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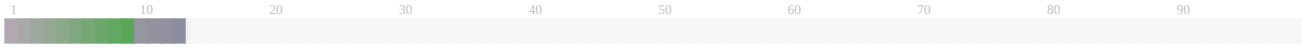

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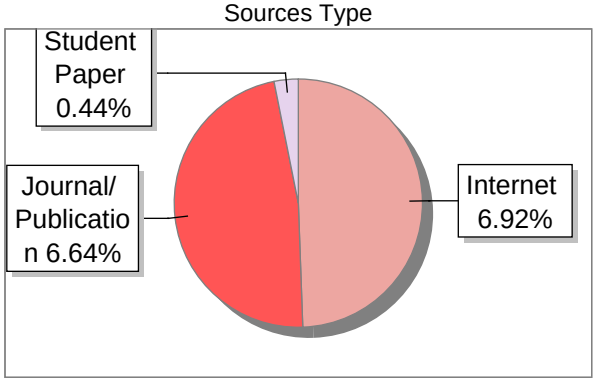

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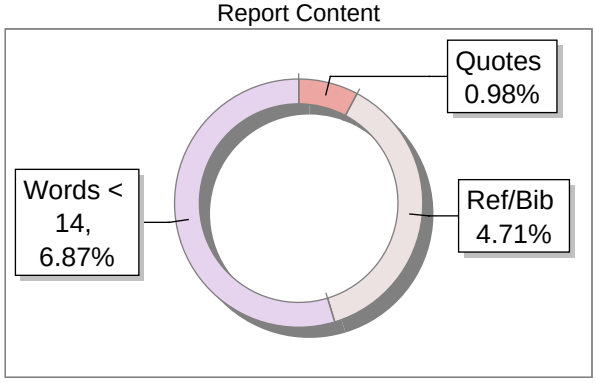

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PROJECT REPORT

ON

Comparative Analysis of Software Process Models and Their Impact on Requirements Engineering in E-Commerce Systems

Submitted to

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(Off-Campus Centre, Nitte Deemed to be University, Nitte - 574 110, Karnataka, India)

In partial fulfilment of the requirements for the award of the

Degree of Bachelor of Technology

in

INFORMATION SCIENCE AND ENGINEERING

By

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Under the guidance of

Dr. JASON ELROY MARTIS

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Abstract

Over the past few years, the boom in online businesses has completely reshaped how companies reach out to customers with their products and services. What used to be a basic website has evolved into these massive, intricate platforms. They track thousands of products, process secure payments without a hitch, safeguard sensitive customer details, and manage orders from start to finish. Pulling all that off means you can't just wing it you need a solid plan right from the beginning.

One standout piece of that planning is requirements engineering. Here's the thing: in our ever-shifting digital world, customer needs aren't locked in forever. They change with user habits, fresh features get tacked on all the time, and security measures have to keep pace with new risks popping up left and right. It's all about staying nimble.

In this report, I take a close look at three popular software development life cycle (SDLC) models Waterfall, Incremental, and Spiral putting them head-to-head. I compare them based on flexibility risk management stakeholder involvement and overall adaptability to surprises. A structured framework makes documentation a breeze, but true flexibility is the secret sauce for riding the wave of today's e-commerce trends, like AI recommendations or instant checkouts.

GitHub Repository Link

https://github.com/avani-tholpady/avani-tholpady-sdlc-process-models-requirements-ecommerce

Introduction

Software development is not only about coding or using advanced technology it actually involves a lot of planning, discussion, and teamwork. Every member of the project team has an important role, and proper communication between them is necessary for the project to run smoothly. Technically a strong project can also fail without proper coordination and clarity.

That is why selecting the correct Software Development Life Cycle (SDLC) model at the beginning of a project is very important. The SDLC model guides how the project will be carried out and how requirements will be handled from start to finish. Managing the changes become difficult later.

In traditional methods like the Waterfall model, all requirements are gathered and finalized before the development phase begins. This approach works well when requirements are clear and stable. However frequent changes are not applicable.

Requirements Engineering plays a key role in ensuring that the final system satisfies user needs. It includes identifying requirements, analysing possible constraints, documenting them clearly, and handling modifications when necessary. Proper requirement management reduces confusion and increases the chances of project success.

This report compares the Waterfall, Incremental, and Spiral models based on their flexibility, risk management, and ability to handle changing requirements, particularly in dynamic domains like e-commerce.

Problem Statement

Most e-commerce platforms run in a space that really encourages innovation across online marketplaces. For long term sustainability this

kind of innovation is essential. For e-commerce sites to remain competitive and make sure customers get the best possible service, they have to go through periodic updates. An updated platform brings in things like smoother user interfaces, more reliable payment systems, handy order tracking features, and exciting flash sales to draw in shoppers.

Proper management of requirements is crucial for keeping an e-commerce platform sustainable, especially since it involves so many modules that all interact with each other. The goal of this research is to explore how well different SDLC models handle changes to requirements, manage risks, and involve collaborators when developing an e-commerce system.

System Description – Online E-Commerce Platform

System Overview

The system normally comprises

• User registration and authentication

• Product catalogue management

• Order processing system

• Payment gateway integration

• Administrative control panel

As these systems handle monetary transactions and other sensitive information of the user these systems would need to function reliably, securely and with high efficiency.

Stakeholders

The e-commerce platform has many stakeholders who are:

Customers

They surf through the products, prices, services and then order the required items.

Vendors

These involve product listings, prices, inventories and promotions.

System Administrators:

They are responsible for monitoring systems handling the database and solving technical problems.

Each of these parties has its own set of expectations. Requirements engineering is effective when all these factors are considered.

Key Characteristics

1. Large User Base: The system has to serve many users at a given time especially during promotional events.

2. Frequent Feature Updates: Businesses may introduce new features in an effort to attract customers.

3. High Security Requirements: Financial information and personal data must be kept confidential through the use of encryption and authentication techniques.

4. Scalability: The platform needs to be scaled up efficiently.

Such features make flexibility and risk management very important.

Methodology

The fact that e-commerce systems are used for the development of the case study is because of the dynamic nature of e-commerce systems. E-commerce systems are dynamic software systems because they have to be updated constantly so that the dynamic environment is incorporated into the software. This is useful for analysing the development models.

There are three different models presented for software development namely waterfall model, incremental model and spiral model. These models used in software development will be analysed individually with regard to their requirements as a form of requirements engineering for development in the field of e-commerce.

1. Waterfall Model

The waterfall model uses a structured approach which initially involves completion of one phase before proceeding to the next. These are

• Requirement Analysis

• Systems design

•Implementation

•Testing

•Deployment

• Maintenance

This model locks in the requirements at the very start of development and expresses them in documents. Any change from this point onward becomes bulky and it is very costly.

Advantages include:

• Clear structure

• Easy documentation

• Light and easy to handle

The limitations include

• Poor Adaptability to changes in the requirements

• Identification of risks is done very late.

• Limited stakeholder involvement after the initial phase.

In the e-commerce architecture where modifications are common the inflexibility will act as a negative factor.

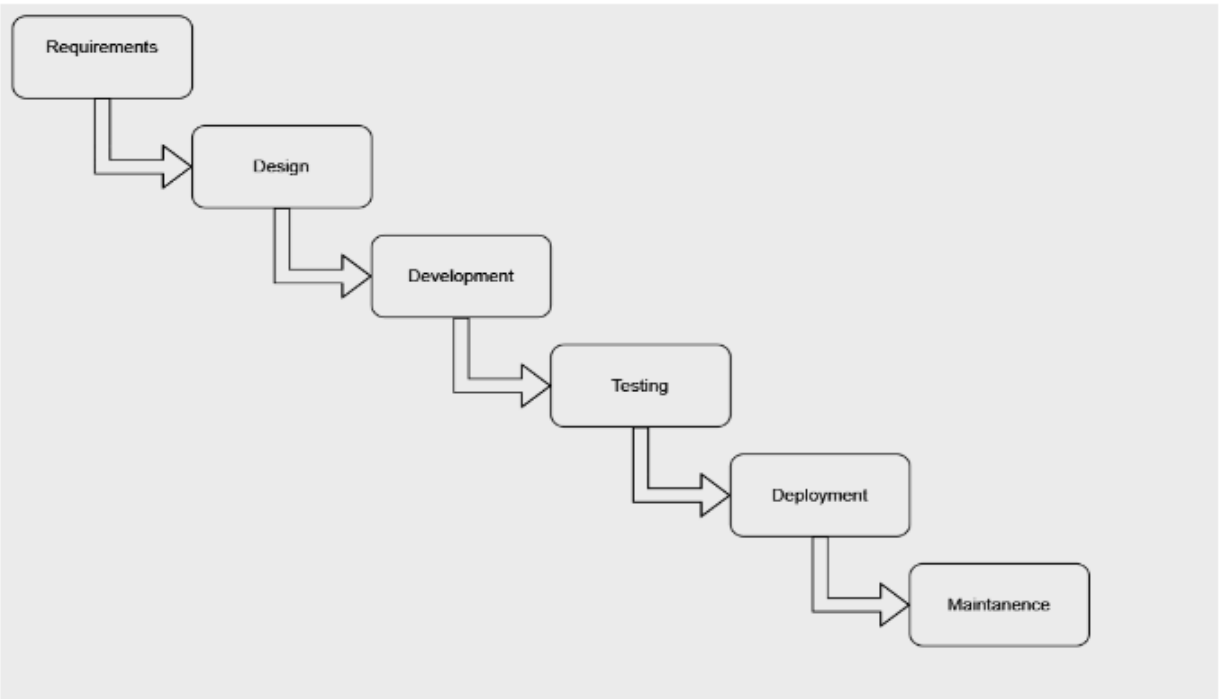


Fig (a)waterfall model

2. Incremental Development Model

The Incremental model is another model that involves breaking up the system development process into smaller parts. The new system is thus

not built as a single unit. However, the new increments are constantly being added.

For instance,

First Increment - User registration and browsing products.

Second Increment – Shopping cart and order management.

Third Increment- Payment integration and advanced features.

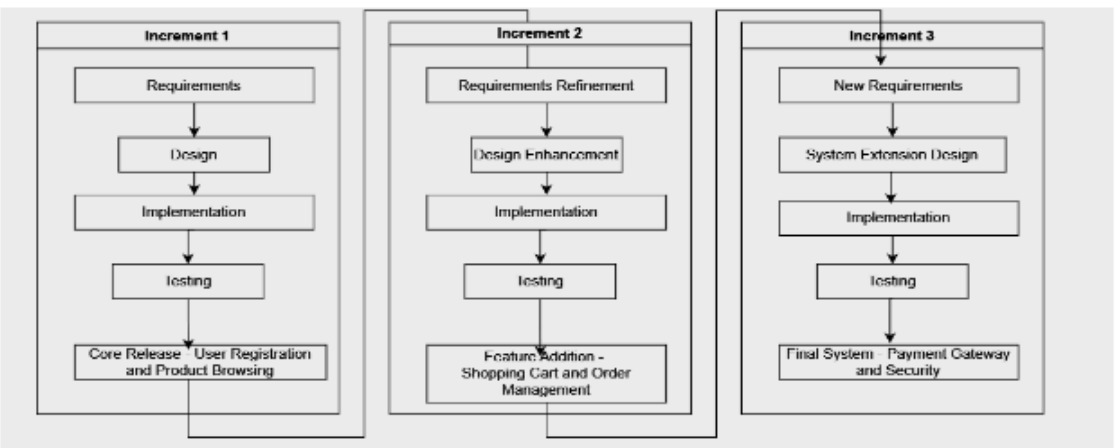
Advantages

- Early availability of primary functionality
- Regular stakeholder feedback
- Lower risk of total system failure

Limitations

- Requires good planning
- Integration issues may arise

It provides more flexibility than the waterfall approach.



Fig(b) Incremental Development Model

3. Spiral Model

The spiral model incorporates the development and systematic risk analysis. A spiral development cycle has the following components:

- Planning
- Risk assessment
- Development
- Evaluation

The model focuses on managing risks at all the stages.

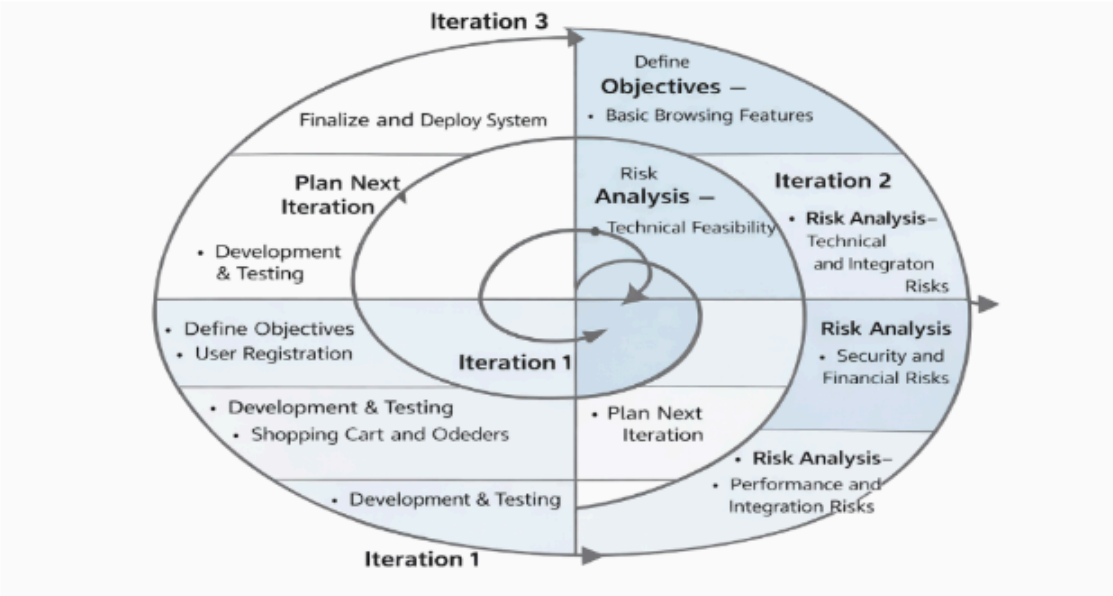
Advantages

- Strong risk management
- Continuous requirement refinement
- High stakeholder involvement

Limitations

- More complex to manage
- Higher cost due to repeated analysis

For the high-risk systems like online shops the spiral model provides good support.



Fig(c)spiral model

Requirements Engineering

The function of Requirements Engineering is to ensure that the final system meets the requirements of all those concerned.

Functional Requirements

Functional requirements define what a system is supposed to accomplish

- User registration and login
- Product search and filtering
- Shopping cart management
- Secure payment processing
- Order confirmation and tracking

These requirements are the essential features of the system.

Non-Functional Requirements

The non-functional requirements focus on different quality attributes of the system:

- Security: User and payment data protection
- Performance: The response time is fast even in peak traffic cases.
- Availability: Minimal downtime
- Scalability: Ability to scale Non-functional requirements assume a level of importance similar to that of functional requirements in a dynamic system.

Comparative Analysis of SDLC Models for an E-Commerce System

In determining which development model is most suitable for an online e-commerce development platform a comparison of waterfall, incremental and spiral development models have been carried out on requirements flexibility, risk handling, cost considerations and suitability.

Comparison Table

Aspect	Waterfall	Incremental	Spiral
Requirement Flexibility	Low	Moderate	High
Risk Management	Limited	Moderate	Strong
Customer Involvement	Minimal after start	Regular feedback	Continuous involvement
Suitability for E-Commerce	Low	High	Very High

Analytical Discussion

The Waterfall model is appropriate only when requirements are fixed. However, the e-commerce application requires frequent update and thus the Waterfall model is not appropriate.

The Incremental model has better adaptability through the addition of individual features.

The strongest support would come from the spiral model due to its increased attention to continuous risk analysis and the refinement of requirements. This is because it is applicable to complex and high-risk systems. With structured analysis it offers a stronger fit with modern software engineering guidelines especially for high-risk applications like online commerce systems.

Most Suitable Model

The Spiral model with the highest level of risk management and flexibility in comparison is appropriate for large-scale e-commerce systems while the Incremental model supports a balanced approach between flexibility and cost efficiency appropriate for small to medium-scale systems.

Discussion

This type of comparative evaluation serves to all the above point that models like Waterfall being a rigid and a sequential model would obviously be associated with a series of limitations in a context wherein the requirements are undergoing changes at a faster rate. In the case of the e-commerce platform the requirements of the customers are subject to change. In this regard the adaptability of the project would be a key factor.

Incremental development would offer better flexibility because of its staged delivery method.

It has to be noted that the strongest argument for requirements engineering is provided by the Spiral model owing to the fact that it addresses the aspect of risk management and validation in an important manner. As has been highlighted by the IEEE guidelines on software requirements engineering [3], "system reliability and quality can be guaranteed only by continuous validation with stakeholders." It is seen that the iterative models are more likely to adhere to such guidelines thus it is more relevant to consider such models while building systems like e-commerce sites which are more complex in nature.

Requirements Validation Strategy

Several validation techniques may be chosen to ensure the accuracy and completeness of a requirement:

- Requirement Review Meetings
- Prototyping of User Interfaces
- Walkthrough
- User Acceptance Testing (UAT)

Such techniques help avoid misunderstandings and are robust.

Challenges in Requirements Engineering

Even with structured approaches there are challenges:

- Ambiguous requirements
- Highly Fluctuating Needs of Business
- Communication gaps
- Conflicts with stakeholders

The challenges involved in these processes are resolved through communication.

Most Suitable Model

Looking at the above analysis, it can be deduced that the Spiral model is more appropriate for large-scale e-commerce systems on account of its emphasis on risk management.

For small or medium projects, the incremental model is a good compromise.

Conclusion

The mode of modelling in the SDLC process has significant effect in the field of requirements engineering. The environment in the case of e-commerce is ever changing.

Waterfall approach provides structure but lacks the sense of flexibility. Incremental provides more flexibility through phased delivery. Spiral with its unique ideas about iterative development and managing risk assessment seems to fit this question best.

An appropriate model in development helps in controlling the requirements reducing any risk present and ensures success in the long run in the environment.

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