

Design-Thinking and User's Requirement Engineering: Human Centred Development

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Abstract:

Design thinking (DT) provides understanding and innovation within development teams and increase quality and fulfill business needs. Design thinking basically work on three aspects/techniques: Viability, desirability, and specification. Design thinking approach of software development addressed towards innovation and end-user satisfaction. Design thinking overcome of project development limitation towards balanced solution for end-user software development. Design thinking applicability for design methods for promoting ideas, innovation and acceptability across the business needs and development and quality growth. Requirement engineering main focus on discovering and satisfaction of the end-user and various stakeholders involved in software development. Human centred development work and takes user's feedback in earlier stages of software development.

Keywords: Design Thinking, Viability, Desirability, Requirement Engineering, Human-Centred Software Development.

1. Introduction

Design thinking technique decrease the technical specification, complexity and provides end-user requirement needs and easy to implement [1,2]. Design thinking is integration of heart, head, and hand (HHH) for gives the analytic and ingenious process development [3,4] and real user satisfaction [2,3,4]. Design thinking makes human centred software development efficient, convenient and addressed end-user requirement specification. Design thinking primary objective is to gathering the requirement and apply summarize and synthesize technique for finding the quality solution for end-user prospective and business growth [1,2,5,7]. Design thinking fill the gap between process designing and operational level" [1,2]. Traditional Software Development approach as shown in Fig:1 generally work on fix/static requirement of end-user. Traditional approach not provides better solution if user's/client's requirement change in development phase in dynamic level or frequently. "Design thinking (DT) methods and tools giving innovation environment and makes work easier for both the end: designers and non-designers [1,2,5]. Generally, we can say that DT provides multidisciplinary teams work structure to develop that can be guided to integrated methods and can transition from more-to fewer reflexive approach's/practices"[5,7,9] Design thinking also addressed/suggestion is to engage different domain people like: business, technical and provide better interface for end-user product satisfaction and quality perspective. Design thinking development approach interacts with experts, get personalized input and feedback for optimize solution according to real-time users [1,2,4,7].

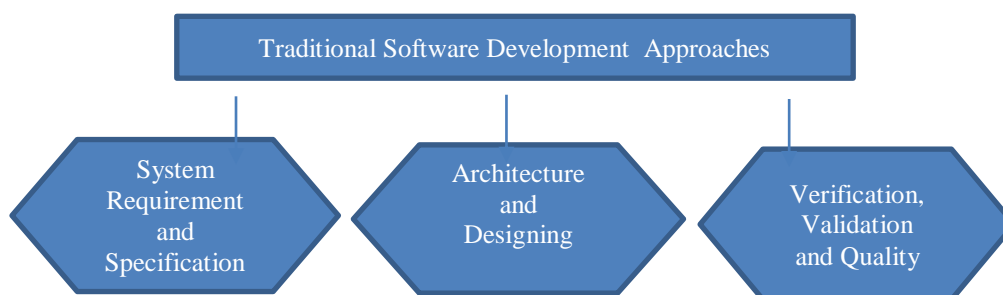


Figure 1: Traditional Software Development Approaches [1,2,4,5]

Requirement engineering (RE) is a software engineering approach provides various standards, methods, principles, tools-all to be selected according the requirement of project and software process models. [8,12] Requirement is approach generally define Human centred development is extent, the effectiveness and efficiency and satisfaction of User to achieve specified goals [3,6,10]. Rest of the paper is organized as Section 2 discusses the design thinking engineering, Section 3 discusses the requirement engineering, Section 4 discusses the human centred software development approach, Section 5 discuss the integration of design thinking and requirement engineering approach towards human centred development, Section 6 shows the conclusion and future scope and finally references[10,14].Human centred designing takes parallel approaches between "novice and experienced of designing to solve the end-user's solutions"[17] and human centred development reset the theories of design that in this approach "designer work as the main agent of product development[19].

2. Design Thinking Engineering

A large number of design approaches and tools facilitates the design thinking (DT) working environment more innovative and enhance the portability and quality of end product delivery according to customer needs.[1,2].One the famous tools given by Alves and Nunes base on the service design (SD) and basis on the surveyed-on industry and academia input and feedback[1,2]. Agile Engineering approach is an enabler to expedite software delivery, control priorities and escalate productivity [1,2,4,5]. Agile-Engineering becomes the medium to improve the solution over specified time, making it a “Living Product” that evolves with user response and new business and end-user requirements [5,7,9]. Agile is seeking rapid input from the end users in manner to ingeminate to the right outcomes by sprit to gather input and uncover undefined needs and requirement from end-user ends [1,2,4,5,7].

Design-thinking (DT) provides new frame-work and theories within in bounds. Since 2000, design thinking has been highly endeavour and is applied to novel challenges in human centred software development approaches [1,2,4,5,7]. Since, then design thinking has become a force of new innovation in business and a point of contention in end-user and buzzword. By the use of design thinking framework and innovation tools designing team provides solutions for end-user requirements to adopt cloud approach for human centred software development satisfaction [4,5,7,9]. If business word and software development team is to be widely adopted, less skilful and experienced end-user’s also will get better standard and quality software. Design thinking (DT) make integration connections between software development environment and innovation addressed by end-user for quality improvement and satisfaction [1,2,4,5,7,9]. Design thinking mainly come across three phases of designing: inspiration, ideation and implementation and design thinking basically used two types of thinking “convergent and divergent” to achieve the goal and full fill the end-user’s requirement [18].Design thinking mainly address the end-user’s needs through systematically study and exploration of different phases of software development[20-22].

2.1. Design thinking (DT) engineering parameters [1,2,5,7,19,20,22]:

- Accomplish process development with short budget and time.
- Give customizable solution for development.
- Increase the effectiveness and quality of development.
- Always target on end-user needs and satisfaction.
- Provide framework for human-centred software development.
- Graphical representation of software development and requirement fulfillment.
- Use two way thinking criteria to solve problem “convergent and divergent”.
- Provide hand-on approach of human-centred development.
- Involved innovation in middle of designing phase to increase effectiveness of development.
- Understand the what the right product.

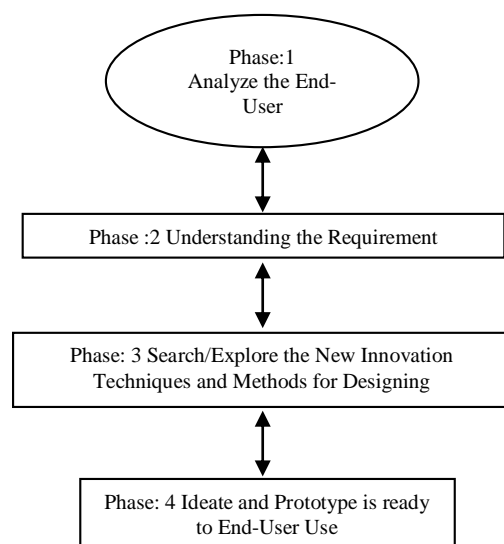


Figure 2: Design-Thinking Conceptual Framework and Phases [1,2,4,5,9]

Design-thinking fundamentals work is thinking towards end-user's actual needs and accomplish the requirement in real designing domain through operational prototype and innovation. By the above Fig:2 we understand the conceptual framework and development stages of Design thinking(DT) engineering approach. Design-thinking provide integrated development environment towards the end-user's view[2,4,5,7]. Design thinking helps to organization to improve/overcome the existing system limitation and provide sustainable product and has the ability to plug out the gap between end-user's need and designing phase[19,21].

2.2 Design thinking core attributes [1,2,4,5,7,9]:

- Define: Understanding, specification and produce assurance of evaluation of end-user's needs and requirements.
- Empathize: In this attribute of design-thinking, development team think and connect with end-users and might be developed better understanding towards their requirements, behaviors, and needs to produce quality/standard results.
- Ideate: It is creative process where development team generate ideas in sessions, produce open mind solutions and judgement free environment for end-user's satisfaction of requirements.
- Prototype: In here designing team focus on to develop standard prototype model base on client's requirements and behaviors and also validate over the end results and outputs.
- Testing: This is dynamic attribute of design-thinking for produce quality product and application for the end users.

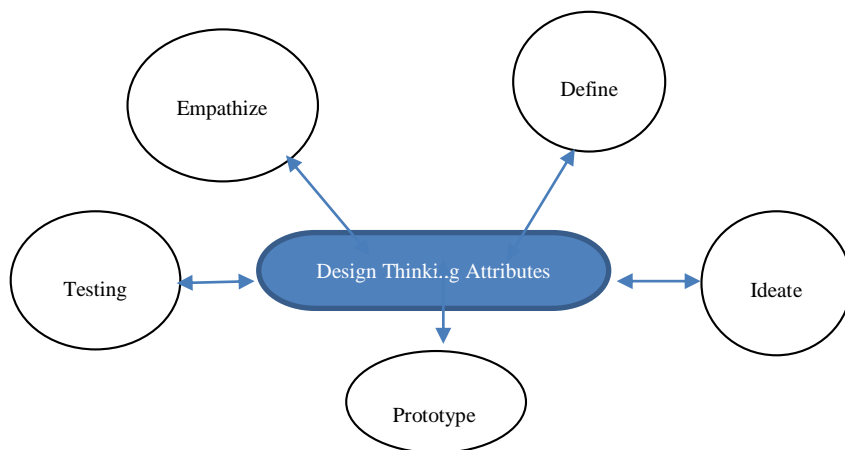


Figure 3: Different Attributes of Design-Thinking [1,2,4,5,7,9]

Design-thinking work on end-user's requirements and provide graphical representation of problem solution and end-user's feedback for better satisfaction and quality management from the end-user's end. In above Fig 3 show the different attributes of design thinking approach and their relationship.

3. Requirement Engineering

The success of software products depends on how well it's completed the needs of end-users and its environment. Software engineering always comprise these inputs, needs of end-users and requirement engineering (RE) is provides the solutions by which we meet and determined the user's requirements. Requirement engineering approach mainly work on understanding, specification and provides the ethnography and synthesis solutions for empathize and ideate product [8,12,13,15]. Given below Fig:4 show the different edges of requirement engineering and relationship with them. In general Requirement Engineering approach deal with challenges with completely different from general software engineering community approach, because requirement engineering technique focus mainly "problem area/space and other techniques main concern on problem solutions" [8,12]. In requirement engineering technique end-user satisfaction and brings end-users in on product design phase quite earlier stage and often to given quality and validation of product [8,12]. Requirement engineering working on easy-to-use, conceptualize, and encourages continued use of end-user's behaviour and needs [8,12,13,15]. Requirement engineering work from requirement feasibility study of end-user's and sustainable development towards the fulfilment and satisfaction of end-user's behaviour and needs [15,16]. Requirement engineering main core focus area is identify the client/end-user's requirements and operational behaviours of requirements fulfilment. As in below fig 4: showing the different edges of requirement engineering and their different working flow of attributes between each other's [12-13].

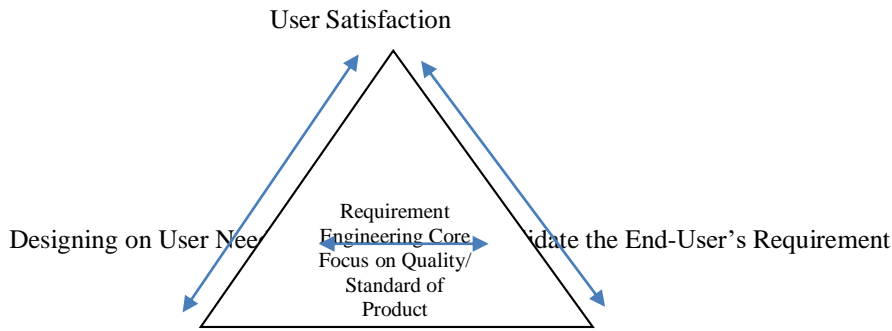


Figure 4: Different Edges of Requirement Engineering [12-13,15-16]

3.1 Different phases and activities of requirement engineering

Requirement Engineering provides depth understanding on client/stakeholder requirements, validate the resources, and provides pave and ground level problem solutions. As below table:1 showing different activities and objectives of requirement engineering to develop intuitive and standard design way and makes human-centred development quite efficiently and effective [8].

PHASE NO	ACTIVITIES /OBJECTIVES
I	One Line Requirement Study and Empathize on Future Work Layout.
II	Understanding, Specification, and Produce Real System Behavior for Development.
III	Sketch, Decide Prototype Model, and Validate According to End-User Needs.
IV	Synthesis, Ethnography, and User Oriented Prototype Model.
V	Define Operations Approach and Apply Solution for Validation Purpose of Client/Stakeholder Requirements/Needs.

Table 1: Different Phases and Activities of Requirement Engineering [8,12-13,14]

This approach are used as like semantic segmentation approach on requirements behaviors of end-user's and get the similarity between the requirement of client's and operational behavior of development process. It is rich knowledge technique to provides the platform to accomplish the user's requirements and provides the synchronous between development operational behaviors at real environment.

3.2 Requirement engineering attributes [8,12-13,15-16]:

- Depth understanding of end-user's requirements.
- Requirement specification for problem and requirements.
- Empathize of end-solutions.
- Procedural layout of problem specification.
- Verification and validation of requirement prototype.
- Decided implementation level according end-users.
- Provide post implementation solution if required by end-users.

3.3 Requirement engineering strategies [8,12,16]:

- Paradigm Shift towards thinking to design.
- Leverage with other technology/disciplines.
- Leverage to adopt new tools and technology.
- Progressive/Evolutionary techniques.
- Domain-specific solution.
- Problem generalization.
- Develop processes or strategies according to end-user needs.
- Evaluate existing research solution.

Requirement engineering core work is understanding of end-user requirement/behavior. In below Fig:5 illustrates the different holistic phases of requirement engineering. Requirement Engineering technique of software development work from the depth understanding of user's requirement towards the operational behavior and realistic solution of problems/requirements. Requirement engineering (RE) core part for software ecosystem (SECOs) nowadays and involved stakeholders in very beginning of design phase and use case[16,23].

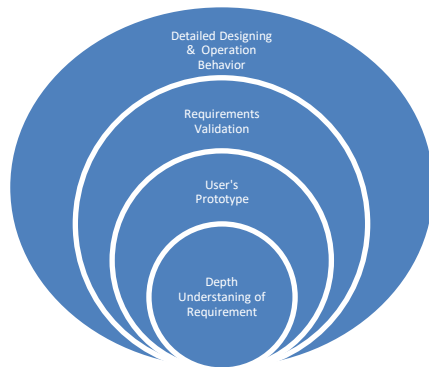


Figure 5: Requirement Engineering Holistic Phases [12-13,15-16]

4. Human Centred Software Development

Human centred software development (HCSD) is a technique that emphasize view to brings end-users in on development phase as early as possible and focus to provide continual validation, instead of waiting the process completion and reach real environment, human-centred approach mitigates that issue and shortens that feedback platform[3,6,10,11]. Human centred software development is brightest approach of software development. In human centred development technique conducting in depth exploratory user research in the initial phase of software development life cycle by this user feedback can forward to overall layout and requirement designed phase to given standard software product [3,6,10,14]. By the use of this technique development team starts to build out that structure which full-fill the user requirements and stories to designed standard application and process delivery become more effectively and efficient.

4.1 Human Centred Development Features [3,6,10,11,14]

- Human centred development helpful to drive minimally-viable prototype (MVP) or feature.
- Human centred development asks user/developer to verbalize their view on process as they come in development phase for use.
- This technique emphasizes on exploratory analysis the requirement of end-user's and provide process delivery on real domain.
- Human centred development methodology mainly focuses on understanding of sprints and standups designing, interviews and soliciting user testing for better development.

4.2 Human Centred Key Feedback Designing Algorithms [3,6,10]

4.2.1 User Layout Feedback Loop

This first feedback loop mainly worked on by asking end-users about their needs, behaviors, expectations, preferences, real impressions of a designing solution. In this loop designing team provides/advocates exactly layout about the clear understanding of designing and clear structure layout path for user point of view and better involvement of end-user's requirement fulfillment.

4.2.2 Execution of Designing Loop

In this level of feedback designing algorithm designing team work on requirement collaboration require from end-user's level across discipline and developers verify the changes come across from the users for implementing and operation level in middle of development phase.

5. Integration of Design-Thinking & Requirement Engineering: Towards Human Centred Development

As discuss above, requirements engineering core aim to providing supporting activities and along with provide with elicitation, analysis, specification and validation of user's requirements to given a standard and quality product [1-3,11]. Requirement engineering identified two types of activities firstly, primary work involves which lead towards to accurate requirements. Secondly, tasks focus on monitoring, controlling, validating and facilitate the success of end-user's requirements [8,12]. Design thinking techniques primary attributes are, identify actual requirements, prioritize, review and inspect artifacts of user's requirements and

iterate requirements development if required in development phase [1-5,19]. Design-thinking (DT) is increase complexity if end-user changes requirement in frequent manner and in short time frame. Generally, design-thinking is more suitable if end-user changes the technical requirement and behaviour of requirement specification only [1,2,4]. In this proposed model we going to elicitation of requirement engineering and design thinking engineering techniques to become ethnographic of human centred software development practices more convenient, cognitive and success [1-3].

5.1 Proposed Model Features [1-6]

- Identify actual requirements and create an initial scope of document.
- Prioritize and determine release/execution of project.
- Review and inspect artifacts of requirements.
- Apply group elicitation, contextual, model-driven approach on user’s requirements.
- Peer review, inspect, verify, validate the development process according to end-user’s requirement scenario.
- Domain specific development, continuous improvement, share information and engage stakeholder’s feedback throughout the software development life-cycle.

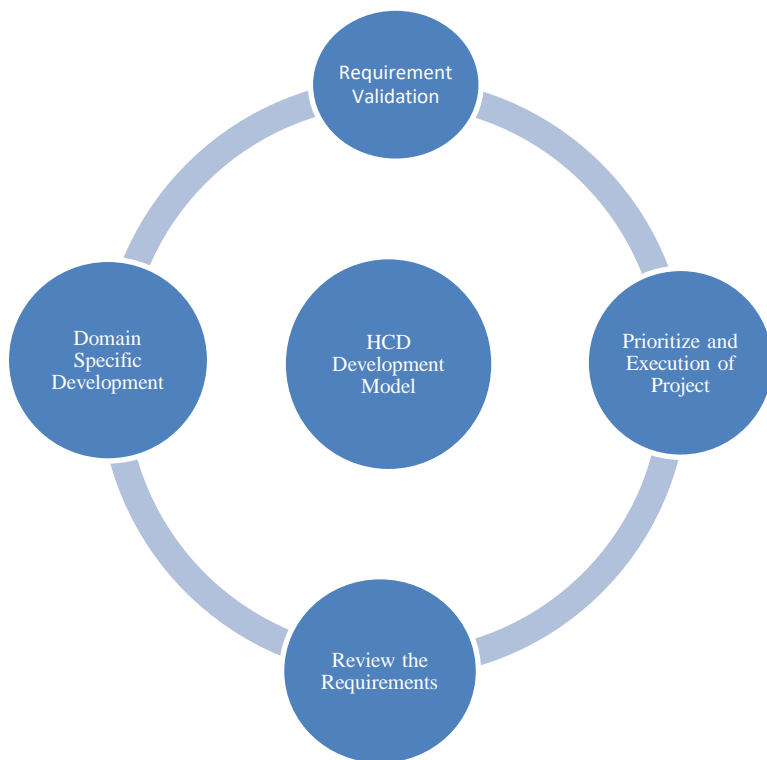


Figure 6: Propose Human Centred Model Features [3,6,10,14]

Proposed model starts from the requirement validation at every stage of the software development and fulfill the end-user’s behaviors and environment. Above Fig:6 show the different features of human-centred integration model and their relationship with each other’s. Proposed model prioritizes and execution the requirements towards for human centred development designing. In this proposed model we emphasized towards domain centric and specific approach and solution towards the end-user’s satisfaction and requirements fulfillment [1-4]. This integration model solves the issues of previous development model in which we not capture or deal the requirement in last phase of execution for this we use the prioritize requirement phase [1-2,8].

6. Conclusion and Future Work

In the proposed model the maximum depth and focus on the hierarchy of requirement engineering and design thinking to fulfillment the end-user requirements and needs. Design thinking working environment for software development is “from insights to viability”. Design thinking methodology provides individual development plan (IDP) for real-time application execution and internalize the concepts of development for the prospective of end-user’s satisfaction and needs. Design thinking provides holistically and continuously problem-solving environment for software development. Requirement engineering other end provides the way to handle incoherent requirement in product development and find out the relevance requirement accordingly the real time users. Now, the future scope we going to integrated the agile engineering, requirement engineering and designed thinking software development approaches to develop the ‘human centred software’ meta model to validate and full-fill the real time and end-user’s needs and requirements in effective and efficient manner in less uses of time and resources.

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