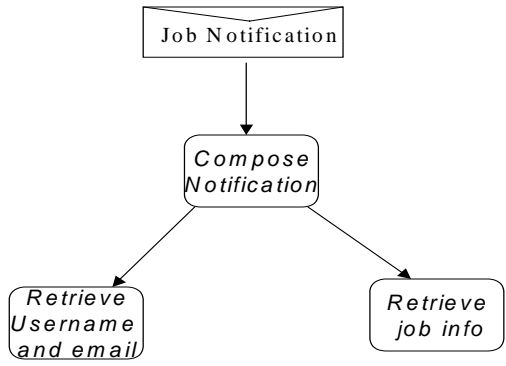


Figure 5. JNA agent overview diagram

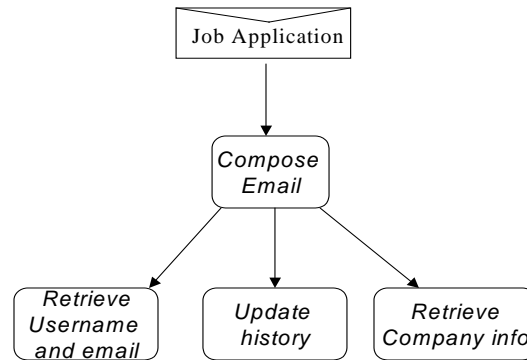


Figure 6. JAA agent overview diagram

5.2 Class diagram

Class diagram is good for representing the static relations among agents.

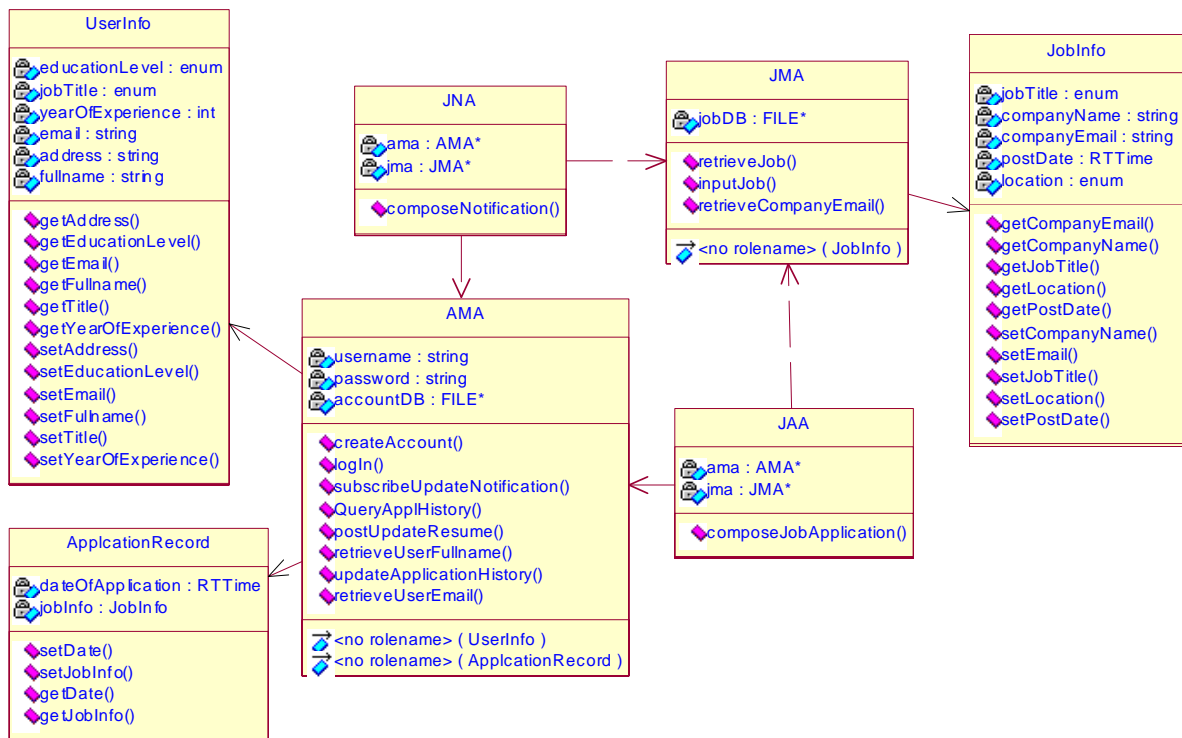


Figure 7. JAS class diagram

5.3 Interaction diagram

The sequence diagram is good representation of interaction protocol between agents and environment. So only the scenarios with interactions between agents are represented in the interaction diagrams.

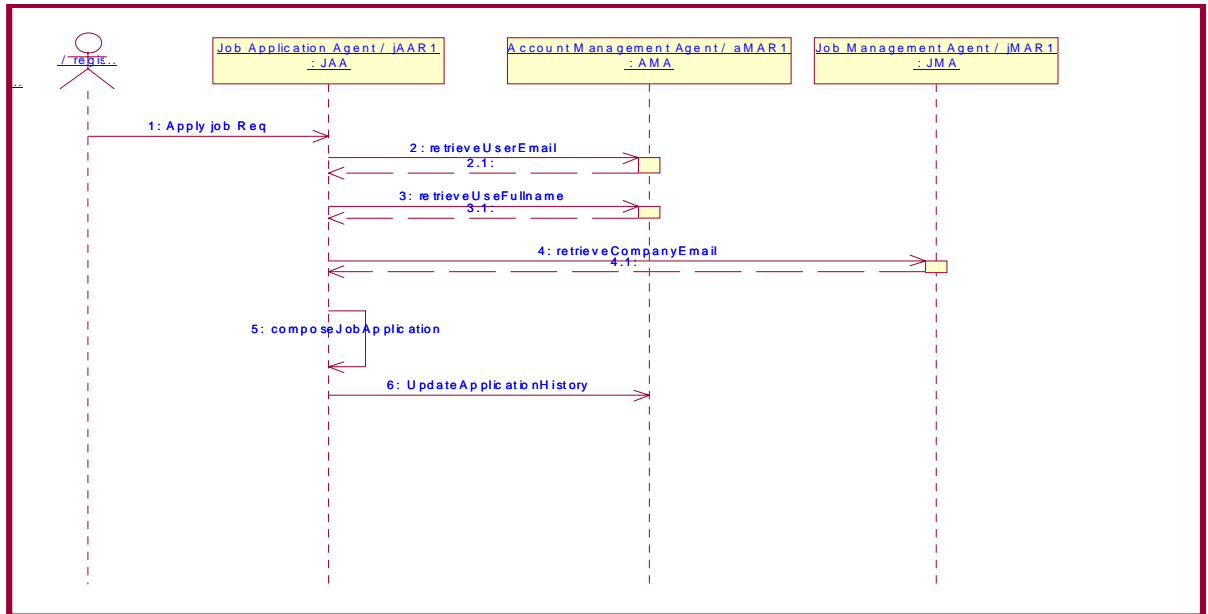


Figure 8. Apply Job

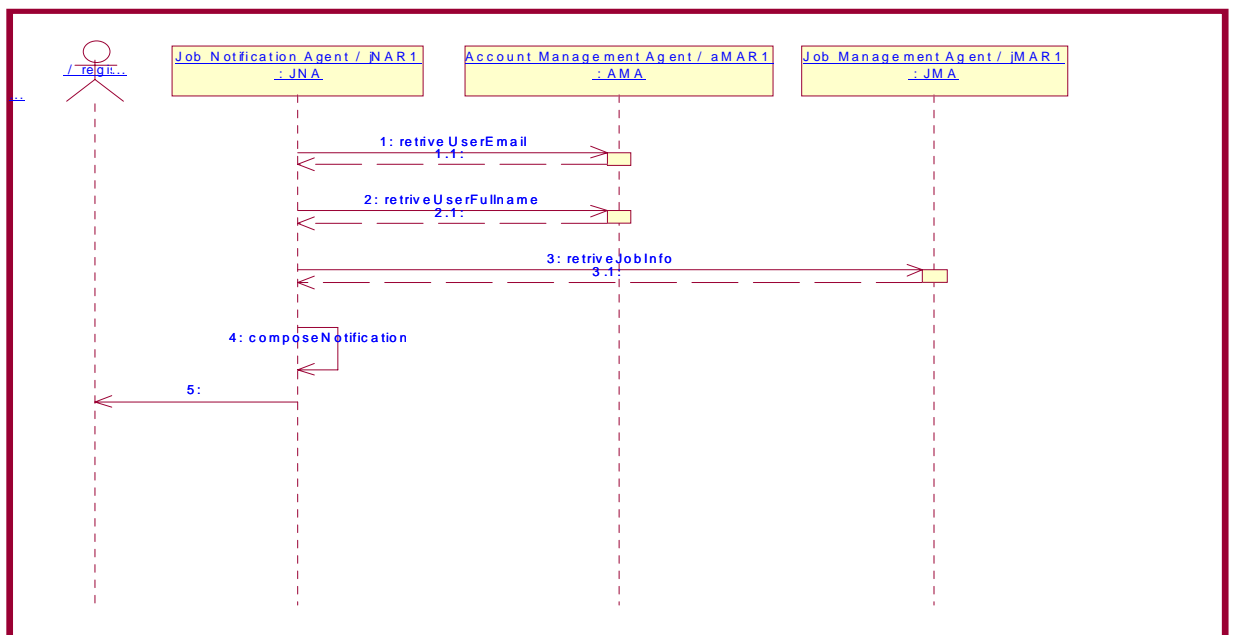


Figure 9. Job Notification

Figure 8. Apply Job interaction diagram describes the protocols among JAA, AMA and JMA while registered user applies job.

Figure 9. Job Notification interaction diagram describes the protocols among JAA, AMA and JMA while system composes and sends job notification to user.

6. Dictionary

JFAS – Job Finding Agent System
AMA – Account Management Agent
JMA – Job Management Agent
JNA – Job Notification Agent
JAA – Job Application Agent

7. Conclusion

This development of this project basically follows the Prometheus that is an agent system design methodology. I find that Prometheus is simple, clear and very easy to use. The visual modeling used by this method is very efficient and straightforward. But this methodology uses a waterfall process, instead of an iterative process. In my design of this project, the iterative process is used. The use case descriptors and agent descriptors were omitted since the purpose of this project is to focus on evaluating the Prometheus process instead if the project itself.

8. References

[1] UML Distilled, Applying The Standard Object Modeling Language. Martin Fowler

[2] L. Padgham and M. Winikoff: [Prometheus: A Methodology for Developing Intelligent Agents](#), Proceedings of the First International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS 2002), 2002.