Linking Business Process Models and System Models Based on Business Process Modelling

Faisal A. Aburub

Abstract—Organizations today need to invest in software in order to run their businesses, and to the organizations' objectives, the software should be in line with the business process. This research presents an approach for linking process models and system models. Particularly, the new approach aims to synthesize sequence diagram based on role activity diagram (RAD) model. The approach includes four steps namely: Create business process model using RAD, identify computerized activities, identify entities in sequence diagram and identify messages in sequence diagram. The new approach has been validated using the process of student registration in University of Petra as a case study. Further research is required to validate the new approach using different domains.

Keywords—Business process modelling, system models, role activity diagrams, sequence diagrams.

I. INTRODUCTION

SOFTWARE can be considered as one of the important tools that support business running and development. Organizations today need to invest in software in order to run their businesses. For example, software can be used to reach more potential customers, streamline operations, improve efficiency and support better relationships with partners.

In order to meet the software's objectives, the software should be in line with the business process. Business process modelling is analytical representation of organization's business processes. Business process modelling is used to depict the current processes of organization to create a baseline for processes improvements and to design future processes with that improvements.

This research aims to derive system model based on business process model of a certain organization. Particularly, the research aims to use business process models in order to synthesize system models. Many studies have been developed to link business models to system models. Reference [1] proposed a semi-automatic model that transforms functional requirements of stakeholders to software requirements. The authors developed a new model based on enterprise model to meet software requirements of stakeholder. Reference [2] proposed a flow diagram that aims to explain the process of transformation business processes into functional software requirements and properties based on demand computing model. Furthermore, [3] introduced Systems Development Methodology for business process-oriented software systems (SDM-BPoSS). This methodology is rigorous, agile and consider web services such as remote and local web services.

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Moreover, [4] proposed an approach called BPMN MUSIM which aims to help experts using business process management notation BPMN in order to model business processes of a specific domain. This approach also improves the automatic transformation of business process model into functional software applications.

Reference [5] proposed a metamodel called secure business process (SBP), which aims to assist transformation of abstract business process model to lower abstract model of system model such as use case diagrams and class diagrams. The resulted models include abstract software requirements as well as abstract security requirements. They obtained rules that automatically transform SBP models into class and use case diagrams. Reference [6] argued that software applications life cycle has some problems and limitations, as it needs to cover required needs such as dynamics, flexibility, creativity and scalability. They focused on the dynamic view of business process in order to improve software development process. They indicated that dynamic case management can be used to support different types of activities in a certain organization such as semi structured, structured and unstructured activities. Reference [6] indicated that business process modelling improves the formulation process of functional requirements of ERP systems. They used a Greek manufacturing company as a case study to verify their approach. Reference [7] proposed unified business process modeling methodology (UPROM) that is used to generate useful information (artifacts) based on business process models such as requirements documents, process metrics list and business glossary.

The research aims to bridge the gap between system models and business process models by generating system models based on business process models. Particularly, we present a method that can be used to synthesize sequence diagram (system models) based on RAD (business process models model).

II. RAD MODEL OF THE STUDENT REGISTRATION PROCESS

We used the process of students' registration at University of Petra (Jordan – Amman) (www.uop.edu.jo) as an example to illustrate our approach. This business process has been modelled using RAD [8].

Fig. 1 shows the RAD model of the students' registration process in University of Petra. This research used the process modelling language RAD to model the students' registration process. RAD models are easy to understand, clear and easy to use by non-technical people. RAD models identify clearly the main roles (responsibilities), activities, interactions and

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decision points.

The main roles involved in the students' registration process are Student, Financial Department and Advisor. When the student wants to register, he/she has to pay the fees firstly to the financial department. When the student paid the fees, then financial department updates student account and allows the student to register. After that, receipt is generated for the student. If the student's GPA is less than two, then the student should visit her/his advisor. Otherwise, the student can register by logging in to her/his account through registration page. When the student accesses her/his account, he/she should select the studying semester (first, second or summer semester). After that, the student should select the classes. When the student selects the required classes, then the student can enroll in the selected classes. When the student enrolls in the selected classes, confirmation of enrolment will be generated. Table I describes briefly the roles, activities and interaction included in the students registration process.

III. AN APPROACH FOR LINKING BUSINESS PROCESS MODELS TO SYSTEM MODELS

Many organizations develop process models for their businesses in order to meet many purposes such as business process improvement, process reengineering and TQM. This approach can be used to link between business process models and system models. The link between business and system models helps the organizations to develop information systems fit to its business processes, which will make organizations benefit from its information systems to achieve its work. Our approach includes the following steps:

A. Create Business Process Model Using RAD

The objectives of creating business process models using RAD are to understand processes of such an organization. RAD shows an organization as a set of activities, roles and interaction. In addition, RAD shows how the information flows within the organization. These explain how the origination carries out its business process to achieve its goals. Fig. 1 shows RAD model of students' registration model in University of Petra.

The objective of students' registration process is to register students smoothly, easily and electronically. Students' registration process is part of University of Petra business processes. This process has been modelled and understood using mainly interview and observation. Students' registration process has been selected to illustrate our approach as it small, clear and provides necessary details such as roles and activities.

B. Identify Computerized Activities

According to [10], activities in RAD models are classified into computerized activities that are carried out using computer systems and non-computerized activities which are carried without using computer systems. Fig. 2 shows RAD model of students' registration process with bold boxes to represent computerized activities and normal boxes to represent non-computerized activities.

C. Identify Entities in Sequence Diagram

UML is considered as a formal standard language for system modelling and largely used by software and computer industry. According to [9], sequence diagram illustrates how the entities interact in a system. Sequence diagram consists of main three items: Entities, messages and lifelines. Interaction between entities is represented by messages that are transmitted from one lifeline which called transmitter to another lifeline which called receiver. Fig. 2 shows the sequence diagram of students' registration process.

Sequence diagrams are used in this research to represent system model as sequence diagrams are clear, easy to understand by most stakeholders such as decision makers, end users, system and business analysts and managers.

In order to develop sequence diagram, we have firstly to identify the entities of the sequence diagram. Entities can be identified as:

- Convert each role in RAD model into an entity in sequence diagram. Fig. 2 shows that the roles student, Finance Dept and Advisor in RAD diagram shown in Fig. 1 have been converted into entities.
- Also, convert each computerized activity in RAD model into an entity in sequence diagram that can be used to perform that activity. Fig. 1 and Table I show computerized activities in RAD model, which have been converted into entities in sequence diagram that can perform those activities. Those entities are: Student account, semester, classes, and enrollment as shown in Fig. 2.

D. Identify Messages in Sequence Diagram

Messages of sequences diagram can be derived based on interactions and computerized activities included in the RAD model as:

- Interactions: Convert each interaction between roles in the RAD model, into message between entities that represent the roles in RAD model. For example, interaction between roles student and financial dept. in RAD model shown in Fig. 1 has been converted into message between entities student and financial dept. as shown in Fig. 2.
- Computerized activities: Convert each computerized activity into message between entity that represent the role that hosts that computerized activity and the entity that can be used to perform that activity. For example, computerized activity "Log in to student account" can be converted into message called "Login" between the entity (student) that represents the role that hosts the computerized activity "Login to student account" and the entity (student account) that can be used to perform computerized activity "Log in to student account". Table II shows all steps that can be used to convert RAD model shown in Fig. 1 into sequence diagram shown in Fig. 2.

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TABLE I
STUDENTS REGISTRATION PROCESS: ROLES, ACTIVITIES AND INTERACTIONS

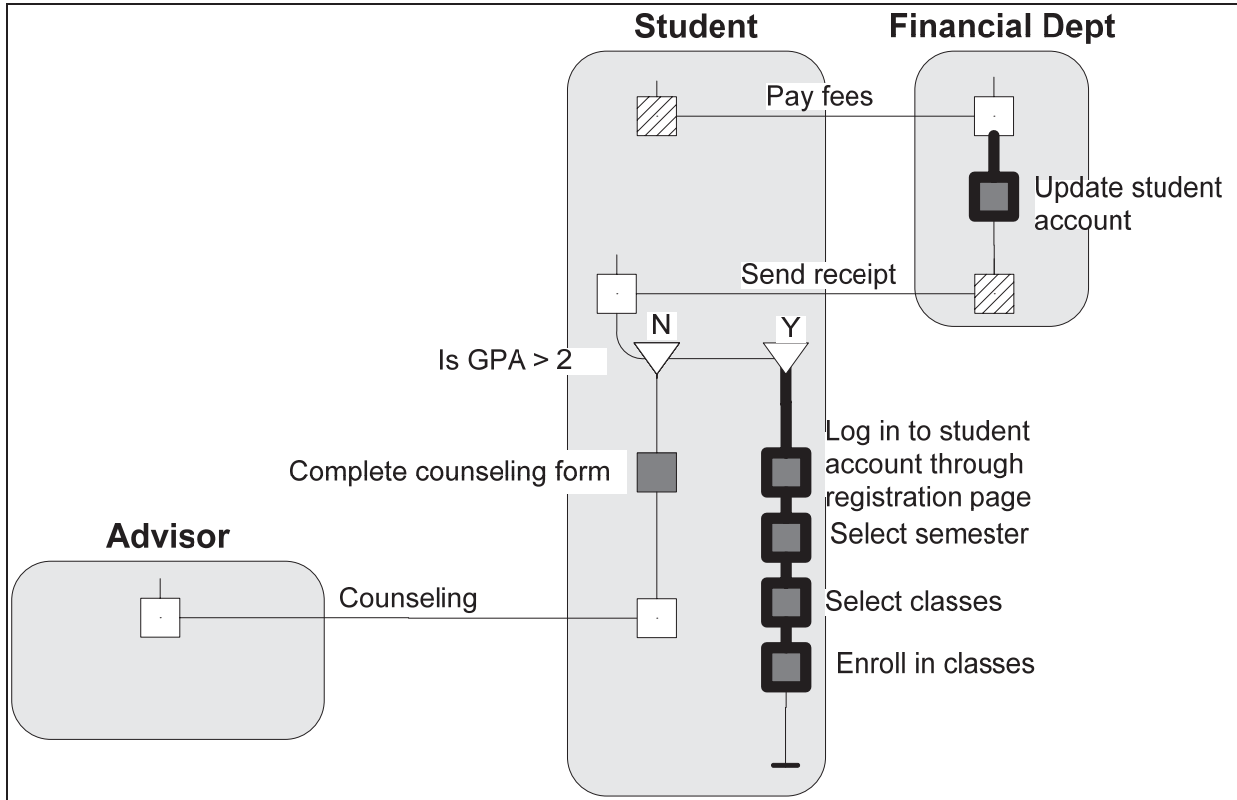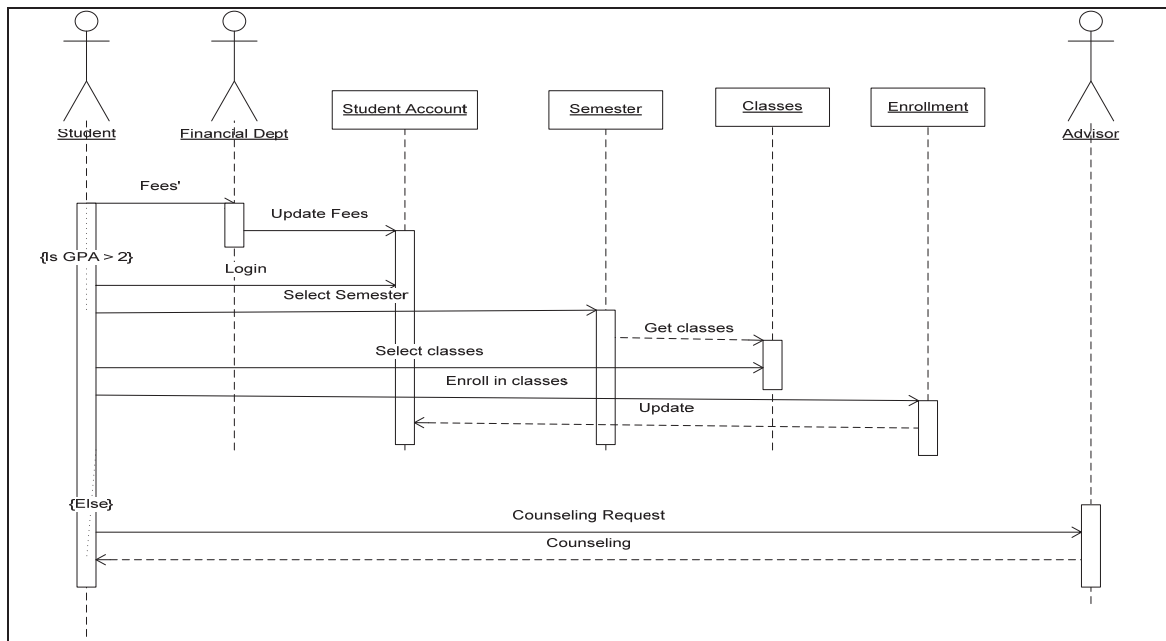| Roles	Activities	Interactions
Student	Log in to student account through registration page, select semester, select classes, enroll in classes and get enrolment confirmation.	Financial Dept.
Financial Dept.	Update student account	Student

Fig. 1 Process of Students Registration

Fig. 2 Sequence Diagram

TABLE II
STEPS OF CONVERTING RAD MODEL INTO SEQUENCE DIAGRAM

Identify Entities in Sequence Diagram		
Steps	RAD Model	Sequence Model
Roles		**Entities**
1	Student Role	Student
2	Financial Dept.	Financial Dept.
3	Advisor	Advisor
Computerized Activities		**Entities**
4	Log in to student account through registration page, update student account	Student Account
5	Select semester	Semester
6	Select classes	Classes
7	Enroll in classes	Enrollment
Identify Messages in Sequence Diagram		
Steps	RAD Model	Sequence Model
Interactions		**Messages**
1	Pay fees	Fees
2	Counseling	Counseling Request
Computerized Activities		**Messages**
3	Log in to student account through registration page	Login
4	update student account	Update Fees
5	Select semester	Select semester
6	Select classes	Select classes
7	Enroll in classes	Enroll in classes

IV. CONCLUSION

The paper addressed a new approach that aims to link process model and system model. Moreover, the research demonstrated how to link RAD model and sequence diagram. The process of student registration in University of Petra has been used in this paper as a case study. We proposed four steps to link process model and system model namely: create business process model using RAD, identify computerized activities, identify entities in sequence diagram and identify messages in sequence diagram.

The new approach aims to bridge the gap between process models and system models. Furthermore, one of the objectives of this method is to develop system model based on process model, which makes the resulted system model in line with process model. Moreover, the proposed approach helps to design system model on early stage without applying system development life cycle steps and approaches, which is mainly expensive process.

In future research, we plan to validate our approach using different domains such as healthcare. Moreover, further work is required to develop tool for analyzing RAD models and linking them to system models, which has in this paper been performed manually.

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