FRAMEWORK DEVELOPMENT OF FUZZY SOFTWARE

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Abstract

The incompleteness and uncertainty difficulties that define the software release planning problem contribute to the problem's complexity. The computer intelligent fuzzy logic technique may be used to efficiently manage incompleteness and uncertainty concerns. Although numerous approaches to dealing with incompleteness and uncertainty have been offered, they are all focused on optimization techniques.

Keywords Fuzzy rule-based system, Uncertainty, Fuzzy logic, Software release planning.

1. INTRODUCTION

In today's society, software development activities are critical. As internet technology becomes a more integral part of our lives, the demand for trustworthy, effective, and appealing software products is growing (Information Resources Management Association 2013). The major disadvantage of experience-based software release planning strategies that rely on human experience is that they are unable to accommodate the problem's complexity and high degree of unpredictability.

This research makes a contribution by proposing a unique framework for dealing with the uncertainty and incompleteness information in the software release planning problem using an intelligent method like a fuzzy rule-based system. In addition, the suggested framework will address the software release planning problem's flexible time intervals kind of time horizon constraint.

2. RELATED WORK

This section shows how many release planning research papers have emphasised the need of including intelligent support tools and the variable time intervals issue into the release planning problem.

(Greer, D. and Ruhe, G 2004; Ruhe, G., and Ngo. - repetitive solution method. EVOLVE and its extended family of development algorithms addressed the data uncertainty of the release

planning models and proposed a very limited range of solutions. Then, a person as a decision maker based on his or her experience and knowledge should evaluate solutions and make a final decision.

FRBS is a created system that utilizes the power of the mysterious mind, which is the ability to decipher real-world news using obscure sets, such as the problem of editing software (not quick sets).

OVERVIEW OF PROPOSED FRAMEWORK

This section describes the technologies that are used in the proposed framework for software release planning. One of the technologies involved is a method for planning a high-quality software release. The technologies involved include a fuzzy rule-based system, a release planning model, and an online questionnaire.

Stakeholder complaints are the proposed framework's contribution. P-thresholds (set by the project manager) must be reviewed after gathering stakeholder complaints before making a final decision. Ruhein's approach to "the art and science of software release planning" is used in the processing phases (Ruhe and Saliu 2005). Experts are utilised in the art process to examine and validate the generated strategy as well as evaluate the usefulness of the provided framework. The following three steps make up the processing stage:

Phase 1: Requirement elicitation and release planning modeling based on online questionnaire andrelease planning factors.

Phase 2: Development and distribution of a fuzzy rule-based system based on the data obtained in the preceding phase.

Phase 3: Expert opinion depending on the circumstances of the case.

3.1   Phase 1: Requirement elicitation and release planning modeling

3.1.1   Requirement elicitation

The process of eliciting requirements begins in the early phases of requirement engineering. The examination of software release planning revealed that each software project has distinct sorts of stakeholders, as well as varied timetables and locations. As a result, organising a session to gather and categorise demands for all identified stakeholders is a tough task.

One of the necessary and legal options for dealing with different schedules and locations is the online questionnaire (Dennis, Wixom, Roth 2008). The online questionnaire is used as an official tool that has helped to explain, clarify, and prioritize (based on stakeholder

preferences) effectively. Therefore, the online questionnaire can support the specification of needs and the challenge of prioritizing software release (Ruhe, G 2005). As the online questionnaire is accessed through a web browser for participants who choose a visual environment using their personal computers, the online questionnaire minimizes the threat of being filled with incorrect data (participants may not work as they would in a real world). Also the online Questionnaire offers new unique capabilities such as inserting mixed media images and audio into a test tool (Dennis, Wixom, Roth 2008). In addition to the online questionnaire, the method of requesting document analysis can be updated to support the request process.
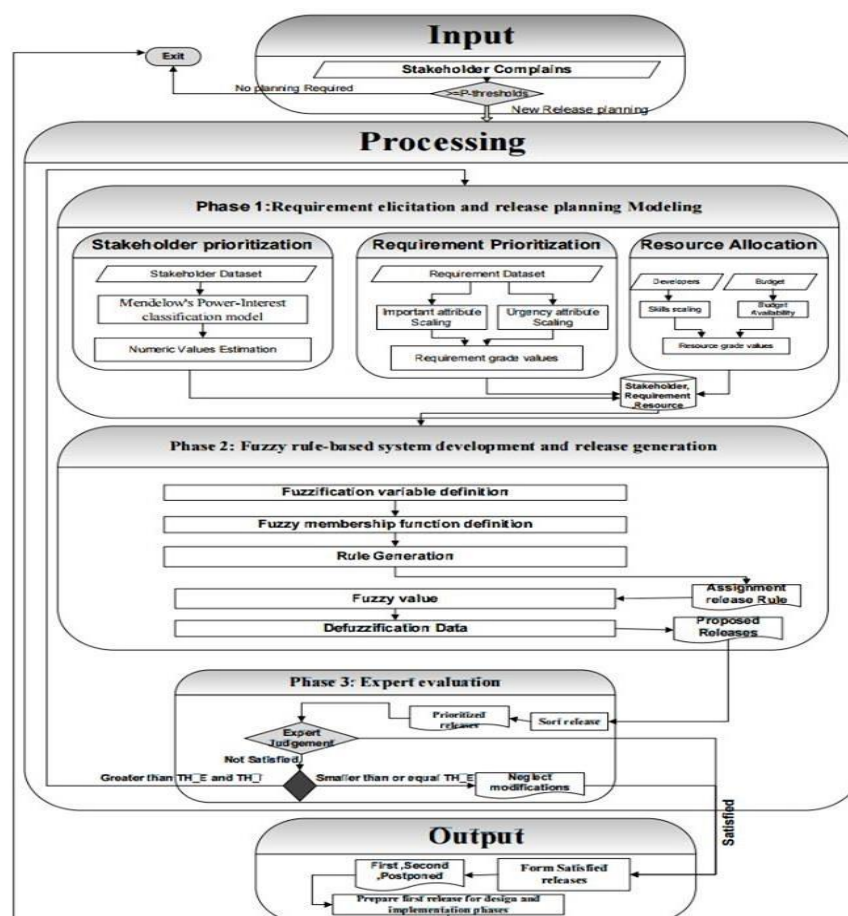

Fig 1. Proposed software release planning problem framework

3.1.2 *Release planning factors*

The following are the most important release planning elements and qualities to consider while building a fuzzy rule-based system to solve the software release planning problem:

Release date expected in the future: It has been found that merely preparing for one release is insufficient. Stakeholder dissatisfaction/disappointment as a result of their highly ranking

criteria not being included in the next release and no strategy to add them in the future (Danesh A.S. and Ahmad R 2012; Elsaid et al. 2015). Each need is allocated to one of the following instances in the proposed framework provided in this paper: first release, second release, or postponed requirements. The fuzzy rule-based system's output is the assignment of each need (based on the following release planning modelling elements).

➢   **Stakeholder priorities:** In order to solve the problem of planning a software release, a different group of stakeholders must be involved and all these stakeholders are equally important, and they must be different. By the proposed framework presented in this paper, all participants were categorized and prioritized according to the model presented in (Elsaid et al. 2017).

➢   In the model presented in (Elsaid et al. 2017),

➢   In order to differentiate and prioritize participants, a non-verbal integration approach is used with Mendelow's Power-Interest model. First, individual participants were divided into one of the model classes of Mendelow's Power-Interest 1) high power / high interest, 2) high power / low interest, 3) low power / high interest, and 4) low power / low interest. Then, in order to avoid having all the participants fall into the same category, each individual participant gets a significant level of membership in his or her pre-determined category. The output of that model is an accurate listing that prioritizes participants. The priority list of participants is considered to be included in the developed rules based on the ambiguous rules.

➢   **Requirement Prioritization**:

Each participant assigns a value or benefit to each requirement. For each requirement, a minimum, average, and maximum rating is required, and a range of the selected scale is given.

Emergency services: The time to go to the market is encouraged and participants are provided for each need. The participant decides to exclude where each requirement should be applied (first version, second version and postponed). Then, the distance is assigned to each selected version.

The significance and emergency values of the numbers of each requirement taken from participants' opinions are considered to be the inclusion of an unambiguous rule-based system.

➢   **Resource Constraint:** While allocating needs to multiple releases, a project manager must consider various resource restrictions and requirements dependence (coupling and

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precedence relations) (Ngo-The, A., Ruhe, G. 2009). All forms of resources may be categorised into the following categories:

➢ Human Resources: Various sorts of developers who are capable of carrying out the duties required to generate the needs.

➢ The effort and money resources are taken into account in the suggested framework.

➢ A low, medium, and high skillingscale is required for each developer, and then a grade is assigned to each developer depending on the specified skillingscale. The budget limitation is also evaluated according to its availability.

Planning a new release without consultations

The project manager can take a decision for planning a new release without consulting high-powered stakeholders if one or both of the following cases occur:

➢ If the ratio of the complains given by the stakeholders who are classified as high power-high interest or high power-low interest to the total numbers of complains given by all stakeholders is greater than or equals a percentage threshold (P1-Thershold).And this ratio of stakeholders complains that the existing software requires new requirements and rank the criticality of these new requirements as very high or high.

➢ If the ratio of the complains given by the stakeholders who are classified as high power-high interest or high power-low interest to the total numbers of complains given by all stakeholders is greater than or equals a percentage threshold (P1-Thershold). And this ratio of stakeholders complains of current software release bad services, and so it requires enhancements for existing requirements and ranks the criticality of these enhancements as very high or high.

3.2 Phase 2: Fuzzy Rule-Based System Development and Releases Generation

The basis of an incomprehensible law-based system is a clever computer-based intelligent system. Fuzzy logic, introduced by Zadeh, is another clever mathematical method of managing the uncertainty and imperfection of knowledge (Zadeh, LA 1965). An obsessive-compulsive system is the fizzy inference system (FIS) (Jang, J.S.R 1993). Next, the values to be executed will be negligible to determine the release of each requirement. The steps that lead to the creation of a fuzzyrule-based software product production system are as follows:

Flexible description to be summarized: The output of the previous section is considered the input variable to construct an incomprehensible rule-based system. These variables include

stakeholder priorities (stakeholder prioritization list), prioritization requirements (critical and urgent range values), and resource limit (resource level values). Variation of system effect based on incomprehensible rule for future expected release (first release, second release, or postponed requirements). Domains (flexible sets) for all fuzzyrule inputs and outputs are defined. The values in these sets are not clear using the appropriate membership function (Mougouei, D., H. Shen and Babar M.A 2015; Ramzan, M. 2010).

3.3   Phase 3: Expert Evaluation

By finding a solution based on an incomprehensible legal system, a set of requirements is assigned to the first release, second release, or deferred requirements. After that, he can decide his final decision which he may design and apply the next release or fix an incomprehensible legal system solution.

An expert decision can be satisfied or unsatisfactory with an unambiguous system-based system solution; first release, second release, or postponed requirements.In the case of an unsatisfactory decision, the most important changes transfer the value of the requirements from or to the first release (and what will be designed and implemented).

Before starting the specialist evaluation process, the project manager must determine the TH_E threshold that can be defined as a predefined percentage of the total number of requirements given for the first release (subsequent issuance) found in section 2. When the specialist specifies the percentage TH_E, then the first release is transferred to the design and implementation phase (ignoring expert opinions). If the total number of conflicting needs their available resources is greater than TH_I (cross-border limit determined by the project manager), then the expert data obtained is added to the data collected in section 1 and the proposed framework restarts from scratch. If not, If the total amount of conflicting requirements is less than TH_I or their resources are not available, then the project manager has a responsibility to decide whether to restart the proposed framework from scratch or to ignore expert opinions.

4. EMPIRICAL EVALUATION: UPDATING FACULTY WEBSITE CASE STUDY

Motive: A real-world project, a smart website plan, is underway to ensure the proposed framework presented in this paper. According to the proposed framework P-thresholds are assessed if new releases are required. After checking the P-thresholds, the faculty information technology unit receives a message system warning that requires "planning a new release".

Extensive in-depth research and analysis of unit staff and student grievances were conducted. The result of the analysis is that the website intelligence system does not have the necessary requirements and needs to be updated and upgraded very quickly.

1-Establish project objectives: to revitalize and improve the faculty website to improve the services provided.

2-Find your participants: In the unit, participants are people who may be affected, affected, or appear to be affected by the decision, function, or outcome of the website.
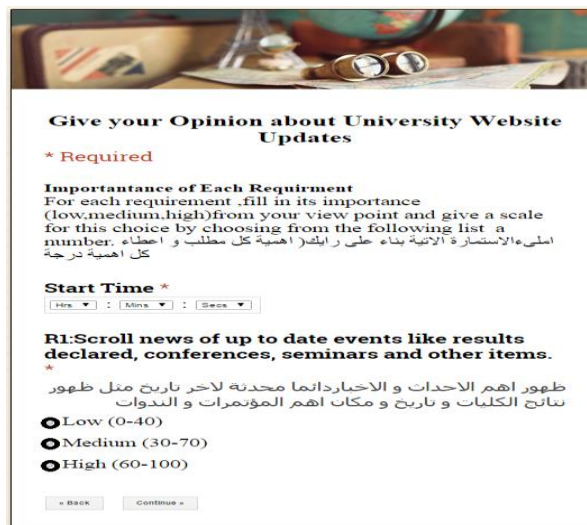
3-Create questionnaire: The questionnaire consists of three parts; The first part is to collect personal information for each participant such as name, professional position, final certificate, etc. The stakeholder prioritization model presented in (Elsaid et al. 2017) will be used to generate significant stakeholder lists based on collected stakeholder information.

The second part is the proposed requirements and its priorities. To prioritize in terms of value; each participant should decide whether the requirement is important, very important, or very important.

The third part is about the existing intelligent resource allocation process. The facultyis is a non-profit organization; it depends on its limited resources. The resources available in this case are: 1) effort: skilled engineers, 2) budget: available software and hardware.

4-Conduct interviews: A modified online questionnaire link is sent or posted to the designated stakeholder contacts. The interactive questionnaire is also prepared for those who do not have access to the internet or those who need more information.

5-Analyze data: All responses are automatically saved to the sheets for easy analysis. All answers can easily be used to create expert charts and graphs.

Fig sample of online questionnaire for gathering the importance of a requirement

Phase 2: Fuzzy Rule-Based System Development and Releases Generation

In the previous section, the set of data requirements requested was prioritized from the participants' perspective based on the modeling features of the release plan. In order to further strengthen the effects of the release assignment and reduce the uncertainty or imperfection of human involvement, a non-compliant control system (FRBS) is being developed. For each release, the task to be performed is determined by the participants' prioritization level, critical distance, urgency, and resource level for each requirement. As shown in Figure 4, the FRBS input is a stakeholder prioritization, value level, urgency, and flexible service level and output is the delivery of each release requirement.
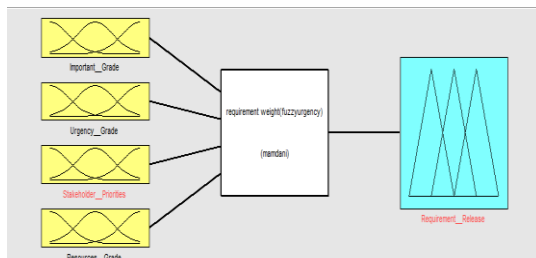

Fig 4 A screens for the input variables of FRBS.

Phase 3: Expert Evaluation

At this stage, before the production of the faculty renewal website is presented to the professional community (not directly involved in the production of the faculty renewal website project) to evaluate the production output and decide on the next step, the project manager determined TH_Eas15% and TH_I as 75%.

To date many aspects of SRP contain information uncertainty and imperfections as well as previous methods of editing software that used the intellectual property to display its features did not cover many of these features. .

Priority for Stakeholders: In previous software delivery processes, the individual (project or product manager) must allocate relevant values to each participating participant in the actual service engineering process. In contrast, the proposed framework classifies and prioritizes stakeholders involved in the required engineering process using the model outlined in (Elsaid et al. 2017).

Time Horizon: Approximately the previous methods of programming software release methods are fixed. Only (McElroy and Ruh 2007; McElroy and Ruhe 2010) provide a

flexible timeline over a period of probability. the following is a flexible period of time based on P-thresholds.

CONCLUSION

This study introduced a new approach to the problem of scheduling software releases. By designing an incomprehensible rule-based system, the proposed framework addresses the problem of planning software release information uncertainty and imperfections. The proposed framework is divided into three sections. The first step is to negotiate the requirements and planning features of the release. During this phase, an online questionnaire is compiled, and the following information is collected: a stakeholder data set that is categorized and prioritized, prioritizing needs based on the importance and urgency of the participants' perspective, and resources available from the project manager's perspective. This database is used as the input database for the next unambiguous phase based system. Finally, experts review the created output, and the next step selection is made when the decision maker issues a test phase. According to experts, the output created by the proposed framework is acceptable, reasonable, and satisfactory.

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