

# Green Software Engineering Adaption In Requirement Elicitation Process

Umma Khatuna Jannat

**Abstract:** A recent technology investigates the role of concern in the environment software that is green software system. Now it is widely accepted that the green software can fit all process of software development. It is also suitable for the requirement elicitation process. Now a days software companies have used requirements elicitation techniques in an enormous majority. Because, this process plays more and more important roles in software development. At the present time, most of the requirements elicitation process is improved by using some techniques and tools. So that the intention of this research suggests to adapt green software engineering for the intention of existing elicitation technique and recommend suitable actions for improvement. This research, being involved qualitative data. I used few keywords in my searching procedure, then searched IEEE, ACM, Springer, Elsevier, Google scholar, Scopus and Wiley. Find out articles which published in 2010 until 2016. Finding from the literature review, Identify 15 traditional requirement elicitations factors and 23 improvement techniques to convert green engineering. Lastly, The paper includes a squat review of the literature, a description of the grounded theory and some of the identity issues related finding of the necessity for requirements elicitation improvement techniques.

**Keywords:** Software Engineering, Green Software systems, Requirements Elicitation Technique.

## I. INTRODUCTION

Requirements elicitation is the initial stages in the software development life cycle. It is the instant analysts elicit to understand many methods and techniques which are validating the requirements of a system from practitioners. If the system failure is owing to poor communication with analyst and users. Therefore, the objective of elicitation process is required to solve problems [1] [2]. At present technology has introduced many Requirements elicitation (RE) techniques and provided with various possible options. Requirement engineer can use the option of adopting green methodologies for developing software. The Green software development technique is trying to discover as many troubles as possible so that it could become easier to produce premium software along with expected plans by applying elicitation techniques tools. In certain, requirements elicitation is getting more and more important for its multidimensional and iterative movement that deeply depends on the communication skills of software requirement engineers. Usually requirements elicitation technique can shift the green software engineering [3]. Green elicitation processes encourage the use of reusable design frameworks, patterns only when it is clear that it can save power or increase quality. It is only indicated by some eminence indicators, either directly or indirectly [4]. Nowadays, most of the software has been driven by green. Over the last decades, research has emerged green software model design and RE should focus on green environment, how to achieve this green environment on earth. In the literature, found that the different elicitation technique depends on time and resources. So, elicitation technique depends on time and resources and green software engineering is also giving this thing with more and more features for developing software. Analyzing all these studies need to include some essential fact that can develop and maintaining green software system or environment friendly software system.

According to requirements elicitation techniques in the past, green software system has technologically advanced little. For the purpose of literature review the extent of requirement elicitation process, this paper following the research question:

**RQ:** How to convert traditional requirement elicitations in green software requirements elicitation techniques?

**Motivation:** To identify and convert traditional requirement elicitations in green software requirements elicitation techniques.

**Problem:** Traditional requirement elicitation technique has not fully supported green software requirement elicitation technique [5]. Though several researchers proposed how analyzed documents, interface and interview design in the traditional way [6] [7]. In existing literature is proven green requirement elicitation technique is yet not established. So green software engineering method can support the character and this approach classify and turn green RE. This method also allows for supporting tools, to support process design. For example, green IT, efficient algorithms, smart grids, agile practices and knowledge management [8].

**Contribution:** In this paper describe the requirements elicitation process and this process can adapt the new atmosphere of green software systems using some of existing technique and demonstrate.

## II. RELATED WORK

With the increase of technology development number of software system has developed to give a good performance like requirement phase. In the requirement elicitation process it is necessary to consider the environment friendly software system to help current and future perspective. Greenpeace International and Liu et al. define green software is less harmful for people and the environment [9] [10]. Because a green software system is to reduce unsafe materials, endorse the recyclability and plug-in architecture making the system efficient. In literature review researcher provided some approaches such that some efforts are focused on green software, some intend software

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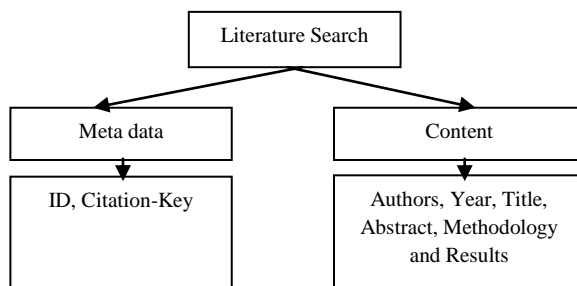
processes to assist all stakeholders in building green software products, focused on some tools and the application can save operating system energy with effectiveness and help control the power consumption. Including virtualization, closing applications no longer in use, energy estimation of nested loop programs [11] using for loops and conditional on power consumption, programs efficient algorithms writing for compact design of codes and data structures, reduction of parallelism overhead of developing efficient load balancing algorithms, fine grained green computing, and creating energy allocation algorithms for routing data. According to Mahauxetal.declaration green innovation is altering IT significant effect [12] yet the use of the green it as exposed in existing literature to have been useful in developing for a software system. The eminence of the requirement elicitation process provided a good basis for the software system. Such techniques also present inherent factor in terms of document analysis is using paper, interview is using hard copies, some custom hardware use and it generate large amounts of data [13], interface analysis sometimes it is using complex and long algorithms [14] and hence, these would be key requirements techniques to be considered in adapting a sustainable green software system.

### III. RESEARCH METHODOLOGY

In this study, this research design method is using qualitative research and adopts the guidelines of Kitchenham and Charters [15]. Paper collect, process using Systematic Mapping Study [16] for searching publication. Basically, snowballing use for paper selection. I used a few keywords in my searching procedure. These papers are searched in "requirement elicitation", "green it", "green software engineering", "requirement engineering". Using and/or/not. By using those keywords I have made a search string, which used in different databases such as

- IEEE Computer Society Digital Library
- ACM Digital Library
- SpringerLink
- Elsevier
- Google scholar
- Scopus and
- Wiley

**Figure 1: Searched Databases: Collection**



Following this search, find out journal articles published in the English language between the years 2010 to 2016. Search engine find practical related articles 182,137. Then 39 articles find out that have published in reputed journals or conferences. I applied inclusion and

exclusion criteria proposed by the Kitchenham et al. in this study. After that, I have included 30 studies in this study as major findings from the literature. I have also used an open coding technique to analyze the collected data. Both researchers reviewed the findings from the literature, which helped to mitigate the validity threats.

## IV. GROUNDED THEORY

### A. Green Software Engineering

In the literature the process of green software engineering has reduced waste, reuse and recycles for developing software [17]. Green software must support sustainable process to develop environment and give solution to improve, fixed, strengthen, reduce the error-failure, improve data protection etc. in a way of software engineering. In global software development is inspired by the green software engineering establishment. It is an energy efficient software development system and it does not consume time. It is also efficient for software space allocation, efficient in memory capacity, availability, usability and storage of data and information also parallel task can develop.

### B. Requirement Elicitation Techniques

The perception of requirement elicitation will be defined key statements of preferred functions. This is usually referred to collecting requirements. There are different classic requirement elicitation processes; I have taken three processes to convert green requirement elicitation: interviewing, document analysis, interface analysis. First, interviewing is the most common technique for requirement elicitation. Interview starts to question and answers, then discover the problem. Sometimes interview can be open discussion or meet in physical and some of the time is can be use paper base with different types of environments. Secondly, Document analysis always eliciting the requirement. Basically, it is use of existing system and implement a required system. Document analysis typically includes market studies, request for proposals, statement of work, memos, existing guidelines, procedures, computing product literature. It is hard to find, out existing relevant information and it is a time-consuming work process. Thirdly, Interface analysis is the way of user interacts with an application. It can be conducted with both internal and external systems and users. This can require one or more interfaces with external parties, systems or devices and helps to clarify the boundaries of the system. For examples user interface, system-to-system interface, external hardware device interface, to external applications, to internal applications.

## V. RESULT

In this section I have identified 15 traditional techniques with 23 improvement techniques from the literature review. In this study, I have divided into three categories such as Interview, document analysis and interface analysis.

### A. Traditional Requirement Elicitations

The traditional requirement elicitation process uses a variety of techniques. Table: 1 Show exists three processes of requirement elicitation technique such as: interviewing, document analysis, interface analysis.

**Table 1: Traditional Techniques: Challenges**

| Techniques         | Description   | References |
|--------------------|---|------------|
| Interview          | Using hard copy   | [18]       |
|                    | Generate large amount of data uses  | [19]       |
|                    | Physically interview is performed   | [18]       |
|                    | Computer hardware usages  | [19]       |
|                    | Brainstorming, design a diagram to asking questions                           | [21]       |
|                    | Use technical environment network.  | [21]       |
|                    | Use cognitive structural analysis   | [23]       |
| Document Analysis  | Data flow diagram, Entity relationship diagram                                | [24][25]   |
|                    | Use paper base work   | [22]       |
|                    | Use chart and diagram   | [22]       |
|                    | Memory usage and it is consuming the cost                                     | [28]       |
|                    | Use CPU and other devices   | [20]       |
| Interface Analysis | Use bright colors or colors that harm the eye of the user                     | [20]       |
|                    | Use computers and devices with high power that consume large amounts of power | [20]       |
|                    | Installation package which is the larger size                                 | [20]       |

Following this table scenario, identify some traditional practices which are used in requirement elicitation technique for software development process.

### B. Requirement Elicitation Process Adaptation

The requirement elicitation process development, can adapt a variety of practices. Table:2 proposed to existing three processes of requirement elicitation technique can adapt green requirement elicitation such as: interviewing, document analysis, interface analysis.

**Table 2: Adaptation Techniques: Control**

| Techniques   | Description   | References   |      |
|--|---|--|------|
| Interview  | Using paperless forms, questionnaires, collect requirements through electronic means  | [26]   |      |
|  | Need to be added to the non-functional requirement  | [26]   |      |
|  | When physically interview is decided considered and usage virtual meeting   | [26]   |      |
|  | Determine exact CPU usage of specific components of the application and optimize them to reduce CPU usage   | [27]   |      |
|  | Reduce transportation means and instead uses the internet for communication and use cloud computing   | [27]   |      |
|  | Necessary activities reuse  | [27]   |      |
|  | Using a computing center cooling and airflow. Introducing paperless environment, optimizing resource utilization, and minimizing e-waste  | [28]   |      |
|  | Computer hardware reuse of the project.   | [28]   |      |
|  | Document Analysis   | The focus should shift in paperless work                               | [28] |
|  |   | The focus should shift Nuance's PaperPort, OmniPage, and PDF Converter | [29] |
| Memory usage has a minimal cost  |   | [28]   |      |
| Determine exact CPU usage of specific components of the application and optimize them to reduce CPU usage  |   | [27]   |      |
| Reduce the number unnecessary activities in the system and must use environmentally approved products  |   | [27]   |      |
| Use of service oriented software and requirements collecting, using some alternative energy sources such as wind or solar energy   |   | [27][30]   |      |
| Using a computing center cooling and airflow, introducing paperless environment, optimizing resource utilization, and minimizing e-waste   |   | [28]   |      |
| Software and hardware which use less energy resources and eco- friendly, improving operational efficiency, improving operational efficiency and close the application when it is not in use or switching off the computer and compute turn it on when it is needed again otherwise turn of the application when it is not needed |   | [26][27]<br>[28]   |      |
| Interface Analysis   | Programmers should write efficient algorithms via writing a compact design of codes and data structures based upon the application, programming language and the architecture of the system | [26]   |      |
|  | The effect of reuse and application development environments specific frameworks  | [26]   |      |
|  | Designs must include specific measures and practices that relate to environments – using fewer hardware, use of virtualized systems   | [26]   |      |
|  | The challenge is to meet the non-functional requirements using a minimum of system resources  | [26]   |      |
|  | Reduce the number unnecessary activities in the system and run the system on computers with powerful profiles   | [27]   |      |
|  | Finding out the possibility of server virtualization  | [26]   |      |
|  | Improving operational efficiency and use computer hardware recycling of the project   | [27][28]   |      |

Following this table scenario, this table suggests some good practices which will ensure a better green requirement elicitation technique for software development process.

## VI. CONCLUSION AND FUTURE WORK

This extended abstract defined this aspect of green requirement elicitation technique in software development. This paper defines its form of exemplary descriptions on how to adopt these aspects in green requirement elicitation technique process development. As future work, I will visualize and building a green requirement elicitation model for software engineering.

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