Chapter 3

SYSTEM DEVELOPMENT METHODOLOGY

3.1. Introduction

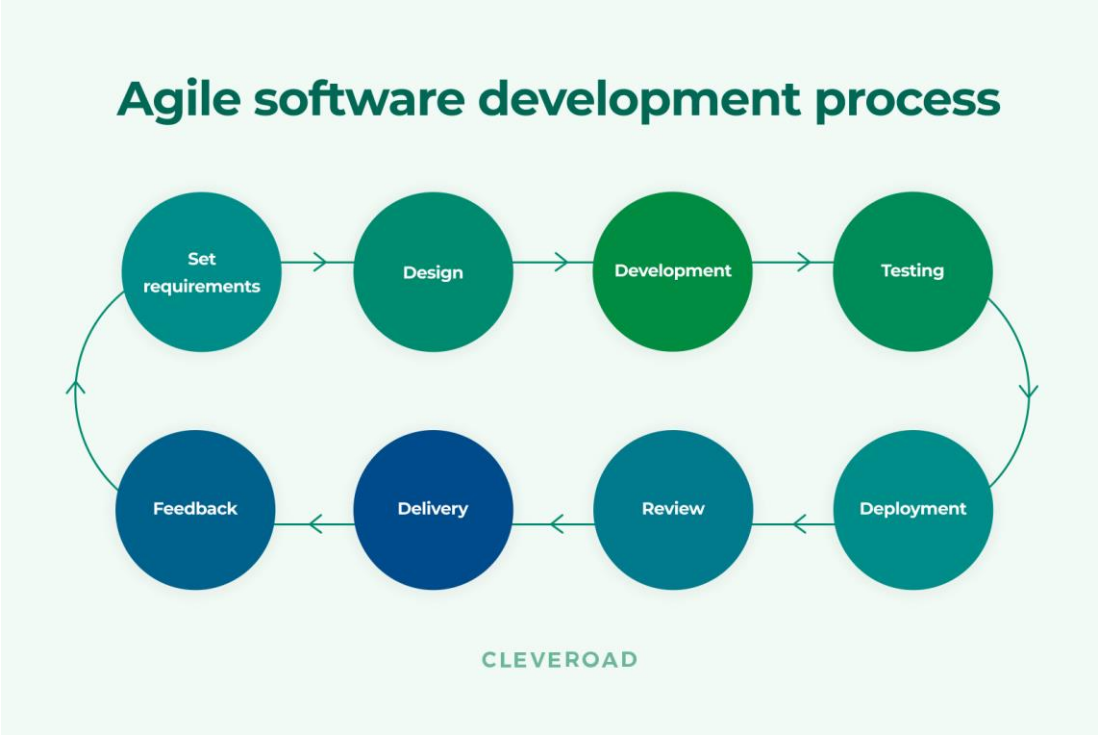
Software development is a complex and long process. It is a challenging and complicated effort that requires careful planning in order to avoid financial losses and provide high-quality results. A small defect during software development can cause a vast amount of loss. If no planning is done before starting the development of a software, then many errors may arise during the development phase, it will result in the development of faulty software and also it will require a lot of time for its development. For this reason, planning and management are important steps of software development.

Specific methodologies are followed by developers to develop a software according to its type and requirements. The term "software development methodology" describes a planned, conducted out, and managed approach to software development initiatives. It provides a framework for organizing tasks, defining roles and responsibilities, and establishing a sequence of activities to be taken along the development process.

There are many methodologies that have been followed by developers to develop software. Such as Waterfall method, Incremental method, Agile development, Prototyping, Rational Unified Process etc. Each of these methodologies have their own characteristics and used according to the software being developed.

3.2. Methodology Choice and Justification

The methodology that will be most suitable for this system is the Agile Software Development methodology. Agile is a wide umbrella of software development beliefs. It is a conceptual frame-work for software engineering that begins with a starting planning phase and follows the road toward the deployment phase with iterative and incremental interactions throughout the life-cycle of the project. (Al-Saqqa et al., 2020) The traditional Waterfall method is not used because it is not suitable for developing automated systems using web scraping. Web scraping projects often require flexibility and adaptability due to the dynamic nature of websites and changes in grant criteria. The waterfall methodology is linear in nature which makes it challenging to respond to these changes effectively, as it can result in a significant amount of rework if requirements or design need to be modified. On the other hand, in Agile method, the changes can be made easily in the next step as it is an incremental process.



The main advantage of agile method is its iterative approach. In this method, the project is divided into smaller increments or sprints. Each iteration of the grant-finding algorithm can focus on collecting information from a certain website or applying a particular filter. This makes it possible to release functionality early and continuously, which makes it simpler to validate and get feedback from users or stakeholders. By developing software using agile method it is possible to provide the software early than other methods. Because in this method, a small part of a code can be constructed first and it can be used and also the part of code can be enhanced later to make larger systems. In short, through developing the system with Agile Methodology, a working version of the system can be gotten early and also improvements can be done on it due to its incremental process of development.

3.3. Phases of the Chosen Methodology

Agile methodology focuses on delivering working software in small increments and emphasizes frequent communication with customers and stakeholders. Developers can respond to changing needs of stakeholder and provide value early in the development process due to the methodology's emphasis on flexibility, ongoing planning, and openness. There are six phases of Agile software development which are concept inception, iteration, release, maintenance, and review. These are discussed below:

3.3.1. Concept Phase

The first phase of agile development is Concept phase. In this phase, the basis of the software development is completed. A layout of the system is created in this phase. The scopes and objectives are identified, the primary requirements are discussed with the stakeholder. The developer provides solutions to the problems of the stakeholders and an estimation of costs and probable date of completion through brainstorming, initial discussions, and gathering information.

For the FC Research Grant Finder system, it is necessary to define the objectives and vision of the system. The necessary documentation needs to be prepared and the features of the grant searching has to be identified with the stakeholder by discussions and brainstorming. An estimation of project completion date and coat will be provided to the stakeholders.

3.3.2. Inception Phase

This phase can start after the concept phase is completed. This phase marks the end of the planning stage of the project. The requirements, functionalities and objectives are researched and discussed in depth. The tasks are divided among the developers in a team and the tasks are prioritized. The necessary tools for the development are provided to the developers. It is important to build the project structure in this phase. The mockup user interface and the system development are designed in this phase.

For the system FC Grant Finder, this phase will be the last stage of planning. The requirements will be revised with the stakeholder. The scope and the objectives may be revised. The different tasks for the development such as grant searching, filtering, grant dashboard etc. will be identified and will be prioritized in an order. The mockup user interface will be designed according to the proposed system and the development phase will begin.

3.3.3. Iteration Phase

This is the longest and most important phase of agile development. This is the phase where the development of the system starts. The tasks are divided into sprints based on their priority. Each sprint has specific tasks and deadlines. The development progresses with the progress of the sprints. In this phase the coding starts, and the design is transformed to code. A sprint can consist of planning, execution, and delivery of the completed tasks. Throughout the iteration, the team holds daily stand-up meetings to provide an update on progress, discusses any challenges or impediments they are facing, and highlights their planned work for the day.

For FC Research Grant Finder system, all the tasks will be identified and divided into sprints. The sprints will contain planning and execution of tasks, such as designing the front end, building the

structure of the system, including search function, filtering grants. Each sprint will contain extraction of grant information from specific websites. In this way through the progress of multiple sprints, the development of the system will be completed.

3.3.4. Release Phase

The release phase starts when the development of the system is almost done. That is the coding part is almost done. After the development of the system is done it will be tested by the testers to ensure that it can perform its functionalities properly. If the testing goes well, then the product is set for release. When all the coding of the FC Research Grant Finder will be completed, and the complete structure of the system is visible, the testing will be done to ensure that the system is working properly. A release will include scraping capabilities that will be done from multiple websites, filtering options, and a user interface. The release would undergo testing and quality assurance before being deployed or distributed to users.

3.3.5. Maintenance Phase

The maintenance phase begins when the software is released. Now that the system has been built completely, users may access it. The software development team will continue to offer help during this stage to keep the system operating efficiently and fix any new issues. They will also be available to provide consumers with further training and to make sure they are familiar with how to utilize the product. New iterations can be made over time to improve and add new features to the current version.

For the Fc Research Grant Finder software, after its release, maintenance of the system will be a vital task for the operation of the software. The system has to work with a lot of data and for every search for grants by the user it will use web scraping to extract information. Besides, there may be many new websites that provide grants. So those websites need to be added to the system. To maintain smooth searching of grants including filtering and up-to-date grants, it is necessary to maintain the system to cope with the new changes.

3.3.6. Review Phase

The development team presents the functional features or software that have been developed throughout the iteration during the review phase. This demonstration allows stakeholders to assess the progress made and provide their input. The developers present the working software or completed features to stakeholders, showcasing the functions that have been implemented in the system.

Stakeholders have the opportunity to provide feedback during the review phase. They can express their ideas, concerns, and requests for any necessary modifications or improvements.
After release, the FC Research Grant Finder app needs to be reviewed by the stakeholders. They need to check whether the system is working properly or not. They need to check if the website could extract grant information from the sources and do the filtering according to the user criteria. After certain functionalities that have been developed at each sprint, the stakeholders do a review of the system, to ensure that the functionalities have met their requirements.

3.4. Technology Used Description

The FC Research Finder system will be a web-based project. There are uncountable websites available on the internet. There are many different types of technologies that are available to design web-based software. Each web language has its own unique characteristics. So, the language is chosen according to the requirements of the system. Some of the languages for web development are Python, CSS, JavaScript, ReactJS, NodeJS etc.
Since the FC Research Grant Finder will be using web scraping technique and will have a dashboard to view the analysis of the data, the system will be developed using the Django framework of Python and will use python libraries like Beautiful Soup, Scrapy etc. As the system will have to store a large amount of data in the repository, a database language is needed to manage those data. The database system that will be used is MongoDB. By using these technologies, it is expected that the system can be built properly functional and adaptive.

3.5. System Requirement Analysis

This section includes the hardware and software that are needed to develop the system. By using the proper hardware and software a user can run the system properly and efficiently.

3.5.1. Hardware Requirements

This section gives an idea about the hardware needed to develop the FC Research Finder.

3.5.1.1. PC/ Laptop

A working PC or laptop is needed for the documentation of the system and also for doing the coding and testing the system.

Hardware	Minimum Requirements
Processor	I3 6th gen or equivalent
Type of Operating System	64-bit
Random Access Memory (RAM)	4GB
Disk space	256GB
Minimum free disk space	15GB
Input device	Keyboard, mouse
Output device	Monitor, Printer

3.5.2. Software Requirements

There are many software that are required to build a web application. This section will describe about the software that are required to develop the FC Research Grant Finder system.

3.5.2.1. Visual Studio Code

Visual Studio Code is a source-code editor that will be used as the main platform for coding the application in this project. Visual studio code contains different plugins for different languages which help writing codes easily and nicely format them. It also has a code runner to run the code.

3.5.2.2. Enterprise architect

Enterprise architect provides a platform for creating, visualizing, and managing enterprise architecture artifacts and models. A variety of features and functions are available in enterprise architect software to help software designers with their work. It enables the creation and upkeep of architectural diagrams, including infrastructure designs, component models, architectural models, and package diagrams.

3.5.2.3. Windows 7/8/10 or equivalent MacOS

The operating system is necessary for the computer or laptop to function.

3.5.2.4. Google Chrome

Google chrome is the web browser that will be used to run the system and also to browse through various websites for resources and tools.

3.5.2.5. Microsoft Word

Microsoft Word will be used for documentation.

3.5.2.6. Microsoft Excel

Microsoft Excel will be used for arranging the extracted data from websites through web scraping.

3.6. Chapter Summary

This chapter goes through the importance of planning and choosing a software development method for the FC Research Grant Finder. It includes the reason that Agile Methodology is the best suited for the system and describes the different phases of that methodology. The chapter also provides a brief description of the tools to be used for the development and the hardware and software requirements for the system.

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