Investigation and Analysis of the Requirement Engineering in Software Development Process and its Systematic Requirements Elicitation Approach

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Abstract— In this research, we investigate and Analysis of the Requirement Engineering in Software Development Life Cycle and its Systematic Requirements Elicitation in the software development process. In the next step, the research considered some approaches which are previously being used for requirement elicitation. Requirement elicitation has always played a vital role in project development. This research narrows down some pros and cons of RE. Furthermore, it has some research methods, research strategies, and research design which are followed during our research process. The main goal of this research is to introduce a new methodology for requirement gathering and apply it to a case study. Some future work and conclusions of using previous methods and a new approach are also part of this paper.

Index Terms— Requirement Elicitation, Requirement gathering, Agile Spiking, Wireframe, Prototyping, brainstorming, Point of Sale, Comparison approach, requirement analysis, Software development life cycle.

1 INTRODUCTION
To make a successful system which satisfies the end-user fully, the most essential step is to gather requirements in the first place. A good requirement elicitation process keeps track of each stakeholder, user, customer involved, and features required. The RE process strictly depends on an understanding of the purpose and scope of the system. [1]. On the other hand, sometimes the failure of the project is also caused by this process. This procedure can be called as one of the most difficult steps of the entire development process because one slight mistake can lead towards the dissatisfaction of customer, delay in delivery or budget mismanagement. [2]. Requirements are those attributes which need to be built prior to software development. [3]. There are usually two types of requirements which are extracted from user stories. They are Functional and Non-functional requirements. Functional requirements consist of the functions which system must do on every user action. Functional requirements are best defined as the functionalities of the system, excluding physical interaction. Non-functional requirements, on the other hand, focus on the maintainability, usability, ease of access and security like constraints. [3]. Once the RE team go through the complete Requirement Elicitation process, they are able to state functional and non-functional requirements. Requirement engineering process builds a model according to the problem statement rather than doing analysis. Hence the information provided from this process is more precise and accurate. [4] Suhaib and Ohnishi Introduce conflict free methodology in goal oriented requirements analysis [11].

During the requirement engineering process information gathered and make a solution out of it. In large organizations or system which are to be developed on a high level this step is most essential yet difficult. This paper presents the different methods and techniques widely being used for requirement elicitation along with their comparison. The challenges which are faced during RE and how we can overcome them. Lastly, it includes a case study which is for a large inventory management system. To handle projects for large organizations data gathering is always tough.

2 RESEARCH METHODOLOGY
This research includes analyzing both qualitative and quantitative research methods, including data acquisition, survey research, and observation. Quantitative methods classify features and create statistical models to test and explain observations. Qualitative methods are for a complete, detailed description of observations, including the context of events. A research project is a series of activities, which must be performed to get the desired outcomes and proper information. Along with the activities, we will make interviews with developers and agile team to ask them about the spike efficiency in software development projects. These activities vary from one project to another. [5]. The set of activities performed during research are:

- Identify Research Scope and Objective
- Define Research Approach to be used
- Critical Literature Review
- Define Research Design
- Analyze Problem
- Research Strategy

Following the first step, the scope of this research is to cover various approaches and methodologies used by requirement
engineers to gather data. Next is the critical literature review which is on the approaches that are being used for requirement gathering by different requirement engineers for different kind of projects. The most common approaches are Interviews, Prototyping, Story Boarding, Workshops, and Brainstorming sessions and observing. In one-to-one interviews, meetings are set up with the relevant actor and they are asked about their requirements from the system. Each stakeholder and end-user attend the meetings separately and the requirement engineering team narrow down all the requirements. Unlike one-to-one interviews, actors are not asked for their priorities separately in prototyping. [6] A sketch of the system is made on either a piece of paper or representation through wireframes are made. These wireframes are shown to the end user so that they can approve it or identify the required changes. The inverse technique is also very useful for clients who are confused about what they want. We can clarify the concept of inverse technique by using an example that, the RE team will ask the user which colors they don’t like instead of asking which they like. Because they might like so many colors but only dislike a few one, so we can ignore the disliked colors and use any else. This is an effective way for the system designer to gather information about designs. There’s another approach Agile Spiking which is used in agile methodology. Spikes are a special type of story used to drive out risk and uncertainty in a user story or other project facet. The main purpose of a spike is defined uncertainty. However, the use of spikes in Agile methodology could be a better approach to follow. The spikes as mentioned above is used for the purpose of identifying issues. [7] Another popular approach for capturing requirements is User Stories. They mostly follow a template which includes, As a ( ), I want ( ), So that I can ( ). [8] However, apart from all these approaches, there are still some conflicts between the stakeholders while gathering requirements which cause hurdles in a smooth software development process.

RESEARCH GAP
Each software project has its own novel elements, whether it is in the domain of application or in the skills required. These elements can affect the completion and success of the development. It is for sure that the development team is not able to provide accurate information as they don’t know how some things need to be done in the project. Responsibility is on the requirement team to get every stakeholder on the same page. A project might be failing or delayed if the team lacks the knowledge or skill. In the process of capturing requirements, conflicts are expected since there can be the mismatching goal of every stakeholder. To make every stakeholder which have different responsibilities and concerns on the same page is a difficult task. The approach of negotiation is majorly used to handle these conflicts. To cope up with this major gap in the requirement engineering process which is no less than a hustle along with managing the conflicts and bringing everyone on the same page, we are required to introduce a new method which will be beneficial for the stakeholders and the developers as well.

RESEARCH QUESTIONS
The research questions refer to some issue or specific concern. They are the initial step towards the research and after this, you get the idea of your research and that which gaps you must fill. [9].

RQ1: How can we improve the requirement elicitation process?
RQ2: How the conflicts between stakeholders can be minimized?
RQ3: Which approach would be best suitable for developers to understand requirements?
RQ4: How can we control the changing requirement of the user after every release?
RQ5: How can the RE team cover all functionalities of the system expected by the end user?

RESEARCH APPROACH
Research approach follows a procedure which consists of assumptions and data collection methods. It also states the analysis and interpretation of the data. The research approach is majorly divided into these two categories:
- Data Collection
- Data analysis and reasoning.

DATA ANALYSIS
The approaches for data analysis are Inductive and Deductive approach.

Inductive Approach: In this reasoning, we start with some observations and measures which are specific and begin to detect the regularities to formulate some hypothesis that we can find, and, in the end, we develop conclusions or theories. [5].

Deductive Approach: When we start research, we first think about the topic according to our interest and then we come to the next steps which are more detailed and specific, then we test it. Furthermore, we gather information and observations to address the hypotheses. All these steps lead us to test the data and confirm the theories. [5].
Qualitative Research: It is used to collect or generate data. However, it is less analytical techniques to the interpretation of data. The inductive approach uses detailed analysis data to get the right concepts and models. Basically, it is the procedure in which we gather the non-numerical data. The qualitative research is associated with the inductive approach for theory development and natural research design is used to get a theoretical perspective. This research studies the relationship of participants by using data collection techniques and analytical procedures to have theories and framework. [5]

Quantitative Research: Quantitative research is the statistical analysis to make decisions. It uses numerical analysis of data. It uses the surveys, questionnaire and such techniques to gather information. This research is usually associated with the deductive approach. The focus of this is, using data to test theories. It may also associate with inductive where the data is processed to develop theory. This approach measures the relationship numerically between variables and analyze them using statistical and graphical techniques. It ensures the validity of data. Because data is collected using standard manner so it’s important to make sure that every question is understood properly. [10]

Research Design
Research design can be defined as a framework of techniques and some methods chosen by a researcher to combine different components of research in a logical way so that the research problem is efficiently handled. The research design is a plan of what steps must be taken place to answer the research questions. And to achieve the targeted objectives. The classification of a research design is usually divided into three groups

✓ Exploratory
✓ Descriptive
✓ Explanatory [9]

Exploratory: The exploratory research design is dependent on the personal inclination about the topic. It gives the explanation about unexplored aspects of the topic which are provided along with details and related to research questions. Exploratory research aims to develop operational definitions to improve research design. It covers the research questions and established to set priorities. Exploratory research design is conduct on the topics which are not previously studied in detail. [9]

Results
A restaurant owner is looking for a good Point of Sale system. Considering the fact that restaurant management can have many actors involved. For example, from the inventory manager to the cashier every person will be using the system.
The brainstorming session was conducted, and user stories are finalized. With these user stories, it is somewhat difficult to understand the design and modules. Each actor has mentioned their required functionalities from the system, but it is not enough for the requirement engineer to state each and every functionality properly. User stories are successful in some cases but in a complex system like POS, they are not always supportive.

After some surveys and interviews from the technical staff and stakeholders, a solution is concluded which can be introduced as a newer approach in the field of RE. The approach can be named as "Comparison Approach". In order to use this approach, the RE team search for a similar system that is previously been made. In today's era, when everything and every system is being digitalized. There are high chances of repeating systems. Considering the POS system, some of the famous POS can be analyzed for this purpose to compare functionalities and offer features. The most commonly used POS systems, Lightspeedhq.com, Vendhq.com, and Squardhq.com are under consideration. A report can be prepared by the requirement engineering team which include the functionalities and screen images from all three platforms. Each module and functionality which is new or different from another platform will be considered. After this, the copy final document can be sent to the stakeholders and they can check their desired functionalities are present or not. With screen images of already made systems, it is easy for the end user to agree on the requirement document as well as for the developer and designer to make a design and system according to the provided layout. This approach can be useful, and it can be helpful to minimize the conflicts of stakeholders.

4 Conclusion
There are many successful approaches and methods which are already being used by RE teams and giving good end results. But ways to improve are always appreciated. From this research, the major gap we found was the conflicts in user and conveying expected modules to the developer. Considering the fact that stakeholder or end users are not technical people always. They are unaware of the benefits and drawbacks of some features. They might want something which is useful or unnecessary for their system. The requirement team can educate them by showing the previously made system of the same domain. The comparison approach will work fine until there’s some project which is not previously developed. The chances of this case are less 1%. Because technology has already covered most of the domains.

References