International Journal of Scientific Engineering and Technology Research

ISSN 2319-8885
Vol.03,Issue.13
June-2014,
Pages:2813-2818

www.semargroup.org,
www.ijsetr.com

Online-Payment System for Electricity Charges using Multi-agent Architecture

SABAI WIN[1], MOE MOE AYE[2]

[1]Dept of IT, Mandalay Technological University, Mandalay, Myanmar, E-mail: sabaiwinn2012@gmail.com.
[2]Dept of IT, Mandalay Technological University, Mandalay, Myanmar, E-mail: moeaye255@gmail.com.

Abstract: The Traditional cash payment for electricity charges is characterized by long queue; long distance traveling and time wasting that negatively affect business activities and ultimately economic development. In the present time, the internet has brought about innumerable changes to the way enterprises do business, so all sorts of businesses (such as shopping, hotel reservation, medical checkup, etc.) are performed online. Agent based e-commerce has emerged and become the focus of the next generation of electronic commerce (e-commerce).The system is designed to pay the electricity charges to Electric Supply Enterprise (ESE) through the Internet. The proposed system is implemented by using multi-agent electronic payment architecture. By implementing the proposed online-payment system for electricity charges, it reduces manual effort, paper work and time saving. The system is implemented with Java based programming language (Aglet).

Keywords: Mobile Agent, Multi-agent, ESE.

I. INTRODUCTION

Commercial activities on the Internet have increased in tandem with the fast growth of the Internet itself. With e-commerce, business transactions have been made easier and faster via the Internet. However, there are still uncertainties and lack of standardized e-commerce procedures. This has slowed down the acceptance of e-commerce activities online. It would thus be beneficial if there was some way to streamline and standardize e-commerce. Agent technology was introduced to e-commerce to provide automation in conducting business transactions. Agents can perform tasks autonomously on behalf of its user. This solution makes use of software agents to carry out product search and differentiation on behalf of human owners. It has the potential to allow e-commerce transactions and payment to be carried out with good security and reliability [1]. In order to maximize adaptability and flexibility in an e-commerce environment, this paper proposes architecture for creating e-payment as a collection of related agents - each agent responsible for a specific task. By working together, the group of agents is able to solve more complex system demands. By breaking a large e-payment system into sub-tasks, the entire system becomes more encapsulated and adaptable.

The ability to solve complex requirements emerges from the interoperation of different agents and potentially the interoperation of different agent communities. A key element in any e-commerce system is the method of payment. However, existing monetary and fund-transfer arrangements are difficult to be transplanted directly into the e-commerce marketplace. Currently, a common e-payment method involves the client transmitting to the merchant details of a payment card such as a VISA credit card. The merchant receives the information and proceeds to carry out a payment request with the card issuer via traditional payment card procedures. This system is simple and does not require the development of a new commercial infrastructure. This paper is established as follows. Section II demonstrates related works. Section III presents Background Theory. Section IV offers the design of Online-Payment System for Electricity Charges using Multi-agent Architecture, whereas Section V gives implementation of proposed system and section VI draws conclusions.

II. RELATED WORKS

R. Jaya Subalakshmi developed a model to enhance small e-health organizations' functionalities using a multi-agent system using the JADE framework. The JADE framework gives the system autonomy, peer-to-peer characteristics, a distributed system, interaction protocols and support for the J2ME platform. The security implementation, however, is fairly vulnerable, as it uses simple firewall, login and password validations to protect the sensitive data. Nevertheless, there is a proposition on enhancing the security in the future by using Elliptic Curve Cryptography [2]. Monia Loulou implemented a conceptual model for secure mobile agent systems. Mobile Agent literature is divided in two trends: the development and implementations of mobile system systems, and the development of the formal aspect by defining operational models which express aspects related to mobile agent interaction and communication.

This paper's proposal follows the second trend[3]. Vieira-Marques presented and described an information gathering system for secure integration of distributed, inter-institutional

medical data using agent technology. This systems was designed to improve on the existing Virtual Electronic Patient Records (VEPR) system to work on networked and distributed medical systems rather than only a local medical system, which brings new challenges. Security-wise, the system needs to ensure that only authorized staff can access the information and that data moving through the network is secure[4]. Braynov and Jadliwala in [BJ04] presented a formal analysis technique that uses coordination graphs to detect malicious confederacies of agents. The assumption is that communications, including those of malicious agents working together, can be monitored to reveal the agents that abet a primary agent in performing malicious activity. Their algorithm defines links, relationships, and cooperation between members of a group in such a way that action and task correlations can be established. The graphs help root out insiders by highlighting actions that cannot be accomplished with the current resources of a given agent [5].

III. BACKGROUND THEORY

A multi-agent system (M.A.S.) is a computerized system composed of multiple interacting intelligent agents within an environment. Multi-agent systems can be used to solve problems that are difficult or impossible for an individual agent or a monolithic system to solve. Intelligence may include some methodic, functional, procedural or algorithmic search, find and processing approach. Although there is considerable overlap, a multi-agent system is not always the same as an agent-based model (ABM). The goal of an ABM is to search for explanatory insight into the collective behavior of agents (which don't necessarily need to be "intelligent") obeying simple rules, typically in natural systems, rather than in solving specific practical or engineering problems. The terminology of ABM tends to be used more often in the sciences, and MAS in engineering and technology. Topics where multi-agent systems research may deliver an appropriate approach include online trading, disaster response, and modelling social structures.

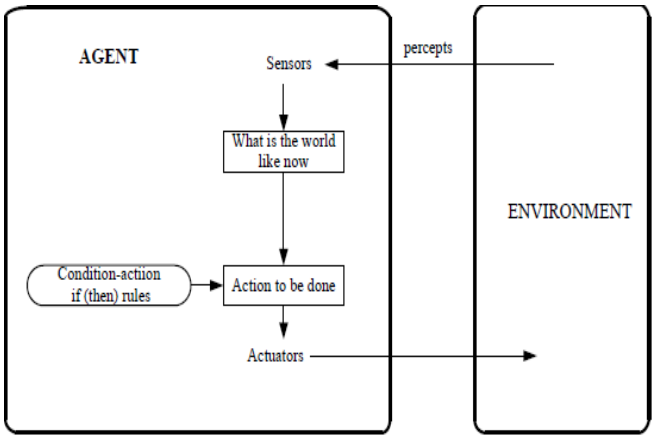

Figure 1. Simple reflex agent.

Multi-agent systems consist of agents and their environment. Typically multi-agent systems research refers to software agents. However, the agents in a multi-agent system could equally well be robots, humans or human teams. A multi-agent system may contain combined human-agent teams.

Agents can be divided into different types:

- Very simple like: passive agents or agent without goals (like obstacle, apple or key in any simple simulation).
- Active agents with simple goals (like birds in flocking, or wolf–sheep in prey-predator model).
- Or very complex agents (like cognitive agent, which contain complex calculations).

Environment also can be divided into:

- Virtual Environment
- Discrete Environment
- Continuous Environment

Agent environments can be organized according to various properties like: accessibility (depending on if it is possible to gather complete information about the environment), determinism (if an action performed in the environment causes a definite effect), dynamics (how many entities influence the environment in the moment), discreteness (whether the number of possible actions in the environment is finite), episodicity (whether agent actions in certain time periods influence other periods), and dimensionality (whether spatial characteristics are important factors of the environment and the agent considers space in its decision making). Agent actions in the environment are typically mediated via an appropriate middleware. This middleware offers a first-class design abstraction for multi-agent systems, providing means to govern resource access and agent coordination.

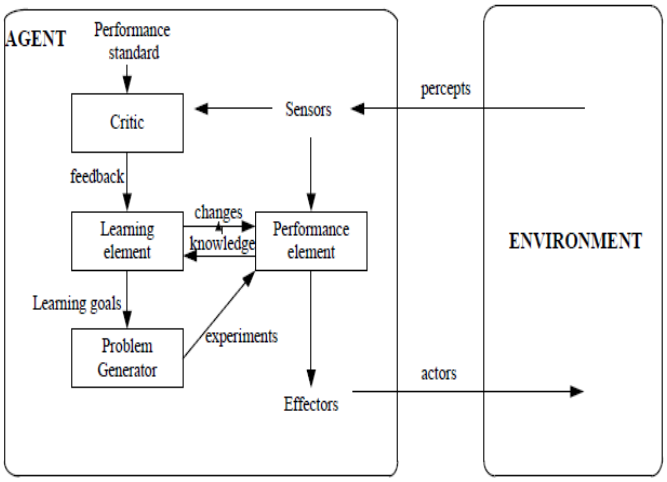

Figure 2. Learning agent.

MAS have interesting characteristics that meet the requirements. These are:

- Autonomy: the agents are at least partially independent, self-aware, and autonomous.
- Local views: no agent has a full global view of the system, or the system is too complex for an agent to make practical use of such knowledge.

- Decentralization: there is no designated controlling agent (or the system is effectively reduced to a monolithic system).

Multi-agent systems offer various advantages:

- Open source software.
- Platform independent.
- Benefits of flexibility and extensibility.
- Take autonomous decisions.
- Reduce the need for maintenance and processing of large data [6].

IV. DESIGN OF ONLINE-PAYMENT SYSTEM FOR ELECTRICITY CHARGES USING MULTI-AGENT ARCHITECTURE

This session presents the multi-agent framework for e-payment of electricity charges that is able to pay the charges by using e-payment via the bank services by the customer instead of traditional payment. The proposed system aims to integrate the bank service, the user and the electricity enterprise in real world. The overview framework of the system is as follows.

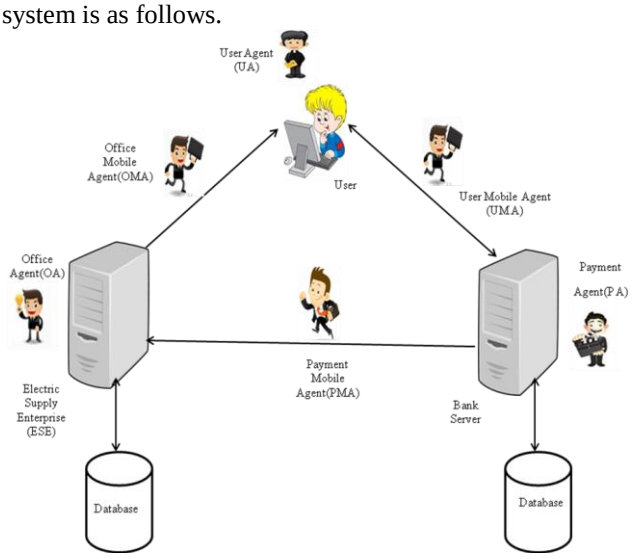

Figure 3. Overview System Flow for MAS of e-payment.

In this architecture, there are three main sites: Electric Supply Enterprise (ESE), User and Bank Server. The roles of these three sites are :

- Distribution Service of Electricity Pay Bill
- Information filling for payment and
- Payment Service By Bank

Firstly, the electricity supply enterprise (ESE) prepares the list for electricity pay bill forms by each month by means of agents. The Office Agent that is the stationary agent is used to check and collect the list of customers for electricity charges for each month from the enterprise database. The distribution service prepares the list of electricity pay bills given by the Office Agent. The Office Agent also receives the reply information for receipt that are returned by the payment service and records the list of customers that have already paid the payment for electricity units in each month.

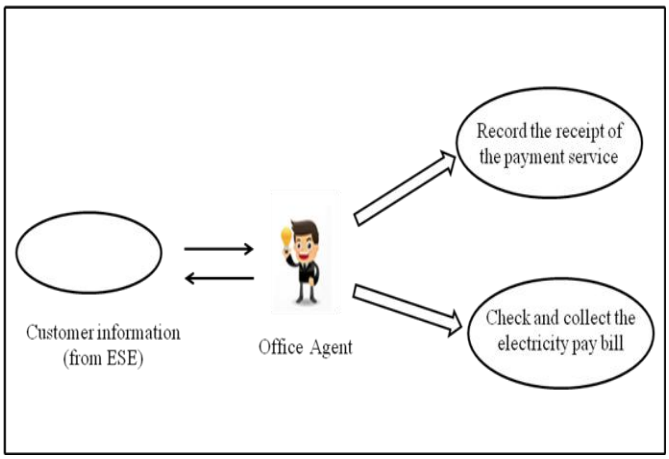

Figure 4. Office agent and its roles.

Subsequently, the Office Mobile Agent (OMA) is a mobile agent which can migrate to the customer sites and carries the receipts for payment to each customer relating to the ESE with the complete information given by the Office Agent. At that time, the receipts with the available information are sent to the respective users.

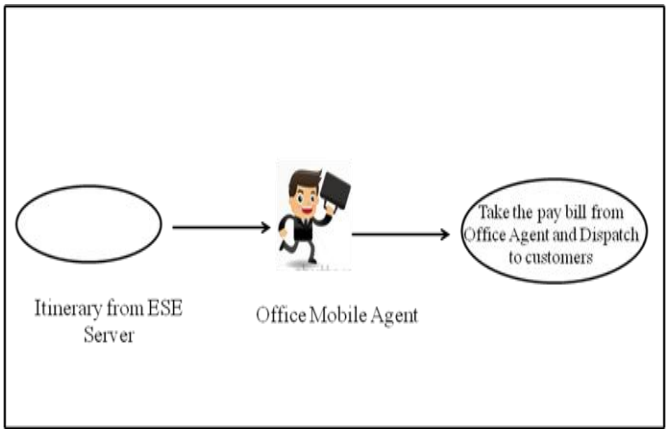

Figure 5. Office Mobile Agent and its roles.

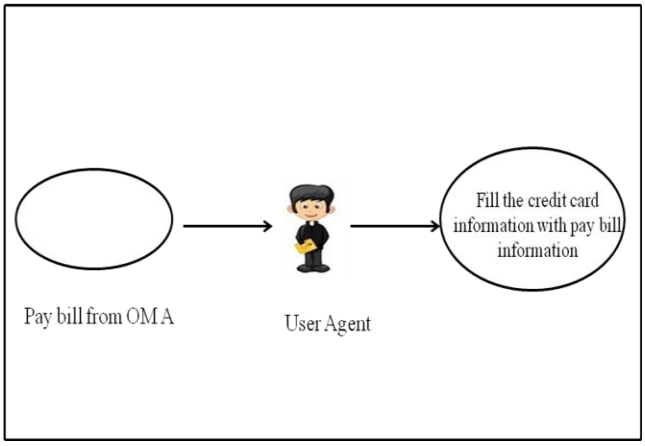

Figure 6. User Agent and its roles.

From the point of user sites, when the office mobile agent dispatches to each customer, the User agent (UA) receives

the receipt information such as ID no, name, township, month, meter units and amount of electricity charges and creates the User Mobile Agent(UMA). User mobile agent is the mobile agent that can migrate to the bank server by carrying the credit card information from the User Agent.

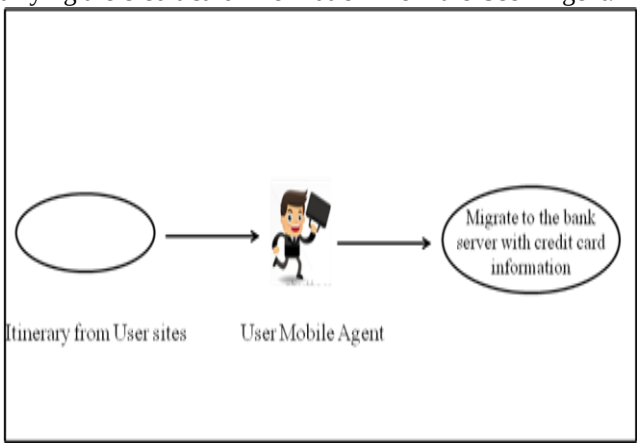

Figure 7. User Mobile Agent and its roles.

Thirdly, it is concerned with the bank server of payment service where the Payment Agent is responsible for perception of the credit card information taken by the User mobile agent and checking whether the card is valid or not and it has enough amount for pay bill.

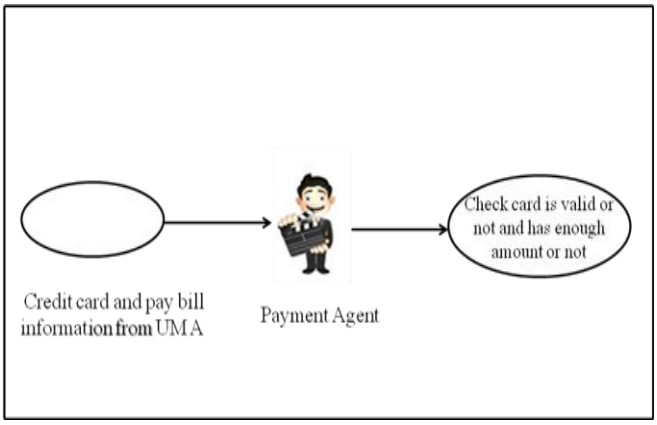

Figure 8. Payment Agent and its roles.

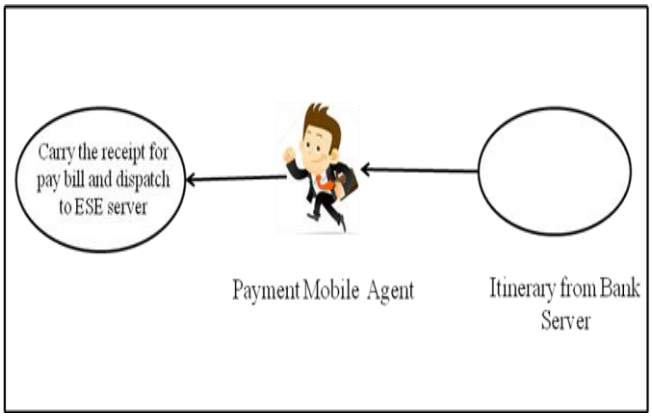

Figure 9. Payment Mobile Agent and its roles.

Subsequently, the payment mobile agent carries the receipts for pay bill from the Bank server to the ESE server. In this architecture, multi agents such as office agent, information agent and payment agent that are stationary agent and , office mobile agent, information mobile agent and payment mobile agent which are mobile agent work cooperatively and make the sense of information intelligently. Therefore, this proposed system save the human energy and time efficiently.

V. IMPLEMENTATION OF PROPOSED SYSTEM

The proposed system is implemented using Java based multi-agent technology (Aglet) and MySQL database. Some of the interfaces of the proposed system are presented in this session. At the ESE site, the main window presented by office agent can be seen as shown in figure 10.User must click "Task Assign for Meter Charge" button to get the invoice.

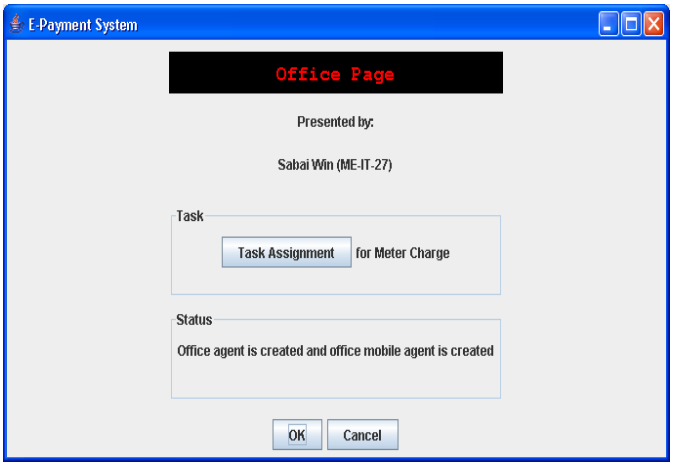

Figure 10. Main Window for Electric Supply Enterprise (ESE) Site.

The office agent creates and dispatches office mobile agent as shown in figure 11.After creating the office mobile agent, it carries the invoice such as ID-No, Name, Township, Month, Units and Total Amount given by office agent to user site. If the office mobile agent wants to go to user site, "Mobile to User" button must be clicked.

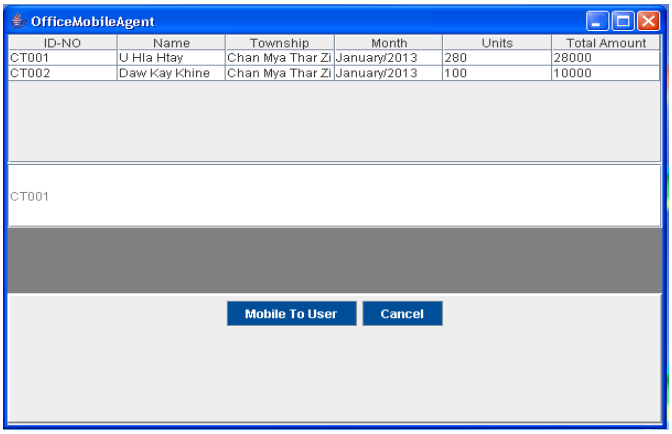

Figure 11. Creating Office Mobile Agent.

After arriving the office mobile agent at the user site, the alert box appears to get the information for meter charges as shown in figure 12. User must click the corresponding

buttons, to see the invoice and to go the bank for paying the bill. If the user wants to see the invoice, "View" button must be clicked. And, if the user wants to go the bank for paying the bill, "Go to Bank" button must be clicked.

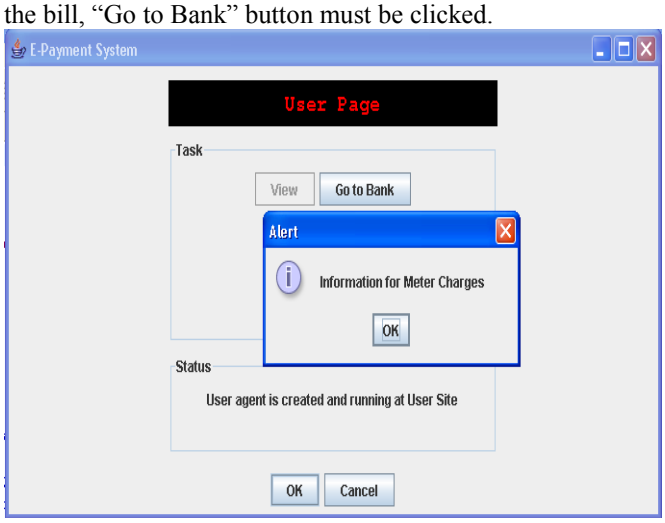

Figure 12. Main Window for User Site.

The user agent creates and dispatches user mobile agent to Bank site as shown in figure 13. After creating the user mobile agent, user fills the information for credit card such as bank name, card type, card number, payment amount and expire date. Then "Go" button must be clicked to move the bank site. After arriving the user mobile agent at the bank sites, the alert box appears to pay meter charges as shown in figure 14. User must click the corresponding buttons to pay the charges and to reply the successful messages. If the User wants to pay the electricity charges, "pay the charges" button must be clicked. And, if the User wants to reply the successful messages to ESE and User sites, "Reply Payment" button must be clicked.

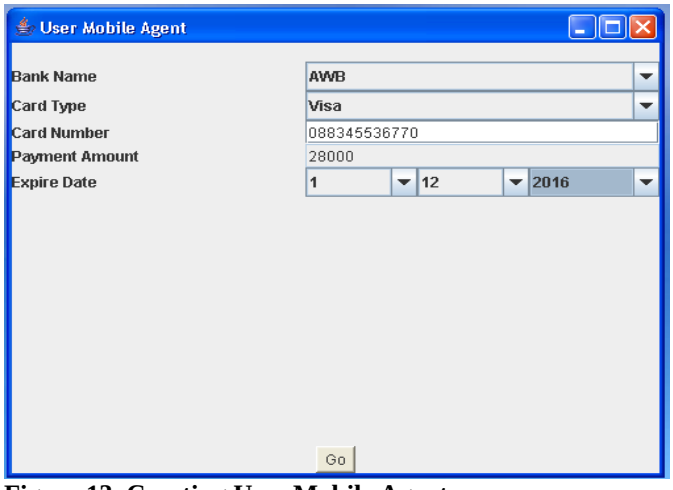

Figure 13. Creating User Mobile Agent.

If user pays the electricity charges, the information message appears as shown in figure 15. The electricity charges are paid to the bank server by payment agent. Finally, payment agent replies successful messages via payment mobile agent and user mobile agent to ESE and User site. Payment agent creates and dispatches payment mobile agent as shown in figure 16. After creating the payment mobile agent, payment agent provides the receipt to the payment mobile agent. Payment mobile agent carries successful message to ESE site.

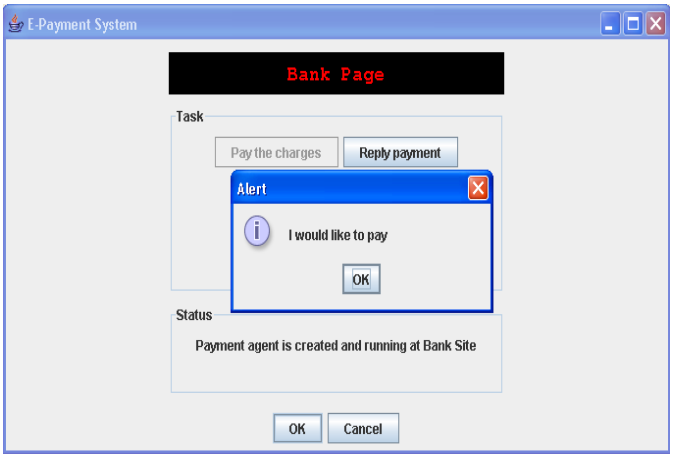

Figure 14. Main Window for Bank Site.

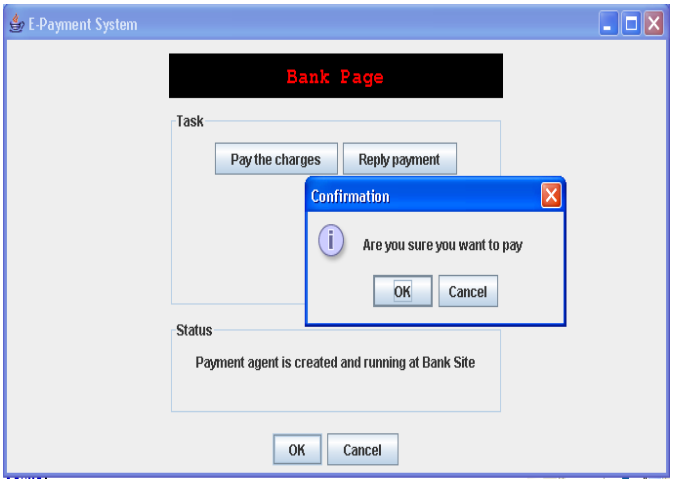

Figure 15. Paying the Electricity Charges at Bank Site.

Figure 16. Replying Successful Message to ESE site.

Also, the payment agent sends the successful message to the user sites via the user mobile agent that runs between user site and bank server as shown in figure 17. User mobile agent carries back the successful message to user site. Finally, the ESE sites and the user sites get the successful message from the bank server. Therefore, the system provides the multi-agent flow among three sites effectively.

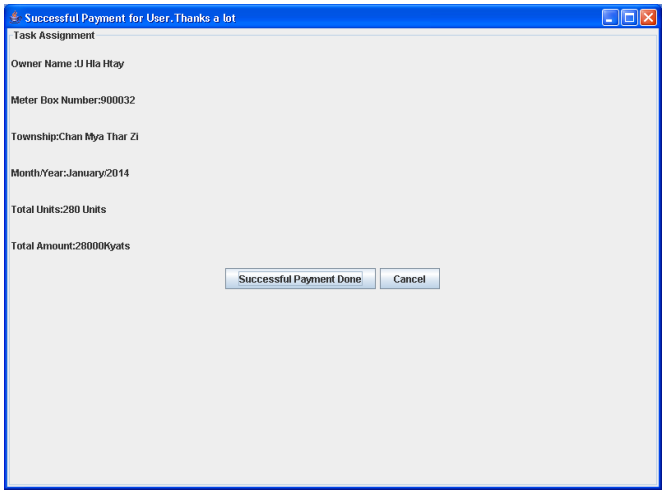

Figure 17. Replying Successful Message to User Site.

VI. CONCLUSIONS

The proposed system is online-payment system based on multi-agent architecture. The multi-agent architecture reduces the network load latency and network bandwidth savings. Cooperation of agents together each other makes the system reliable and save energy and time. The system makes the greater flexibility than existing approaches, paper usage and less staff administration time in the proposed online-payment system for electricity charges. Moreover, the proposed system organizes agents into different categories according to their functionalities and competences.

VII. ACKNOWLEDGMENT

First of all, the author is highly grateful to Dr. Myint Thein, the Pro-Rector of the Mandalay Technological University for his permission for completion of this paper. The author wants to express her gratitude to Dr. Moe Moe Aye for her help and advice regarding of this topic and excellent guidance, valuable suggestions and advices. The author is deeply thankful to Dr. Aung Myint Aye, Head of Department and all teachers from the Department of Information Technology at Mandalay Technological University for their overall supporting during the writing of this paper.

VIII. REFERENCES

[1] Sheng-Uei Guan, Sin Lip Tan and Feng Hua. "A Modularized Electronic Payment System for Agent-based E-commerce", Department of Electrical and Computer Engineering National University of Singapore 10 Kent Ridge Crescent, Singapore 119260.

[2] R.J. Subalakshmi, A. Das, and N.C.S.N. Iyengar. "A small e-health care information system with agent technology". In Computational Intelligence and Communication Networks (CICN), 2011 International Conference on, pages 68 –72, oct. 2011. 2, 4.

[3] Monia Loulou, Mohamed Jmaiel, Ahmed Hadj Kacem, and Mohamed Mosbah. "A conceptual model for secure mobile agent systems". In Computational Intelligence and Security, 2006 International Conference on, volume 1, pages 524 –527, nov. 2006. 3, 4.

[4] P.M. Vieira-Marques, S. Robles, J. Cucurull, R.J. Cruz-Correia, G. Navarro, and R. Marti. "Secure integration of distributed medical data using mobile agents". Intelligent Systems, IEEE, 21(6):47 –54, nov.-dec. 2006. 1, 3, 4

[5] [BJ04] S. Braynov and M. Jadliwala. "Detecting Malicious Groups of Agents". In Proceedings of the 1st IEEE Symposium on Multi-Agents Security and Survivability, Philadelphia, PA, August 2004.

[6] Wikipedia . "Multi-agent system", the free encyclopedia.

[7] Danny B. Lange, Mitsuru Oshima, "Programming and Deploying Java Mobile Agents with Aglets".