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RePizer: a framework for prioritization of software requirements

Key words: Software requirements, Requirements prioritization techniques, Prioritization framework, Planning game, Analytical hierarchy process

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Introduction

- Requirements prioritization has been identified as the most frequently addressed topic in the requirements engineering domain.
- Requirements prioritization plays a crucial role in software release planning by selecting a set of important requirements.
- Finally, the selected set of requirements is implemented in the subsequent planned release of a software system.

Motivation

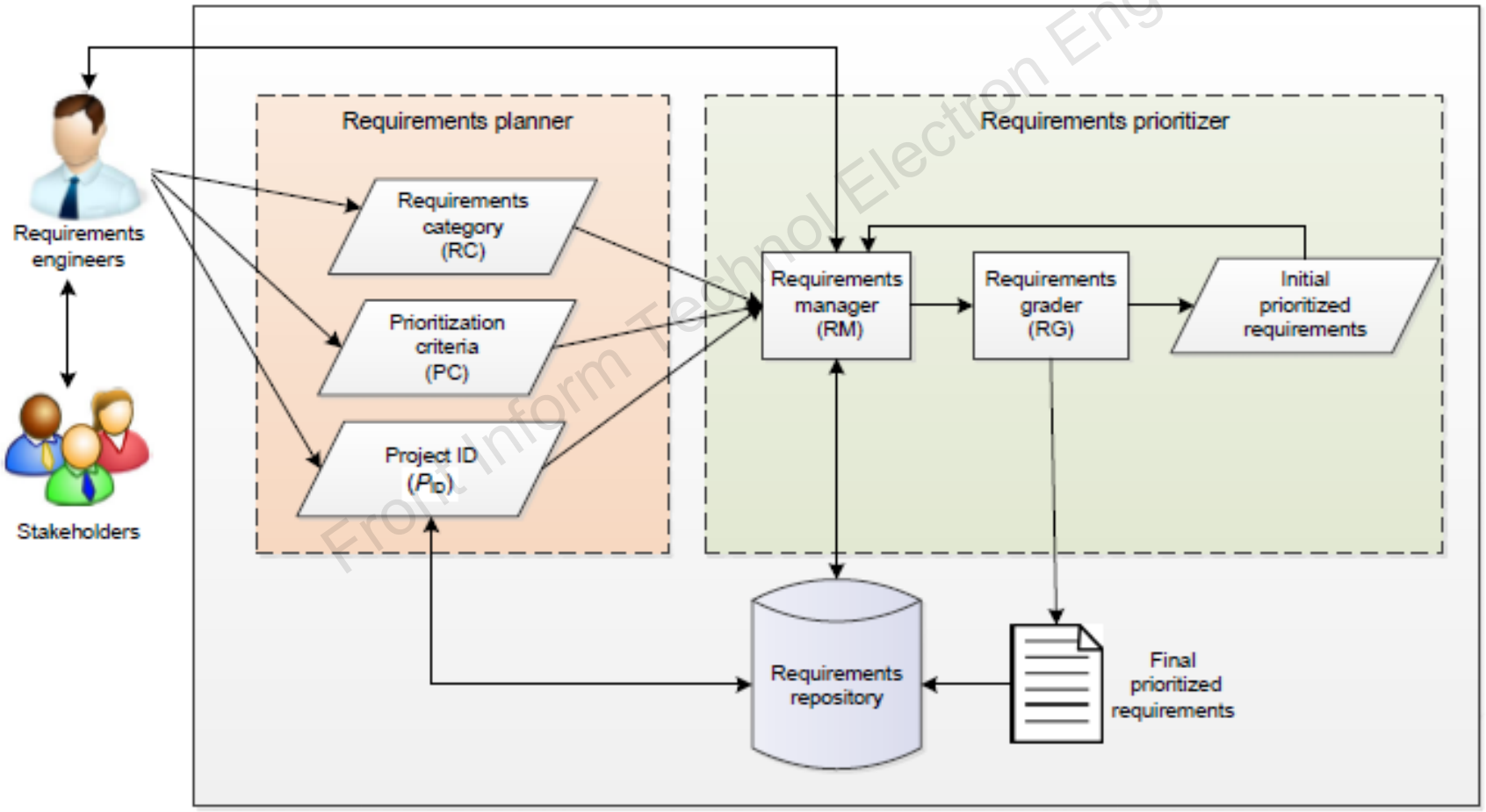
- There are large complex software-intensive systems with thousands of individual requirements.
- Software development organizations need to consider every single requirement to ensure the success of a software project.
- The key factors, including limited project resources, a long project schedule, a low requirements engineering budget, and different levels of importance among the requirements, could affect the implementation of software requirements.
- Software development organizations aim to achieve higher customer satisfaction by addressing high-priority requirements first .
- However, it remains a challenging task for development organizations to meet all the requirements specified by stakeholders due to time and resource constraints.

State-of-the-art requirements prioritization framework

Approach name (reference)	Employed prioritization technique(s)	Requirements type	Retaining historical data	Risk analysis	Multi-perspective support
Multi-faceted approach (Moisiadis, 2002)	Quality function deployment and AHP	Functional	No	No	Yes
Machine learning approach (Avesani *et al.*, 2004)	Pair sampling and rank learning	Functional	No	No	No
Requirements probability approach (Liu *et al.*, 2004)	Probability analysis and impact relationship	Functional	No	No	Yes
Value-based fuzzy logic approach (Ramzan *et al.*, 2009)	Value-based fuzzy	Functional	No	No	Yes
Business value oriented approach (Danesh *et al.*, 2009)	Relative relationship between business values	Functional	No	No	No
AHP-based approach (Sadiq *et al.*, 2010)	AHP	Functional	No	Yes	No
Quality criteria based approach (Otero *et al.*, 2010)	Quality attribute measurement	Functional	No	No	No
Binary priority based approach (Bebensee *et al.*, 2010)	Binary priority list	Functional	No	No	No
AHP-based approach (Dabbagh and Lee, 2013)	AHP	Non-functional	No	No	No
Case-based ranking approach (Perini *et al.*, 2013)	Pairwise comparison and machine learning	Functional	No	No	No
HAM-based approach (Dabbagh *et al.*, 2014)	Pairwise comparison	Functional and non-functional	No	No	Yes
IPA-based approach (Dabbagh and Lee, 2014)	Integrated prioritization	Functional and non-functional	No	No	No
RePizer (current study)	Applicable using different prioritization techniques	Functional and non-functional	Yes	No	Yes

AHP: analytical hierarchy process; HAM: hybrid assessment method; IPA: integrated prioritization approach

Proposed framework



Overview of evaluation of RePizer

Criteria	Description
Goal	Evaluate the performance of RePizer while adopting PG and AHP techniques
Independent variable	Prioritization techniques: PG and AHP
Dependent variable	Accuracy of results; ease of use
Context	Experiment executed using 32 real subjects prioritizing 134 requirements of the OpenURL resolver project

Results

Table 10 Normality of experimental data tested using the Shapiro-Wilk test

Prioritization technique	Expected accuracy			Ease of use		
	Statics	*df*	Sig.	Statics	*df*	Sig.
PG	0.874	32	0.000359	0.846	32	0.000342
AHP	0.803	32	0.000045	0.793	32	0.000030

PG: planning game; AHP: analytical hierarchy process

Table 9 Results of measuring expected accuracy collected from post-test *A* at different Likert scales

Prioritization technique	Measured expected accuracy				
	1	2	3	4	5
PG	–	5	6	16	5
AHP	–	6	17	9	–

PG: planning game; AHP: analytical hierarchy process

Table 11 Results of measuring ease of use collected from post-test *B* at different Likert scales

Prioritization technique	Measured ease of use				
	1	2	3	4	5
PG	–	7	6	15	4
AHP	–	13	13	6	–

PG: planning game; AHP: analytical hierarchy process

Table 12 Summary of hypothesis testing

Hypothesis	Dependent variable	Statistical test	*P*-value	Result	Direction
$H_{0\,\text{accuracy}}$	Expected accuracy	Mann-Whitney	0.007	Rejected	PG
$H_{0\,\text{ease of use}}$	Ease of use	Mann-Whitney	0.003	Rejected	PG

PG: planning game