Verification of Mobile SMS Application with Model Checking Agent

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ABSTRACT
In years, the evolution of mobile SMS (Short Message Service) application is become one of the high demand technology which introduced fast service and cost saving. So due to this, the implementation of SMS as a platform for developing information services are available to enhance the way of system conducted. However, at certain limitation this increasing convergence has effected the performance of information services when system face the uncertainties and unprecedented risk. System become unstable and possible to errors which consequently reduce the user trust. Therefore, the trusted model system is extremely important to build dependable software system. So, this paper propose a model checking agent approach to handle the verification and validation of mobile SMS application to ensure the system correctness. First, we present the design of model checking agent architecture for checking to identify the validity of SMS message. Then, we formalize the proposed model with PROMELA specification for SPIN model checker which contributed to the quality and validity of the system. The model checking agent proposed is focused on the verification towards the mobile SMS application.

Keywords
Verification, Model Checking Agent, Mobile SMS application

1. INTRODUCTION
Nowadays, mobile SMS application is an important and growing current technology. It is a system that integrates mobile technology with information management system. This system used a Short Messaging Services (SMS) to enhance the performance of the system conducted. Towards the rapid development in e-business, mobile SMS application has taken an advantage to introduce the easy, fast and cost saving tools by using SMS as a medium for communication. By reducing the time consuming and human intervention, all processes are converted to SMS. However, there are several mobile SMS application has due to face the uncertainties circumstances when an extensive processes occurred [1][20]. The performance of system became unreliable during hectic time when users used the SMS application at the same time. Consequently, system has become unstable and unreachable to errors. Therefore, we proposed an integration of agent based and model checking method for verifying the architecture of the mobile SMS application that based on the desired requirement.

Practically, based on the experience, model checking is a formal verification that based on mathematical for specification development and verification of software and hardware systems. So far, this technique has proven for significant use in verifying a complex software system [2]. So, as in this paper, we believed that the model checking method has a potential values to be used for checking and verifying the model design and specification of the system. In this context, applying formal verification in SMS mobile application provide the quality and enhancement of design reliability to compete with digital environments. We have applied an agent based in the extended design of our test case study that has a potential approach to increase the performance of SMS application processes. According to [8], agents have an ability to sense, communicate and achieve the task at a given time once the knowledge are delivered. So, we aims to investigate the capability of our proposed model checking agent to verify the communication protocols. We designed an algorithm to verify the validity of the SMS message that based on syntax formality, data type checking and the time consume. The remainder of this paper is organized as follows. We present the preliminaries information of the proposed method in Section 2. The test case study in Section 3. Section 4 and 5 respectively, showed the design of system proposed and verification of model checking agent. The discussion and conclusion of our paper is presented in Section 6.

2. PRELIMINARIES WORK
2.1 Model checking Process
Based on previous research [10][11][13], model checking is a promising mathematical method that able to automatically verify some properties of the model of a system. This method is possible to prove the correctness of systems using temporal logics to specify a system properties. For model checking verification, we need an automata model to demonstrates the sequential of a system processes from one state to another under the action of transition [14]. Apart of that, the process of automata will be form the basis of the operational models that been used to specify the behavior of the systems that need to be validated. In our approach for mobile SMS application, we able to design and formalize the model checking agent into PROMELA specification for SPIN model checker to discover an uncertainties as well as sources of incompleteness. The SMS message properties of the system is verified with the formulation of property in the Linear Temporal Logic (LTL). This methodology of the
2.2 Agent Role for Verification & Validation

In recent years, agent technology has been rapidly developing to fulfill the needs of new conceptual tools for modeling and developing complex software systems [15]. This technology used an agent approach for design and modeling of crucial system by representing their components, behavior and interactions between them. Based on [6] agent is a computer system that is situated in an environment and capable to make autonomous action in the environment in order to achieve its design objectives. Therefore, in this paper we are presenting a model checking agent architecture to verify and validate the mobile SMS application. We formalize the model checking agent action using formal method to handle the SMS message in proving the correctness and the quality of the SMS message in the system. The capabilities of agents to perceive reason and act in their surroundings environments, also cooperate with other agents to solve complex problems [7] is one of the factors that we want to focus in this paper. Our proposed model checking agent will follows the set of requirement specification that are predefined by the user. This is to ensure that the model of the mobile SMS application is true based on the desired requirement or otherwise.

3. TEST CASE STUDY

We proposed our model checking agent in the SMS Management System in Direct Sales and Network Marketing to verify the quality of the SMS message. In SMS Management System, there are four modules which based on the main activities in the business process. The first module is registration, customer register as distributor, and distributor recruit new distributor as their sales force in down line. The second module is selling product. The third module is bonus calculation, which means the profit of calculation percentage in sales force on multi level. The fourth activity is group SMS modules that send out news regarding activities and seminars to motivate and recruit as many as distributor in sales force [1]. Figure 2 shows the modules of SMS system.

The architecture of SMS Management System [1] is shown in Figure 3.
out done the verification, the cost for maintenance possible be increase.

Therefore, this paper presents our proposed model checking architecture of purchase transaction for SMS Management System [18]. Our proposed architecture for SMS Management System is implementing the environment of agent based and model checking to check and verify the model of the system. Based on Figure 4, the distributor starts insert a SMS as the message input for purchasing of items with valid syntax. Then, the Distributor Agent (DA) will be received the message and send to the Model Checking Agent (MCA). This message will be verified by the MCA in order to check whether the message is meet the requirement specified. Otherwise, if the MCA detects the message is invalid, than the MCA will sent a notification failed status to the DA. Then, the Distributor (DA) will sent an acknowledgement asking for distributor ask to key in the message again. If unsuccessful, the message then will be violated. However, if the our proposed Model Checking Agent (MCA) checked and verified that the message is valid, the MCA will sent the details message to the Order Entry Agent (OEA) to create an order and place the purchase of the items with Account Management Agent (AMA). The OEA will sent an acknowledgement to the DA in order to notify the distributor that the message is successfully delivered. The database will be updated after the process completed by Product Server Agent (PSA). Here, agent plays an important role to ensure the data transaction is manageable and releasable during the delivery of messages.

5. VERIFYING MODEL CHECKING AGENT

SPIN model checker is a powerful tool for model checking [11]. In the design of our model checking agent, the process of checking is start once the Model Checking Agent (MCA) has received the SMS from the distributor. The process will always notify the distributor if the errors are still found in the SMS. The design of automata model for MCA is shown in Figure 5 and will be verified using SPIN model checker.

Based on Figure 5, eventually when the end state is reached, it implies every processes are successfully done by the SPIN model checker. However, when state $S = \{S_1, S_2, S_3\}$ is not accomplished, the transition has to be sent in back propagation to $S_0$. The state process continuously checking until the expression for each state satisfies the properties define in LTL. The process of verification and validation of SMS message in SMS Management System is be determined by MCA behavior. The specification of the model is been translated in PROMELA specification for SPIN model checker. The result of our design is represent as shown in Figure 6.

6. DISCUSSION AND CONCLUSION

In this paper we proposed a model checking agent to verify the mobile SMS application with the test case study. The mobile SMS application is designed in agent based platform and then be translated to PROMELA specification. We have shown the architecture of model checking agent and how agent check the SMS message in automata model based on syntax formality, data type checking and the time consume. Although the experimentation is still ongoing, the automatic verification of the properties on the mobile SMS application has been able to discover some inconsistencies. Therefore, the correctness of mobile SMS application is recommended than previous because our model checking agent managed to deal with the problem of communication protocol in the mobile SMS application.

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8. REFERENCES


