An approach to requirements elicitation and analysis using goal

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Abstract— **As systems get complex, the requirements elicitation and analysis are becoming difficult. Though different methods and approaches are proposed, most of them follow traditional approaches which consume more amount of time to elicit, and analyze the requirements. Hence we propose an approach to elicit and analyze the requirements of complex software systems which is very simple and effective. This approach includes elicitation rule and requirements analysis process which are used to better understand the complex requirements of system and obtain refined requirements. Using this approach we can obtain not only the refined requirements but also input requirements. Even though this approach perfectly suits agile software development, it can be used for any other software development methods also. A case study approach is then used to explore the effect of proposed approach.**

Keywords-Requirements, elicitation, refinement, stakeholder

I. INTRODUCTION.

The requirements for a system are the descriptions of the services provided by the system and its operational constraints. These requirements reflect the needs of customers for a system. The process of finding out, analyzing documenting and checking these services and constraints is called requirements engineering.[1]. Requirements analysis is one of the important activity in requirements engineering. Requirements analysis is a process in which the purpose and functionalities of a system are elicited and modeled. The more complex software systems grow, the more important the requirements analysis becomes. However, requirements analysis is a difficult process, because different stakeholders have different requirements and they may express these in quite different ways. This makes developers misunderstand the system requirements and cause a great deal of confusion. There have been several requirements analysis methods such as goal-based analysis, scenario-based analysis, coupling goal with scenario, and use case driven analysis etc. Each method has its own strengths and weaknesses. If one uses only one of these approaches, it is probably difficult to understand the requirements of the system completely and correctly. This may cause to get failure during system development. Additionally, these methods do not support the requirements elicitation process well. For successful software development, we need the requirements analysis method to be able to elicit and analyze the requirements of complex software system from all perspectives. Hence, we propose an approach that facilitates the elicitation, analysis, and understanding of the various dimensions of requirements of complex software systems. This paper consists of five sections.

Following the introduction, section 2 briefly describes the existing methods for requirements analysis and their strengths and weaknesses. The proposed elicitation rule and requirements analysis approach is discussed in section 3. Section 4 discusses how the approach has been applied in developing Library management system. Section 5 provides conclusion.

II. RELATED WORK

Various requirements analysis methods have been proposed in the literature with refined tools supporting the requirements analysis processes. The popular methods used widely are goal based analysis (GBA) [2] scenario-based analysis (SBA) [3] coupling goal with scenario (Coupling) [4] and use case driven analysis (UCA)[5].In Use-Case driven analysis, requirements are represented using the basic unit called “use case”. A use case represents the functional requirements of the system. It helps the developers to understand easily how the system is structured and how it functions. However, these use cases presents more of the developer oriented requirements than user oriented requirements. Another drawback is that UCA cannot effectively support the requirements elicitation process. In the case of scenario-based analysis, requirements are analyzed as scenarios familiar to users. Scenarios are generated by interactions between actors in a particular context. . Goal represents the whole system requirements and is very abstract. As goals are high-level abstract requirements, this method helps us to understand the whole system requirements, but it is very difficult to identify an initial goal. The Coupling approach uses a set of systematic activities that refine goals and generate scenarios. But, this method also has problems in that it is difficult to identify an

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initial goal and there is no way to validate scenarios. This method uses a top down approach, so it has the possibility to miss specific requirements. To overcome these problems we proposed an approach which includes an elicitation rule and requirements analysis process. Using the rule we can elicit the requirements from multiple views of stakeholders and using the process we can refine the requirements to the extent possible. It does not need any modeling. So that by using this approach we can cover multiple views, we can save more of system development time compare to traditional approaches, and at the same time it supports agile software development.

III. REQUIREMENTS ANALYSIS APPROACH.

As the complexity of software system increases requirements elicitation and analysis are becoming increasingly difficult in software development. Requirements elicitation and analysis may involve a variety of people in an organization. The term stakeholder is used to refer to any person or group who will be affected by the system directly or indirectly [1]. Single view forces us to look at the requirements only from a particular perspective. In order to elicit and analyze requirements completely multiple views needs to be considered to meet all stakeholder expectations. Even though different methods have been proposed each method has its own strengths and weaknesses. Hence we proposed a generalized approach based on stakeholders view.

This approach includes elicitation rule and requirements analysis process. Rule is used to gather requirements from multiple views of different stakeholder and requirements analysis process is used to refine the requirements to the extent possible. Using this approach we can identify input requirements which are not addressed in previous approaches. The main objective of this approach is to find out input requirements which are very useful to the end users of the system.

Each <user> wants the <system> to do <something> for <him> [10]

To do <something> for <him> <system> needs to input the <data/information> by the <user>. Based on the above information we proposed rules. The fundamental system operation is shown in Figure 1. The forward flow shows the system operation which can be described by the following rules:

- <Who> is responsible to input <what> into the system and <how>
- Data/information go through a series of processes in the system, either interact with database or not;
- Through a series of processes, system outputs <What> to <Who>, and <How>.

Key words like <who>,<what>,<how> are variables which can be assigned for specific words in the given context. Each of them is a set consists of finite members.

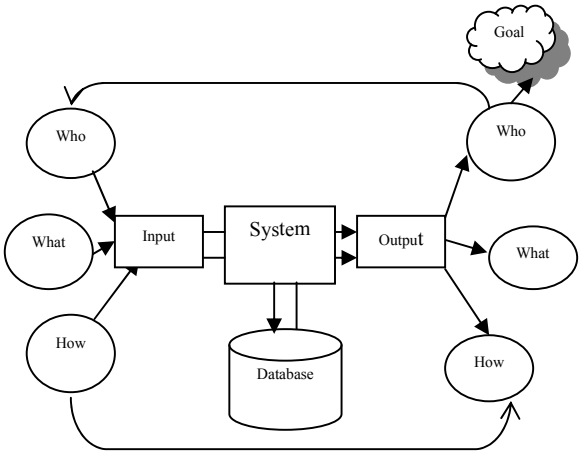

Figure 1. system operation model

The requirements elicitation process can be derived from the backward flow of the model, starting from the goal of <who>, through output unit, processes and data structure, to input unit.

For the System, key words are, in particular, set as followed:

Who: Stakeholders

What: data or information

How: interface

The fundamental unit of system operation process can be depicted in words:

- <Stakeholder> inputs <Data/information> to the System through < interface>;
- Data will be processed following a series of steps, then alternatively be stored in a database a according to a designed data structure;
- Through a series of processes, System outputs <Data/information> to <Stakeholder> through <interface> to meet the goals of <Stakeholder>.

Similarly, we can gather the System requirements following the rule:

- To satisfy the goals of <Stakeholder>, specific < Data/information> needs to be output through < interface>;
- To generate output <Data/information>, necessary processes data extracted from database or input unit has to be figured out;
- <Stakeholder> who is responsible for Input, <Data/information> what to input, and < interface> how to input, has to be confirmed.

From a system engineering point of view, stakeholders, goals, data/information, , data structure, and interface are all interacting or interdependent elements of the system. System requirements are composed of such elements.

Therefore we propose a process for System requirements analysis which is shown in Figure 2

The requirements analysis process can be divided into the four steps as follows.

Step 1: Identify the key stakeholders of the system.

Step 2: Generate the goals from Stakeholders based on developers' Knowledge and experience.

Step 3: Decompose the goal into sub goals /initial requirements and map each sub goal the proposed requirement elicitation rule.

Step 4: Refine each requirement one by one until all input requirements are generated.

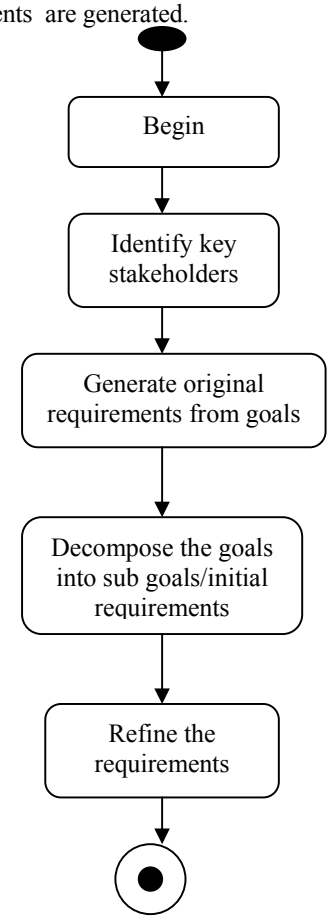

Figure 2. Requirements analysis process

IV. CASE STUDY

In this section we have shown how the proposed approach helps to get input requirements from goals and initial requirements. We considered one case study i.e. online library system. This system may have different goals from different perspectives. so if we can consider all stakeholders views of library system then we can identify their goals based on their specifications.

Here we considered one such stakeholder is student. The common goals are "login", "search book", "barrow the book", "return book". From these goals we need to generate initial requirements which are used to achieve the goal.

To generate initial requirements decompose the goals into sub goals. For "search book" goal initial requirements are "search book by title", "search by author", "search by ISBN" . Then map each initial requirement to proposed requirements elicitation rule. By this we can acquire input requirements like what information he is inputting to the system like enter user name and password, choose the tile, provide the payment details, provide the address information etc.. Which is shown in table 1? From figure 3 we can see how the abstract requirements level one are refined in level 2 as well. Refinement is nothing but process of elaboration [9]. Hence we can say that by using this approach we can refine the requirements and find the input related requirements without putting much effort.

Advantages of this approach are

1. Fits into agile S/W development
2. No analysis modeling is required so that we can save time
3. Since input related requirements are found, the Probability of user acceptance of software is more .
4. All the initial requirements are found by considering multiple views hence no loss of information. By applying rules input related requirements are found. Hence all possible types of requirements (functional) are covered.
5. Initial requirements along with input related requirements acts as validation criteria to be included in SRS

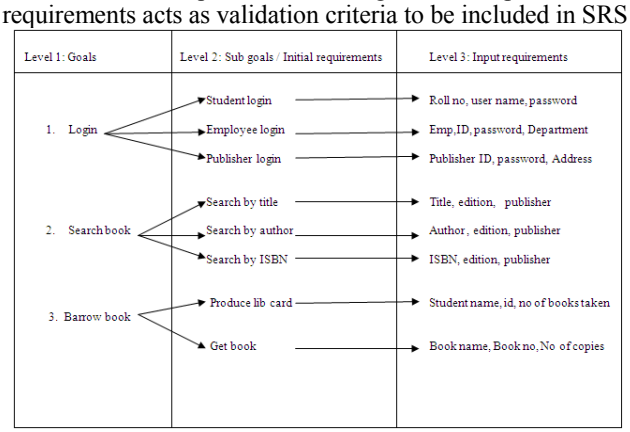

Figure 3. Requirements analysis sample approach

TABLE I. REQUIREMENTS ANALYSIS SAMPLE

System	Library management system
Stakeholder	Student
Goals	Login, view catalog ,search book, Barrow book, return book,
Sub goals/Initial	Student login ,Employee login, Publisher login ,

requirements	view by subject, view by course, view by , publisher Search book by author , Search book by title ,Search book by ISBN, Produce lib card, Get book
Input requirements	Provide roll no, user name , password, , provide employee ID , password, Department provide publisher ID, password, address, provide subject name, course name,, publisher name, provide the book title ,edition, publisher, provide author name, edition, publisher, provide ISBN, edition, publisher, provide student name, id, no of books taken, provide book name , books issued, issue date, fine for no days

V. CONCLUSIONS

In this paper we have proposed a practical approach to analyze the requirements of software system, with requirements elicitation rule and requirements analysis process. This approach mainly bases on stakeholder view. As it considers the stakeholders view we can use this approach for any system and for any stakeholder. This approach does not require any modeling. Using this approach we can gather all possible requirements from all stakeholders without having any difficulty and we can obtain input requirements. Using our approach we can elicit and analyze the requirements in short span of time. This feature causes to use this approach in agile software development. Our future work focuses on identifying relationships and conflicts among requirements.

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