A Conceptual Model of an Automated Land Information Machine (ALIM)

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Key words: Land, Information, System, distribution, consortium, ALIM.

SUMMARY

As Land Information Systems have to serve scientists and decision makers, we observe that a wide range of public users does not take advantage of the current evolution. The decentralization of services and the generalization of distributed computing technologies via Internet have profoundly affected the relationship between humankind and lands. Nevertheless, more efforts should be made to ensure a huge distribution of land information taking in account future needs of basic and public users.

This paper aims to provide scientists, agencies in the domain of land information systems, mapping agencies, and land information offices with a new perspective concerning the design of an Automated Land Information Machine called ALIM. The ALIM consists of an electronic device for automated delivery of land information around the public areas. A user with an electronic card can get a sheet of map concerning an area, driving directions from and to a destination, information on land property, tax information, addresses, and locations of various services such as hospitals, restaurants, stores, and libraries.
It outlines a conceptual model for designing such machine by using an object-oriented approach. It highlights the new requirements, user needs, and the advantages of such machine in evolving public and wide land information .

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1. INTRODUCTION

The Geographic Information System (GIS) technology affects our behavior regarding either the natural or the physical world we have built. This technology has widely been appreciated by several groups of users because it plays an important role in their everyday life. Various GIS applications are conceived and implemented to meet the user needs in different domains. A kind of applications based on this technology is Land Information System (LIS) and web-based GIS/LIS. This has promoted efficiently online delivery, electronic sharing, and transfer of information on land and property spatially referenced.

A wide public users of GIS are stressed to have a public access to land information everywhere and at any time. In developed countries, the Internet technology seems to be generalized and a large people can obtain information on their properties, land ownerships, or general information such as getting direction from/to a site or locating an object on maps. In developing countries, much efforts must be made to promote the use of this technology. Both in the two kinds of countries, the development of a new strategy to enable publically access to geographical information is for a great interest. The way is to conceive an Automated Land Information Machine, ALIM, that will meet user needs weither they may access to Internet or no. ALIM allows to support a computerized land information networking including various agencies, users, automatic machines, and a series of computers maintained by land information agencies.

2. THE BASIC CONCEPTS OF ALIM

The ALIM consists of an electronic device for automated delivery of land information. A user with an electronic card can get a sheet of map concerning an area, driving directions from and to a destination, information on land property, tax information, addresses, and locations of various services such as hospitals, restaurants, stores, and libraries. The interaction between users and ALIM should be assured through an interface consisting of card reader, a numeric keyboard, a screen to display options and allow viewing various information, and an output device for delivering small maps or sheets.

A consortium of land information offices and or map agencies must be established to support automated land information delivery. Each office or agency provides its own data to be shared via ALIM and maintains its own account and process transactions. A consortium server ensures the connection between offices and agencies and communicates with each ALIM to facilitate the interaction with public users. The principal agencies or department that would contribute to building ALIM system can be summarized as below (Figure 1):

- The agency or department of land
- The agency of geodesy, cartography, and cadastre
- The agency or department of transportation
- The agency of department of natural resources
- The agency of water and weather forecasting
- The agency or department of telecommunication
- The agency of information technology
- Private companies of computing and networking
- Banks and financial companies
- Academic institutions and universities
- Designers and developers
- ….etc.

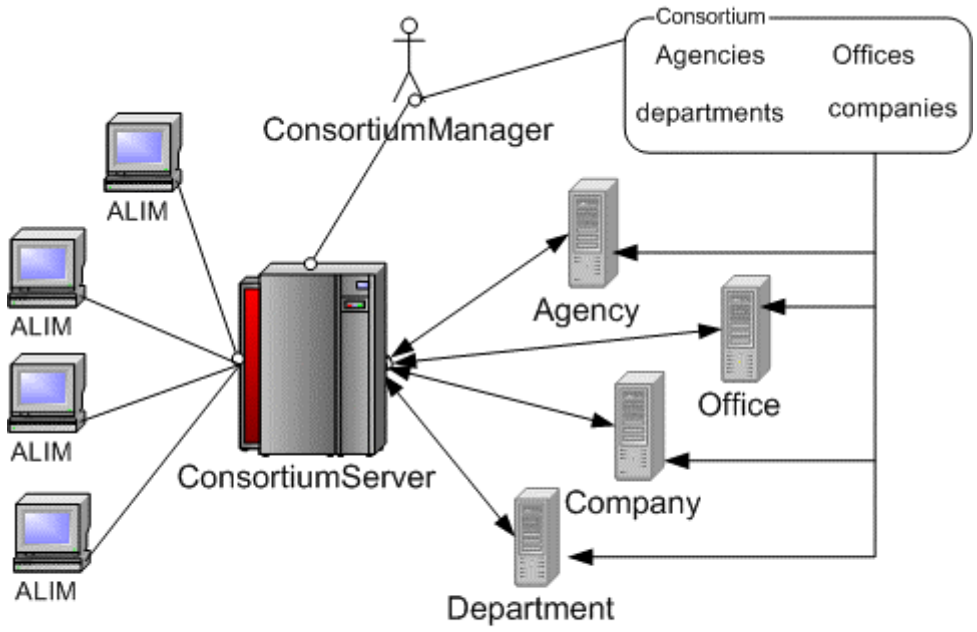

Figure 1: The consortium of Land Information System agencies

As an alliance of the previous agencies, the consortium has the aim to provide standards and guidelines to be shared between these organizations. Each agency should pay annually membership fee as a member of the consortium. The fees will assist the consortium to improve services provided by ALIM. Their amount will depend on the number of cardholders of each agency.

Every agency, office, or company within the consortium of land information machine (CLIS) should develop its specific computer applications according to the consortium standards. This will provide a better service to the public users by giving them an opportunity to access data and information much cheaper through ALIM.

Each user should apply for a card from a member of the consortium to access eligibly to land information. An agreement must be signed between users and their agencies. This enhances the security of distributing and sharing data on land information.

3. THE CONCEPTUAL MODEL OF ALIM

3.1 The Use Case Diagram

The Automated Land Information Machine designing model is based on the UML language developed by Grady Booch et al. (1999). The principal actors that interact with the system include Users, ConsortiumServer, and the ConsortiumManager.

The Figure 2 represents the use case diagram that visualizes the behavior of the system. The important use cases that describe a set of sequences and actions relating actors to the system can be identified as below:

- CheckUser: it permits to verify the membership of a cardholder,
- ProcessRequest: it processes the request submitted by a user,
- PerformAction: it delivers results concerning a request.

The use case Check user is an action that allows the system to validate the user. It informed the Consortium server about the on-going process by sending the cardholder code, password, and its agency. The actor named ConsortiumServer is linked to the consortium for managing information delivered by other agencies. Then, we distinguish other actions as use cases that include (Figure 2):

- UpdateLI: for updating land information produced by each member agency of the consortium,
- ManageCLIS: for managing agencies and warning on the lack of data.

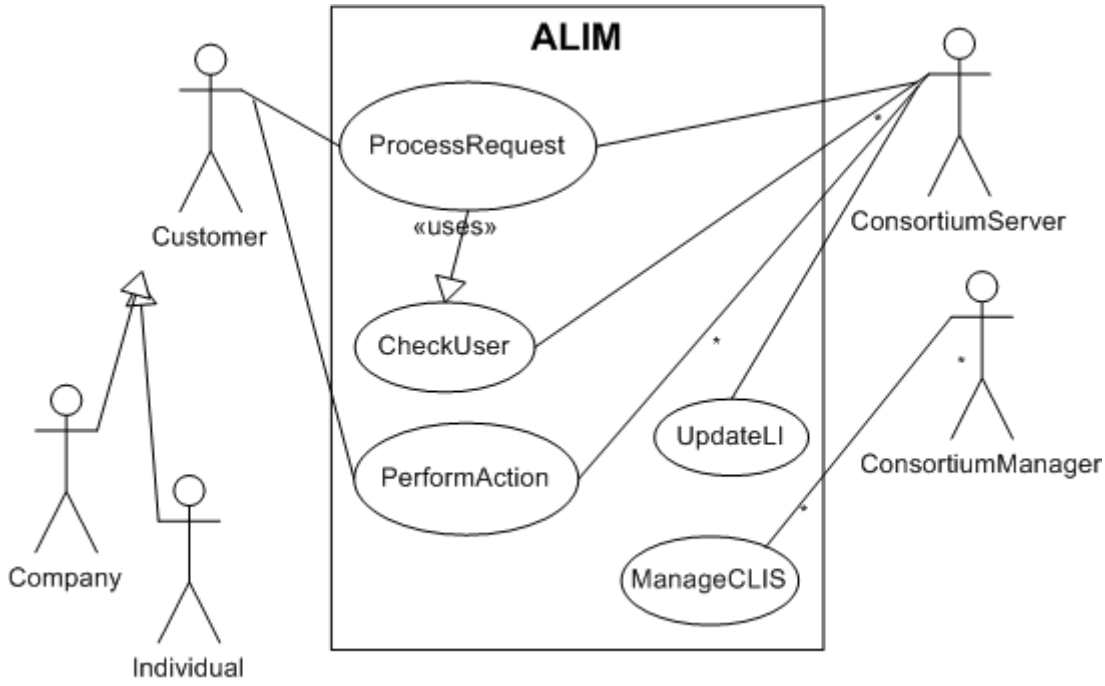

Figure 2: The use case diagram for the system

3.2 The Class Diagram

The class diagram designates the core component of the whole design in UML. It specifies, as a static structure of the system, classes and relationships between them (Rumbaugh et al., 1999). For ALIM system, we find the following classes and relationships (Figure 3):

- Agency: it indicates a kind of agency that furnishes land information to the consortium,
- Consortium: an organization that maintains ALIM and ensures cooperation between land information agencies or offices,
- ConServer: a server that receives and exchanges data with the consortium and delivers them to customers via ALIM,
- Customer: a user using an electronic card to communicate with an ALIM,
- AgComputer: each agency has its own computer to communicate information with the consortium,
- Account: each cardholder should have an account to access legally to land information,
- Information: is a kind of information a user can request from an ALIM,
- AlimCard: is an electronic card that permits to each customer to use ALIM machines,
- AlimSite: it indicates the positional data, which include the index of each machine, its x and y, and the exact address for each ALIM.
- AlimOperation: permits to perform actions requested by customers.

The links between classes are indicated in the class diagram in the figure (Figure 4).

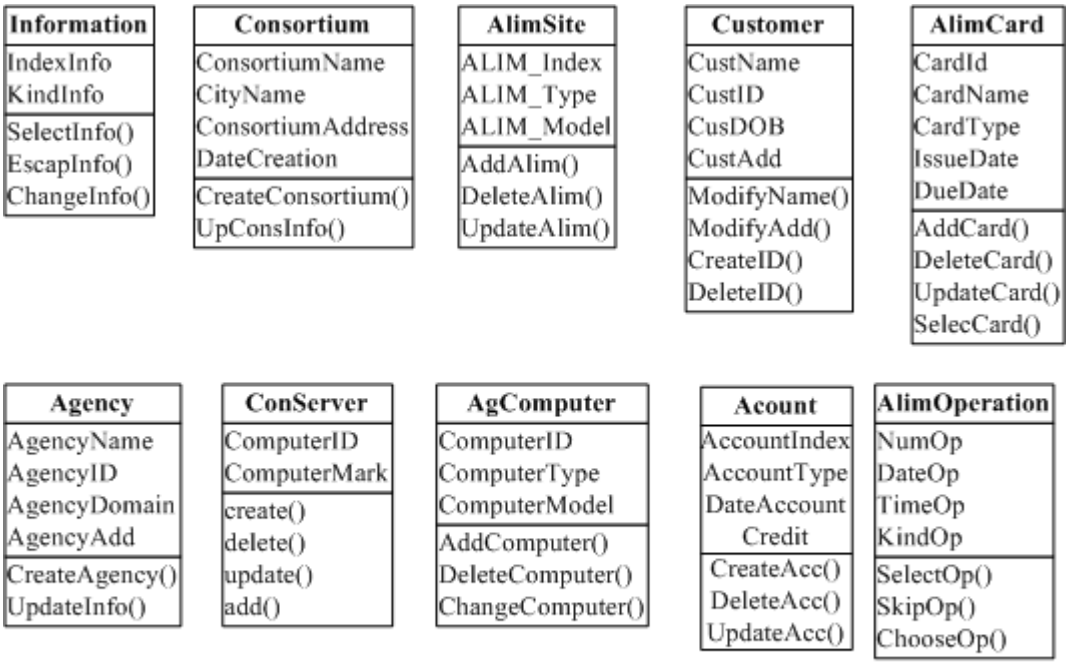

Figure 3: The identified classes, attributes, and operations

3.3 The Interaction Diagram

An interaction diagram, showing either a sequence or a collaboration diagram, models the dynamic aspects of a system (Booch al., 1999). It models particular objects in a system or one specific flow of control of a use case. The sequence diagrams and collaboration diagrams are semantically equivalent. One may take a diagram in one form and convert it to other without loosing information. A specific characteristic permits to distinguish between the two diagrams. The sequence diagram is concerned by modeling flows of control by time ordering while the collaboration diagram performs the same action by organization. In this paper we use the sequence diagram to model the flow control of the “ProcessRequest” use case (Figure 5).

The sequence diagram visualizes the dynamic behavior of a use case scenario. For the whole system, the activity diagram is used to model its dynamic aspects. It shows the flow from activity to activity.

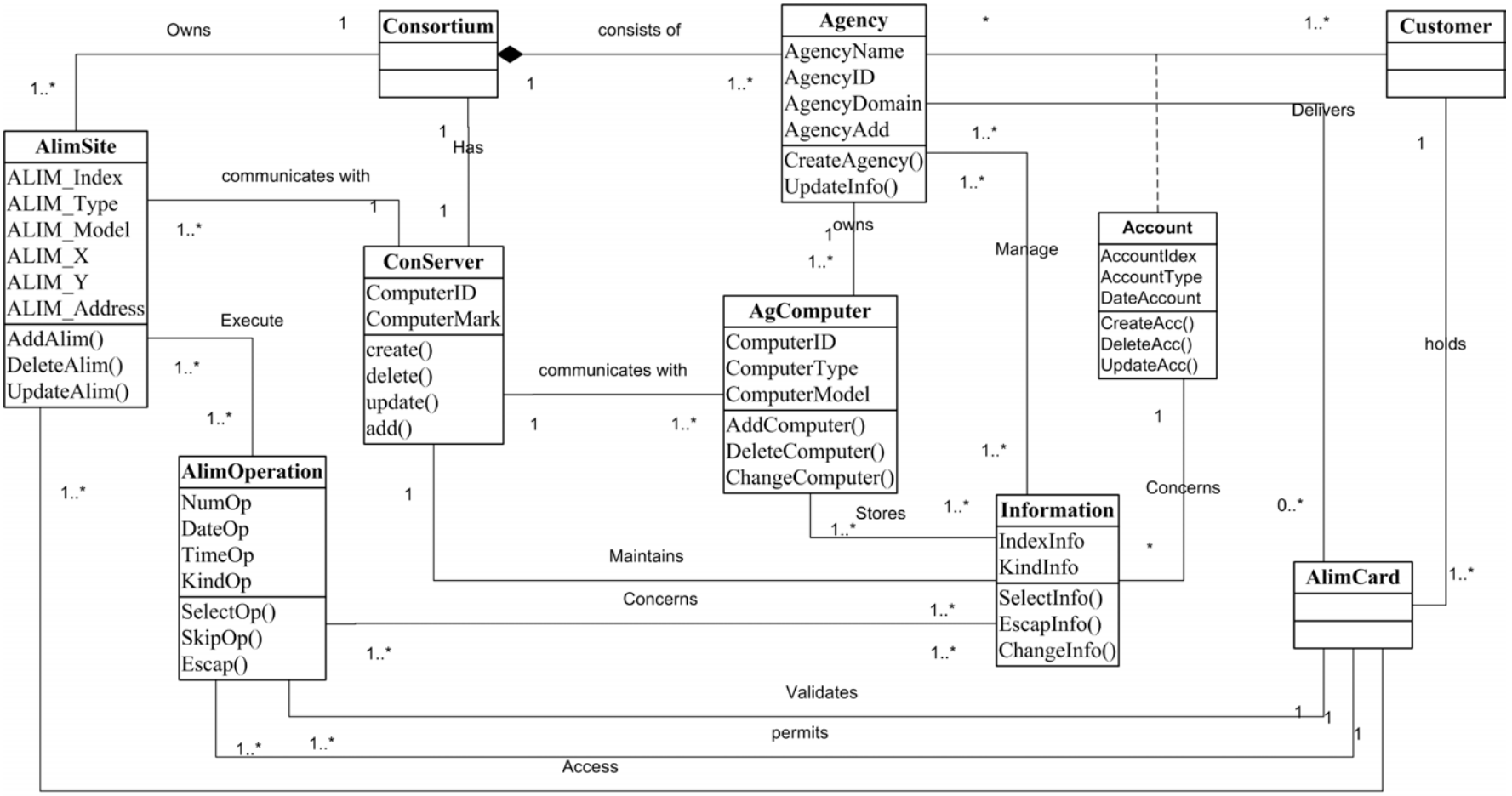

Figure 4: The class diagram of ALIM.

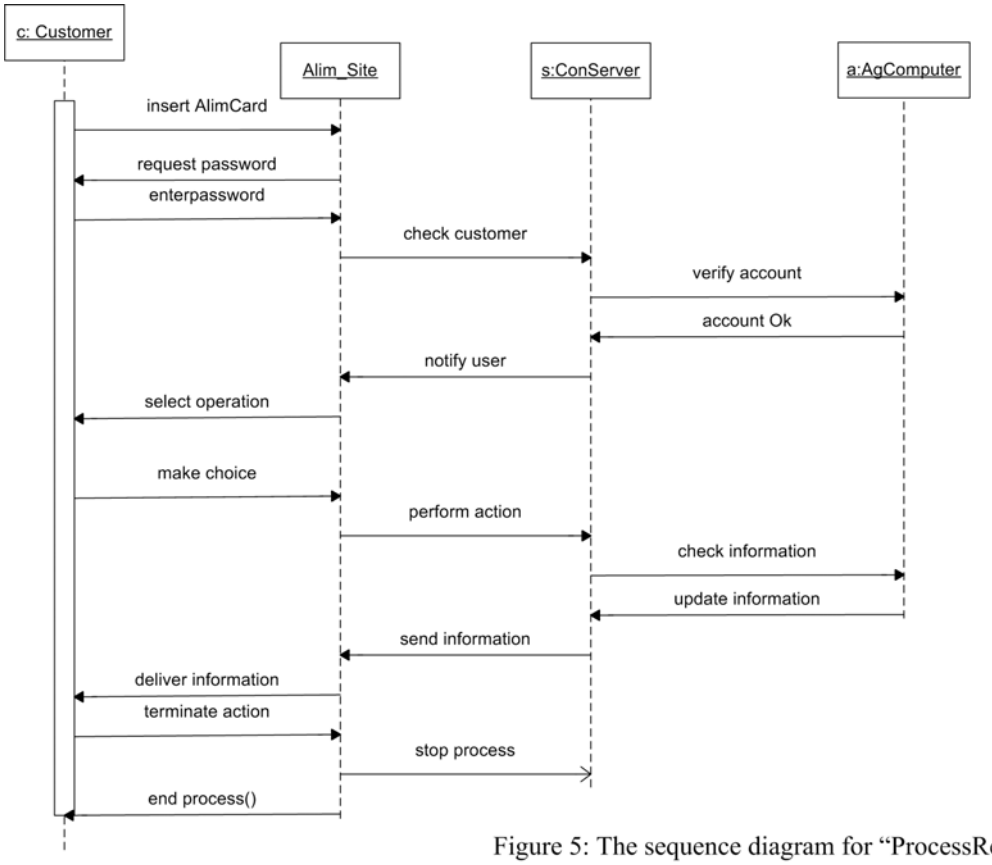

Figure 5: The sequence diagram for "ProcessRequest" use case.

4. CONCLUSION

We developed, in this paper, a new perspective for sharing and distributing land information using an Automated Land Information Machine. The ALIM provides suitable services to many users in public areas. The developed diagrams using UML constitutes the first steps for understanding the system and preparing implementation tasks in the future.

Further efforts must be made to develop firstly different land information systems as basic entities to organize within a consortium. Secondely, a progressive strategy is needed to conduct case studies and test the feasibilty of such system. Other issues such as financial and legal aspects are not discussed in this paper. Formidable studies and propositions will help us to improve our vision in the future.

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