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User Requirements Analysis

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2 User Requirements Analysis

Martin Maguire

CONTENTS

2.1	Introduction	17
2.2	User Requirements Analysis Activities	18
2.3	Eliciting Requirements	18
2.3.1	Documenting Processes.....	19
2.3.2	Stakeholder Meeting	20
2.3.3	Generating Requirements	20
2.3.3.1	<i>UX Technique: Development of Personas.....</i>	20
2.4	Recording Requirements	21
2.4.1	Use Cases.....	21
2.4.1.1	<i>UX Technique: Context of Use Analysis</i>	22
2.4.2	User Stories.....	22
2.4.2.1	<i>UX Technique: User-experience Goals.....</i>	22
2.4.3	Data Flow Diagrams.....	23
2.4.3.1	<i>UX Technique: Prototyping as a Way of Visualizing Requirements Gathered</i>	23
2.5	Analyzing Requirements	23
2.5.1	Clarity, Uniqueness and Traceability.....	24
2.5.1.1	<i>UX Technique: User Feedback Sessions.....</i>	24
2.5.2	Resolving Conflicts.....	24
2.5.3	Design Concept Emergence.....	25
2.5.3.1	<i>UX Technique: Brainstorming</i>	25
2.6	Conclusion	25
	References.....	25

2.1 INTRODUCTION

User requirements analysis is the process of defining the needs and expectations of the users for an application that is to be built or modified. It is a key part of the systems design process and many systems failures are attributed to poorly specified user requirements. User requirements analysis is part of a broader requirements analysis

process that also defines the needs of the customer's business requirements. This will lead to determining the feasibility of the project including resources, time and finance allocated it. Also, it is essential to develop a schedule for carrying out the tasks for developing the system.

User-experience (UX) design is a process of creating products and systems for users that meet their task needs and is both accessible and usable for them. Furthermore, by providing aspects of branding, design, usability and function, it aims to provide a positive user feeling or experience.

This chapter is concerned with applying user-experience methods and techniques to enhance the user requirements analysis process.

2.2 USER REQUIREMENTS ANALYSIS ACTIVITIES

Requirements analysis includes three main activities:

Eliciting requirements: The stage of determining from the user's point of view what the system needs to do.

Recording requirements: The process of recording the requirements in a standard way so that the design team can refer to them.

Analyzing requirements: Reviewing the requirements to ensure that they are clear and compatible with each other.

When the requirements are defined and agreed, then the process of starting to design the system or software application and implementing it begins. This will involve end users to enable their points of view to be represented. There may be different ways of organizing the process ranging from a traditional structured approach to Agile development. In Agile software development, users work alongside designers and developers so that their requirements emerge through day-to-day interaction and the development of lightweight software components over short time periods (Denning, 2019). Both approaches have their advantages and disadvantages and work best in different contexts (Olic, 2017).

Yet, the complexity or formality of the system design process can mean that it is difficult to make the user needs real for the design team or manage evolving requirements as user needs become clearer, or if their opinions change when designs are implemented. Design teams will often employ a user-experience designer to act as the facilitator between the design team and the users.

The next three sections will take each of the three high-level user requirements processes, break them down into specific activities and describe how user-experience design methods can be used to support them and improve their effectiveness.

2.3 ELICITING REQUIREMENTS

This is the process of gathering user requirements and involves documenting the tasks that need to be conducted as part of the business process and then identify the

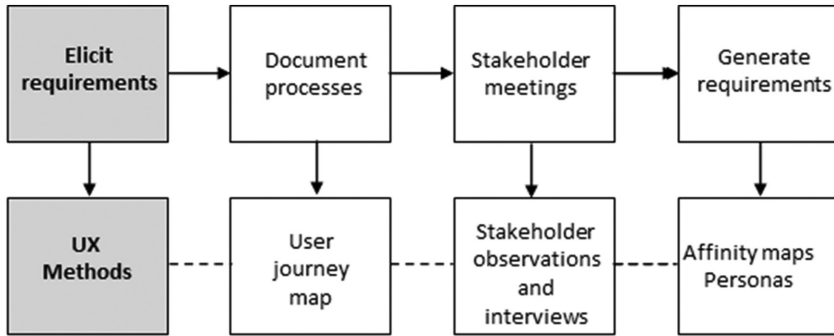


FIGURE 2.1. Eliciting requirements with supporting UX methods

detailed needs of different stakeholders. It will typically involve reviewing business process documentation and conducting stakeholder interviews. This is sometimes also called requirements gathering or requirements discovery. Figure 2.1 shows some key steps in the process.

The starting point for requirements gathering is to understand the general terms of the project. This will involve asking the client what the main goal of the system is, what problem will it solve, have they tried to create a solution before and if so, why did it fail? Essentially the aim is to find out what the client wants and needs from the project as a whole.

2.3.1 DOCUMENTING PROCESSES

All products deal with some sort of process on behalf of the client. The aim is to understand how the client's business operates in order to create a solution that adapts to it, which is crucial for smooth operation when the solution goes online.

Making it visual is advantageous. Seeing each step on the client's process can help the design team understand how things are done and how they can reflect this process in the design itself. It is important here to not just try to understand what the client wants but also how the client's business works.

UX technique: User journey map. This is a powerful technique for understanding what motivates users or customers – what their needs, problems and concerns are. Although most organizations are reasonably good at gathering data about their customers, data alone fails to communicate the frustrations and experiences the customer encountered. The customer journey map uses storytelling and visuals to illustrate the relationship a customer has with a business over a period of time. The story is being told from the perspective of a user, which provides insight into their total experience. This helps the design team better understand and address user needs and pain points as they experience the product or service. The user journey map offers the chance to see how users or customers engage with the organization and then moves through the touchpoints of the entire activity or process. Finally, the team can propose the improvement or actions to be taken against each of the touchpoints.

These proposed actions can be a potential source of software requirements (Visual Paradigm, 2020).

2.3.2 STAKEHOLDER MEETING

This involves identifying people who use the system either as end users, e.g., operators, customers, maintainers, content providers or as other stakeholders who have a valid interest in the system, e.g., standards or regulatory bodies. They may be affected by it either directly or indirectly. A stakeholder meeting is often the method used to identify the requirements of each user and stakeholder. These meetings may be called joint requirements development sessions and may be facilitated by a business analyst or UX specialist. After an introduction from the project manager and/or client, a number of topics will be considered, allowing each stakeholder to describe their needs. Discussions will elicit requirements, which can then be analyzed to uncover cross-functional implications.

UX technique: Interviews and observations. In addition to a stakeholder meeting, two useful techniques are individual stakeholder interviews and observations. These allow the interviewer to step into the shoes of their interviewees and see their role through the eyes of these stakeholders. Part of the interview will be to ask what tasks each user performs with the current system and to identify their needs and pain points. All requirements should be linked to a task to give them context. The interview will also help to prioritize requirements, features and possible testable goals to show their achievement. A further activity is user observation where the researcher will ask if they can observe the user carrying out their work. This method enables the researcher to identify the context in which the user operates and to observe their activities first-hand. This approach often reveals information that is not covered by the interview, giving extra insights into what needs or requirements a user will have.

2.3.3 GENERATING REQUIREMENTS

Requirements will start to emerge from user stakeholder meetings, user interviews and user observations. Requirements will initially be written in a narrative form before being recorded formally in the form of requirements documentation.

2.3.3.1 UX Technique: Development of Personas

Once the stakeholder interviews have been conducted, they can be analyzed and individual informational items can be recorded onto electronic or physical post-its. They can then be analyzed to create personas of individual user roles in the system. Personas are archetypal users that represent the needs of larger groups of users, in terms of their goals and personal characteristics (Cooper et al., 2014). They act as “stand-ins” for real users and help guide decisions about strategy, functionality and design. Personas identify the user’s motivations, expectations and goals that are responsible for driving online behavior and can be brought to life by giving them names, personalities and a photo. Although personas are fictitious, they are based

on the knowledge of real users. Some form of user research is conducted before they are written to ensure they represent end users rather than the opinion of the person writing the personas. In the context of enterprise projects, personas are valuable in articulating the needs of employees (Robertson, 2020).

2.4 RECORDING REQUIREMENTS

Here requirements are reviewed to ensure that they are clear and meaningful, are unduplicated and can be traced back to their source. They may be documented in various forms, including simple lists, activity diagrams, use case diagrams, user stories and process specifications, and data models. The requirements may be divided into “functional requirements” that capture the required intended actions for the system and “non-functional requirements” that define system behavior, features and general characteristics that affect the user’s experience. Three key activities that are key to the analysis process are shown in Figure 2.2.

2.4.1 USE CASES

A use case diagram is the primary form of system/software requirements for a new software program under development (Robertson and Robertson, 1999). Use cases specify the expected behavior and not the exact method of making it happen. Use cases, once specified, can be represented in both textual or visual form. A key concept of use case modeling is that it helps in the design of a system from the end user’s perspective. It is an effective technique for communicating system behavior in terms understood by the user by specifying all externally visible system behavior. A use case diagram is usually simple and contains equivalent elements to a user story: an actor, flow of events and postconditions. It does not show the details of the system processing but summarizes some of the relationships between use cases, actors and systems. It does not show the order in which steps are performed to achieve the goals of each use case.

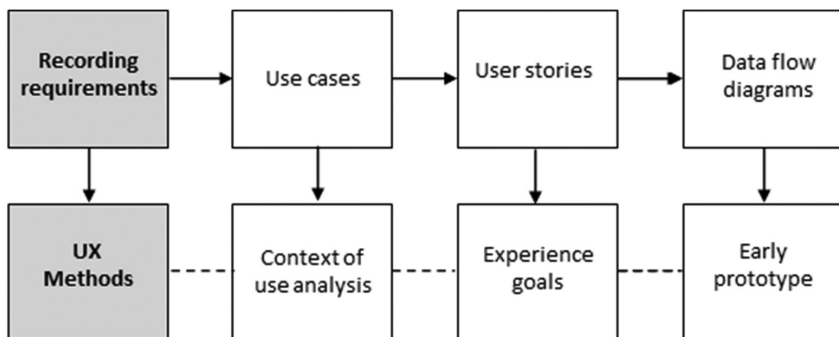


FIGURE 2.2. Recording requirements with supporting UX methods

2.4.1.1 *UX Technique: Context of Use Analysis*

Context of use analysis involves collecting and analyzing detailed information about the intended users, their tasks and the technical and environmental constraints. In this way, requirements can be specified that are in line with the context of use and the use cases that are documented. Understanding what are the main or top tasks that the users want or need to perform is an important basis for design (McGovern, 2018). Context of use is about understanding and responding to actual conditions under which a given artifact/software product is used. For example, ease of use of a building tool may not be significant when used by an experienced builder but it can become significant if a DIY enthusiast uses the same device at home.

A single use case in different contexts can require vastly different approaches that have implications for usability, user acquisition and user-experience. For example, in a satellite navigation app, if the driver finds that their battery level is low they may prefer to conserve energy by temporarily blocking the download of unnecessary traffic information, restaurant locations, pictures, etc., which take battery power. If they are guided to an area where traffic is exceptionally heavy, they will want the app note this and guide them to their destination in another way. If the app is able to identify that the user's destination is closed, it could warn the user that they may be on a wasted journey and give them the option to stop and return home. The benefit of being context-aware allows the system to make the user's experience a less frustrating and seamless experience (Chu, 2018).

2.4.2 USER STORIES

A user story is a note that captures what a user does or needs to do as part of their work. Each user story consists of a short description written from the user's point of view, with natural language. Unlike traditional requirement capture, user stories focus on what users need instead of what the system should deliver. This leaves room for further discussion of solutions and the result of a system that can really fit into the customers' business workflow, solving their operational problems and adding value to the organization. User stories are compatible with the other agile software development techniques and methods, such as scrum (weekly design team meeting) and extreme programming. User stories describe the user's role, goal and acceptance criteria. The details of a user story may not be documented to the same extent as for a use case but are meant to elicit conversations by asking questions during a design team meeting. They allow the generation of design feedback more frequently, rather than having more detailed up-front requirement specification meetings.

2.4.2.1 *UX Technique: User-experience Goals*

User-experience is everything that happens to the users when they interact with the business or organization through a website or application, on the phone or face-to-face, and so it is important to have clear user-experience goals for each of these touchpoints. UX includes everything that users see, hear and do as well as their emotional reactions. User satisfaction is part of the experience. In creating a user-experience that is easy, pleasant and natural for users to be able to achieve a given task, the user will be satisfied and will do it again. When users interact with the

system, they want to find something that will satisfy them. If the user feels that they are not getting what they want from it, they may quit and look for an alternative that offers better service, or, if they are an employee, may be tempted to leave the organization to find less-demanding work. So it is important, through the elements of the system, to try and achieve user satisfaction.

When the user is finished with the system for a particular session, they must feel that they have achieved what they wanted when entering the system. They must also have enjoyed the process so there may be ways to make it more fun and enjoyable. It has been found that websites that are fun and entertaining, in the right situation, tend to get more visitors than those that are not. Users will be willing to spend more time in it and they can even make a purchase of something that they did not even want. It has been found that websites that are easy to navigate and give the feeling of fun to the user will tend to generate more sales (Wilson, 2014).

2.4.3 DATA FLOW DIAGRAMS

A data flow diagram (DFD) can be applied in the requirement elicitation process of the analysis phase within the system development life cycle to help define the project scope. It is often used as a preliminary step to creating an overview of the system without going into detail, which can later be elaborated. For instance, if there is a need to show more detail within a particular process, the process is decomposed into several smaller processes in a lower-level data flow diagram. However they should be flexible enough to allow new design ideas to be suggested and developed.

2.4.3.1 *UX Technique: Prototyping as a Way of Visualizing Requirements Gathered*

At first, requirements will be fluid as the design team discover user needs for the project. They may then be used by the design team to help brainstorm ideas and create early or low-fidelity prototypes that can help make the requirements tangible. It is important to note though that this is just an early representation and the actual system design, when different design concepts have been identified, may be quite different.

Prototyping can play an important role in requirements gathering, rather than leaving the overall requirements to the imagination of stakeholders until late in the product's development process (Justinmind, 2020). Even early on, when the design team first starts to understand the client's requirements, making a prototype may add value to the project. Showing a client, several options can be useful as a way to develop the requirements rather than keeping the requirements the same for the entire project.

2.5 ANALYZING REQUIREMENTS

This activity involves reviewing the requirements to ensure that they are clear, meaningful, unduplicated and can be traced back to their source. Conflicts between activities also need to be resolved. Key steps within this process are shown in Figure 2.3.

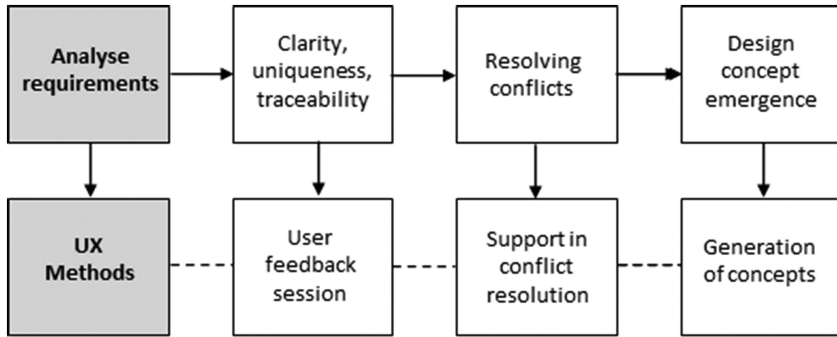


FIGURE 2.3. Analyzing requirements with supporting UX methods

2.5.1 CLARITY, UNIQUENESS AND TRACEABILITY

Analysis of requirements involves ensuring that they are of high quality by checking them for clarity or ease of understanding, uniqueness and traceability, among other attributes. The use of templates is helpful for structuring requirements in a suitable way and making sure that they are of good quality. A further output from the process is the development of a UX vision for the project which communicates the experience that the designers are aiming to create for the users.

2.5.1.1 UX Technique: User Feedback Sessions

One of the key attributes of user-experience design is keeping in close touch with end users and stakeholders. An effective method that can be employed is to run feedback sessions with users and stakeholders to check that they agree with the requirements that have been elicited, make changes if necessary, and confirm who each requirement can be traced back to if needed.

2.5.2 RESOLVING CONFLICTS

Different stakeholders and users may have opposing requirements or there may be different technical requirements that are hard to resolve. An example of a conflicting requirement might be that the human resources stakeholder group requests to capture some personal information for an employee, but the data privacy team argues that the data should not be captured or used in reporting. There are a number of different techniques that can be used for resolving disagreements: (1) Stakeholders work together to negotiate a solution to the dispute. This involves discussion of each other's views to try to persuade people experiencing the conflict to agree on a workable solution or compromise. (2) Stakeholders may be asked to vote on two or different solutions as the resolution for the difference of opinion. This approach will give each party the reassurance that their point of view has been put forward and discussed even if it is not accepted. (3) Different stakeholders can apply their own variants to the solution as parameters. This way the different stakeholders get their

preferred solution implemented. (4) A comparison matrix is created of all key criteria that need to be considered against each solution alternative. This approach often highlights which is the best solution to choose and resolves the disagreement. An important aspect that is central to UX is to listen carefully to each stakeholder's point of view before one solution is adopted over another.

2.5.3 DESIGN CONCEPT EMERGENCE

As the requirements process develops, a basic design concept may emerge that will become the starting point for the developing design.

2.5.3.1 UX Technique: Brainstorming

This is a good way to get input from every relevant department. There are different ways to organize brainstorming with varying degrees of structure and freedom to add ideas. Some teams prefer to structure the conversation, so they have a little more focus while others have a blank board as a starting point. It is also helpful to give users enough time to formulate their own ideas before presenting them to the groups. "Crazy eights" is a technique where the participant has a sheet of paper that they fold three times so that it opens back out with eight sections. Each person sketches up to eight basic ideas, as crazy as they wish, which they then present to the group. Each sheet is then pinned onto a whiteboard for the group to discuss.

As part of the brainstorm session, the group may synthesize all the ideas to generate between three and five different design concepts and discuss the positives and negatives of each. The different user, task and environmental requirements may be used as assessment criteria with each concept being rated (using a rating scale) for each. The concept with the highest score is then chosen as the best and taken forward.

2.6 CONCLUSION

Gathering requirements for a new system or application is a process that can take time and effort. It is important to work carefully through the requirements generation stages to make sure that they represent the needs of each user and stakeholder group effectively. Documentation of the requirements made with care and plenty of input from everyone is key and analysis to ensure that the requirements are of high quality is also crucial. The application of UX methods can help the requirements analysis process to be more effective by bringing the requirements to life, making them more understandable and thereby giving them a human face.

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