END TERM MAJOR PROJECT REPORT
(28th February 2021 – 25th June 2021)

ON

QUALITY ENGINEER WITH SELENIUM AND JAVA

Under the guidance of
Ms. Rohini Priya E

AT

COGNIZANT TECHNOLOGY SOLUTIONS
INTERNATIONAL CONVENTION CENTER (ICC) TRADE TOWER,
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CERTIFICATE

PROJECT REPORT UNDERTAKING

I Mr. Deepesh Yadav Roll No 171380 Branch CSE is doing my internship with **COGNIZANT TECHNOLOGY SOLUTIONS** from 28th February 2021 to 25th June 2021.

As per procedure I have to submit my project report to the university related to my work that I have done during this internship.

I have compiled my project report. But due to COVID-19 situation my project mentor in the company is not able to sign my project report.

So, I hereby declare that the project report is fully designed/developed by me and no part of the work is borrowed or purchased from any agency. And I'll produce a certificate/document of my internship completion with the company to Training and Placement Cell whenever COVID-19 situation gets normal.

Deepesh Yadav
Enrolment No.: 171380
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DECLARATION

I hereby declare that the work reported in this report entitled **"QUALITY ENGINEER WITH SELENIUM AND JAVA"** is submitted in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering/Information Technology** submitted in the department of Computer Science and Engineering and Information Technology**,** Jaypee University of Information Technology Waknaghat is an authentic record of my own work

Cognizant does not allow the project material to be used beyond the said guidelines, I Deepesh Yadav am aware of the fact and appropriately created the project report without violating any compliance.

Allocation of technology track depends on the following – student capability, business demand and location where it can be offered. Student capability is assessed through –electives completed by the student, participation in other technical forums and performance in Internship.

The projects completed in the internship duration (full) will vary from development, to enhancements, research, scripting across technologies like Java, Dot net, AWS, Cloud, FSD, DW, Selenium, SFDC, SAP. Project in Application Development space requires good programming skills. Some of them would require Digital skills as well. These projects are a combination of business aligned business case that we deliver to our clients or internal projects to address Cognizant's business needs

Internship is for a period of 3 to 6 months, during 8th semester. Actual Internship dates and duration would be based on the business demands and aligned skill tracks offered. Thus, I am in middle of the internship program.

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Deepesh Yadav
Enrolment No.: 171380
B. Tech (CSE)

ACKNOWLEDGEMENT

It was a privilege for me to work as a full-time intern at **"COGNIZANT TECHNOLOGY SOLUTIONS"** under the supervision of Ms. Rohini Priya E.

This report describes the training that underwent, for the duration of 28 February 2021 - 25th June 2021 at intern at "**COGNIZANT TECHNOLOGY SOLUTIONS**" an American multinational technology company that provides business consulting, information technology and outsourcing services.

I would like to express our sincere gratitude of the all the people who have helped and supported me throughout. I am deeply indebted to Ms. Rohini Priya E (Programmer Trainee Techno Campus Office (TCO)STPI), Mr. Rakesh & Ms. Sonal (External Trainers), Mr. Yuvraj C (Mentor) and other fellow colleagues at **COGNIZANT TECHNOLOGY SOLUTIONS** for organizing an effortless internship program, efficiently and providing me valuable resources and for their cooperation and willingness to share their expertise and knowledge and to devote their precious time to discuss related topics.

The help and co-operation extended by the staff at **COGNIZANT TECHNOLOGY SOLUTIONS** is fully acknowledged. I thoroughly enjoyed my entire internship program and would like to thank everyone at **COGNIZANT TECHNOLOGY SOLUTIONS** for their guidance and support.

Deepesh Yadav
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ABSTRACT

This report describes the internship that I did with "**COGNIZANT TECHNOLOGY SOLUTIONS**", Pune Office, during the period of February to June 2021. The project assigned to me was "**QUALITY ENGINEER WITH SELENIUM AND JAVA**". The report itself sheds light on the various process and concepts I have learned as a full-time intern.

The primary objective of the internship was to learn software testing and automation using a web automation tool called "**Selenium**". Selenium driver serves as an interface that allows programmer to write scripts in languages such as Python, JavaScript, Java, etc. to automate various tasks on browsers such as Chrome, Firefox, etc.

During the project Selenium driver along with java was to used automate testing of web applications. Also, JSON/XML formats were used to communicate with APIs and JavaScript was used for form validation in various hands-on task provided to us.

Other than this, I was trained on SQL and basics of Java for database management and writing testing scripts using selenium and java.

Chapter I

INTRODUCTION

1.1 About Cognizant

Cognizant (Nasdaq-100: CTSH) is one of the world's leading professional services companies, transforming clients' business, operating, and technology models for the digital era. Our unique industry-based, consultative approach helps clients envision, build, and run more innovative and efficient businesses. Headquartered in the U.S., Cognizant is ranked 194 on the Fortune 500 and is consistently listed among the most admired companies in the world.

India is a crucial piece of our global business strategy, with global delivery centres in Mumbai, Bangalore, Chennai, Coimbatore, Gurgaon, Hyderabad, Kochi, Kolkata, and Pune.

Domain	: Information technology consulting company
Company website	: https://www.cognizant.com/
CEO	: Brian Humphries (1 Apr 2019–)
Revenue	: 1,680 crores USD (2019)
Founded	: 26 January 1994
Headquarters	: Teaneck, New Jersey, United States
Subsidiaries	: Soft Vision, TriZetto Group, Inc. (The), MORE
Founders	: Kumar Mahadeva, Francisco D'Souza

1.2 Training Program

The learning journey contains two stages, followed by a Business Aligned Project.

STAGE 1 –QEA BASICS

- Functional Testing and Soft Skills
- Java Programming and Soft Skills
- Web UI, Data Source and Soft Skills

STAGE 2 –AUTOMATION TESTING –SELENIUM, CUCUMBER, DEVOPS.

- Automation Concepts, Selenium configuration, WebDriver Basics
- Selenium Automation Techniques, Dynamic XPath
- Selenium Web driver With POM and Apache POI
- Automation Testing - Selenium with TestNG
- Digital Technologies

Business Aligned Project is providing for an experience of real time problem solving in Agile methodology.

Cognizant has collaborated with Udemy to provide world class learning videos for the evolving future of work. These Udemy programs are woven into a learning path, empowering you to plan and learn at your style.

The program also connects you with Subject Matter Experts to get the professional guidance on your queries in the learning journey.

The program continuously evaluates if you can apply those self-learnt skills to solve a business problem. Depicted below are the three key learning components, which are distributed across the learning journey for the purpose of continuous evaluation.

SCHEDULING OF LEARNING COMPONENTS

The overall duration of this program is 12 weeks. From the day 1 of the program, every day will have some learning components to be completed by the GEN C.

The detailed student handbook will have the day-wise schedule. All the learning components have to be completed as specified in the day-wise schedule. These components will be auto scheduled in your specific learning paths as per the given schedule.

INNOVATIVE LEARNING MODELS IN 2020

The Gen C (Generation Cognizant) Program stretches across the entire timeline of a campus hire's learning journey from the time he/she accepts the offer letter from the company -to the first year of his/her tenure in the organization. There is a robust learning strategy put in place across each of the stages.

- Modern Flipped Classroom
- Branding @ Campus Events
- Leader Engagement
- Heartfulness Workshops & Webinars Active Volunteering

1.3 Software Testing and Development

In the information age, all businesses rely heavily on information for day to day use, but information itself, has to analysed to be acted upon by human actors. This is where software comes in software helps in everything from ticket booking to delicate medical procedure, softwares have provided users to do things efficiently and save time.

Software itself is a vast topic and software development and testing is at the heart of every software company. Software development refers to the processes and models that help in making of the software, these processes and models provide a through understanding of what is to be done, how it should be done. Software testing is vast and complex field of testing software applications.

Automation of testing procedure helps the software development firms and business to cut down on cost and make effective decisions and development is easier and more robust. Web applications are the perfect candidates for automation as they have to serve many different types of browsers as well as different clients as well. Therefore, Automated testing of websites is huge cost saving strategy for businesses.

An automated site perceives the interesting requirements of guests and upgrades content for every watcher. The product assists with aiding support contacts all the more productively. It is responsive (versatile agreeable) out-of-the-case, completely incorporated with each showcasing channel, and

versatile to the changing necessities of leads and clients.

Java is characterized by a determination and comprises of a programming language, a compiler, center libraries and a runtime (Java virtual machine) The Java runtime permits programming engineers to compose program code in different dialects than the Java programming language which despite everything runs on the Java virtual machine. The Java stage is typically connected with the Java virtual machine and the Java center libraries.

Similarly SQL has the capacity to perceive the various sorts of information bases. It has the capacity to interface with the information base utilizing distinctive SQL association customers. Comprehension of the connection between data set tables, keys, and records. Capacity to compose a basic select or SQL articulation alongside more intricate join inquiries

Selenium is an open source tool that automates web browsers. Selenium is Open Source UI Automation Tool. It is used to Automate the Web-Application but not for Desk-Top Base Application Automation. It was created in 2004 by a ThoughtWorks Engineer. Selenium Web-driver was introduced later in 2006.

Chapter II

SOFTWARE DEVELOPMENT

2.1 Software Development Lifecycle

A Software Development Lifecycle Model tells us about the types of activities executed at every stage in a software development project, and how the ventures relate to one another aptly and chronologically**.**

- SDLC is the elision of Software Development Life Cycle.
- It is furthermore called as Software Development Process.
- SDLC is a complex set apart assignments executed at each parade in the product up gradation measure.
- ISO/IEC 12207 is a global typical for programming wheel of life measures. It is said to be the streamer that sets every one of the assignments needed for fabricating and looking after programming.

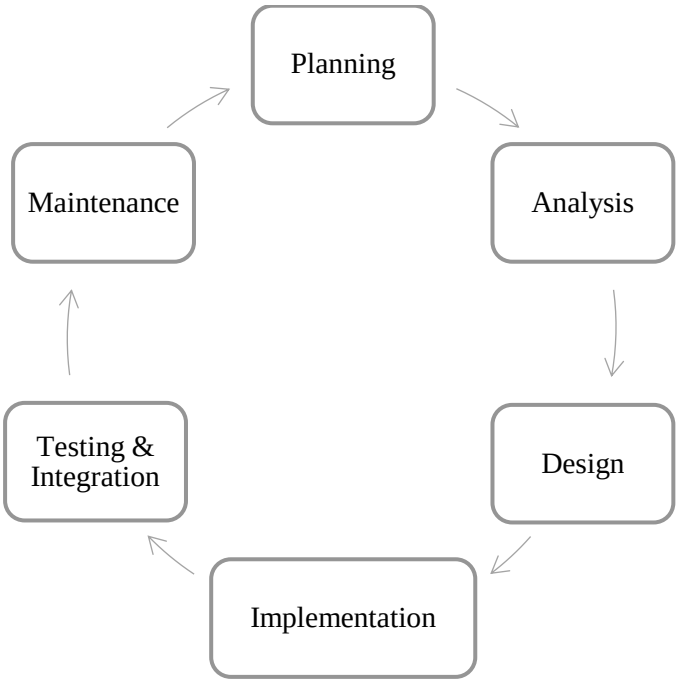

Figure 2.1 Graphical representation of the processes of SDLC

2.2 Software Development Models

Software Development is generally of two types:

1. Sequential
2. Iterative and Incremental

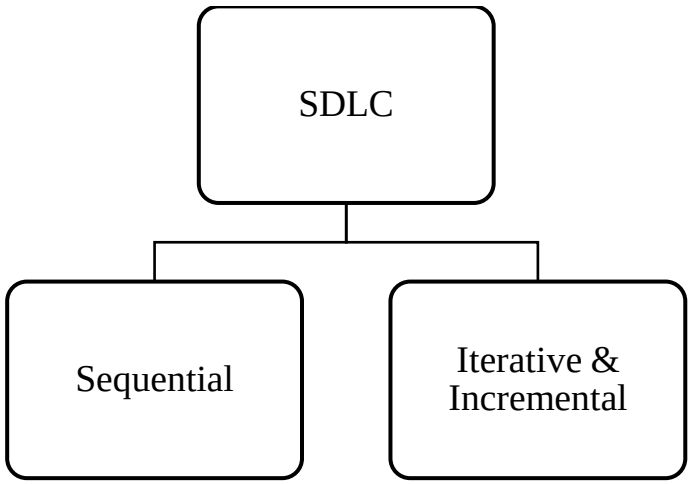

Figure 2.2 Types of SDLC

2.1.2 Sequential Software Development

A sequential development model expresses the software development process as a continuous, progressive flow of activities. This implies that any stage in the advancement, interaction should start when the past stage is finished. In principle, there is as such no cover of stages, yet by and by, it is useful to have early input from the accompanying stage.

Advantages

- Cost Effective
- Less time taking
- Suitable for different geographical positions
- It’s linear
- Maximized customer satisfaction
- No pre knowledge required

Disadvantages

- Rigid
- Absence of central authority
- Lack of intuitiveness
- No centrality of the client

Waterfall Model

In the Waterfall model, the maturing ventures are completed one after another. In this model, test ventures only occur after all other maturing activities have finally been out righted.

Its diagrammatic portrayal looks like a course of cascades.

Figure 2.3 Stages in waterfall model

V-Model

Disparate the Waterfall model, the V-model mingles the test operations all round the development process, executing the principle of before time testing.

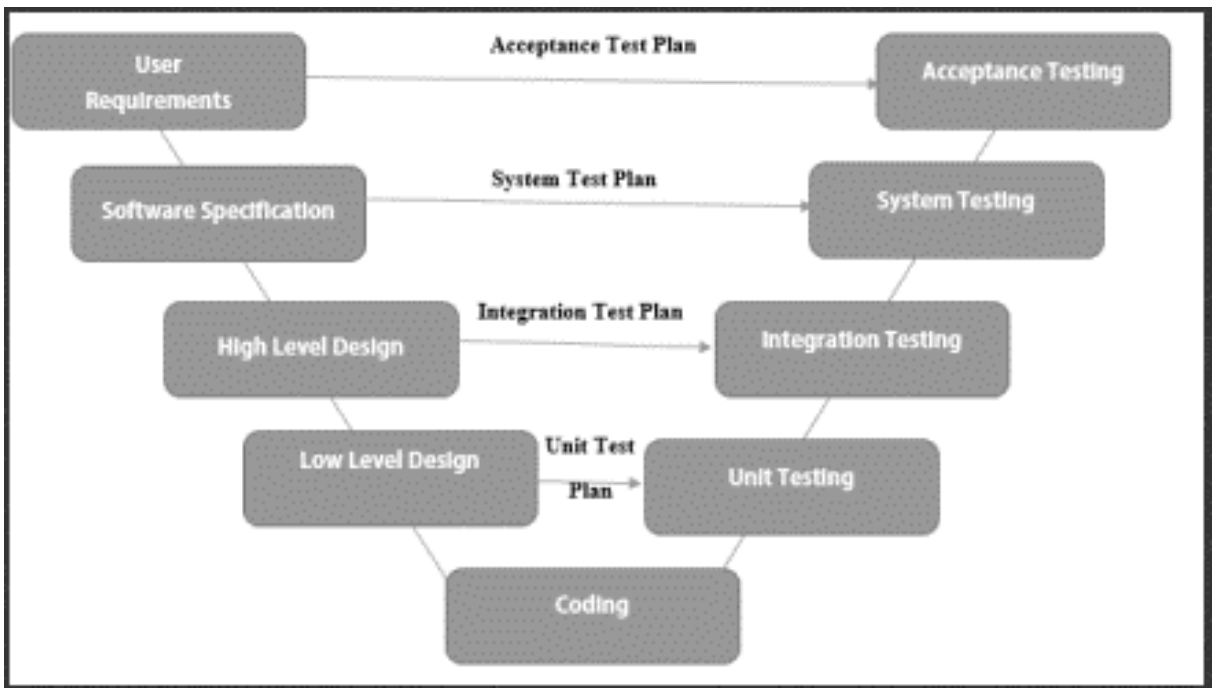

Figure 2.4 Stages in V-model

Incremental and Iterative Development

Incremental Model is an interaction of programming advancement where prerequisites isolated into numerous independent modules of the product improvement cycle. In this replica, every single module goes through the necessities, intent, execution, and trial stages. Each ensuing advent of the segment adds magnitude to the earlier discharge. The interaction gets going until the entire skeleton attained.

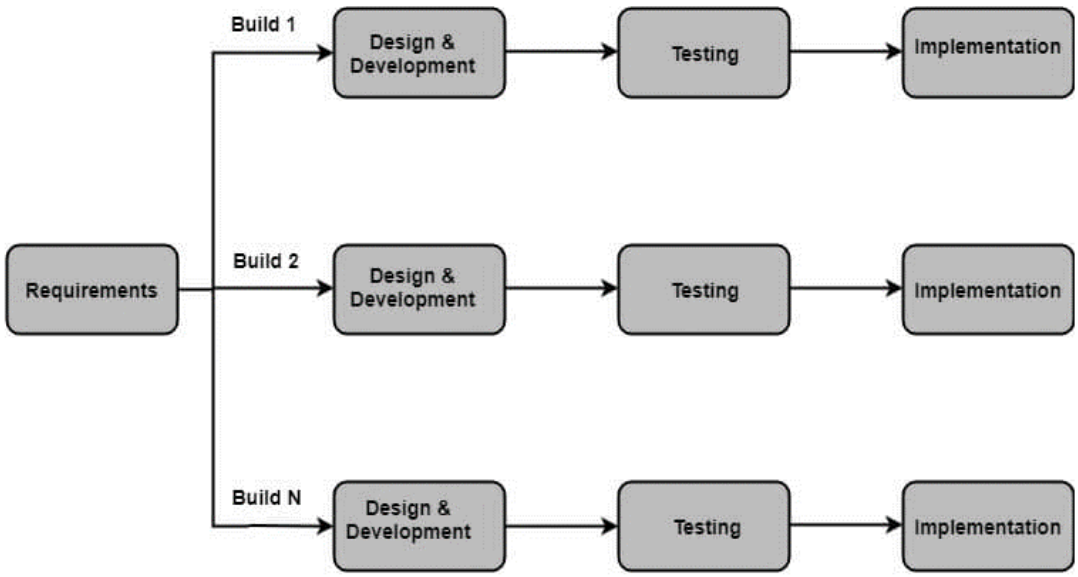

Figure 2.5 Incremental Model

In Iterative Model, you can begin with a portion of the product determinations and build up the main adaptation of the product. After the main form on the off chance that there is a need to change the product, another rendition of the product is made with another emphasis. Each arrival of the Iterative Model will result in a definite and fixed period that is called cycle.

This replica sanctions the coming by to antecedent stages, in which the diversities made discretely. The rearmost yield of the venture recharged towards the varnish of the Software Development Life Cycle measure.

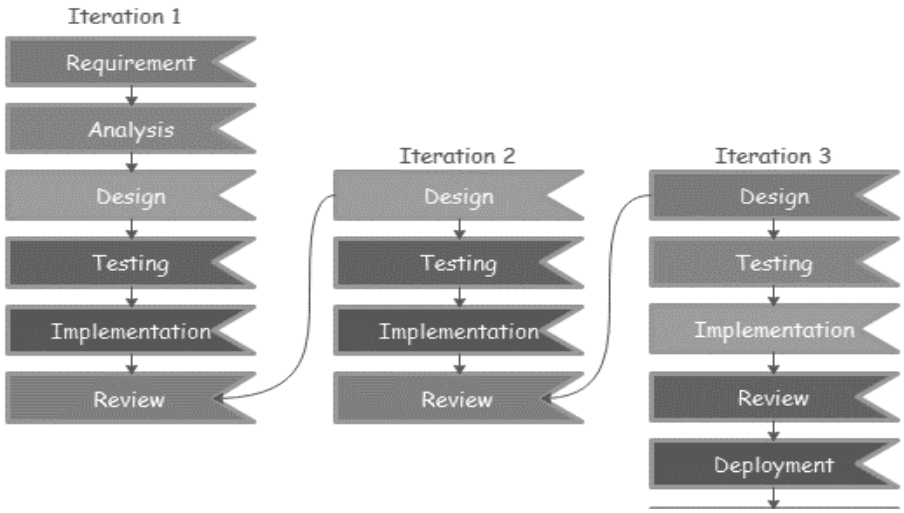

Figure 2.6 Iterative model

2.3 Agile Methodology

Agile methodology for software development is a combination of incremental and iterative processes. With Agile the main objective of the developers is on adaptability and customer satisfaction by rapid delivery of working software products. These products are developed in rounds of weeks, which are then iterated over and over, keeping customer's priorities in mind.

Every agile iteration involves, cross functional teams working simultaneously on different areas like:

- Planning
- Requirement Analysis
- Design
- Coding/Development
- Unit Testing
- Acceptance testing

Agile model relies on the belief that every project has different requirements and has to be handled differently, therefore, the methods have to suit the project requirements.

In the earlier days of software development, there were different methodologies that were synonymous to agile, but there were few differences because each of these methodologies were developed by different groups with varying project requirements.

Popular methods like Extreme Programming (XP), Scrum, feature driven development, etc, are now collectively known as Agile Methodologies, after the agile manifesto came into existence in 2001.

Agile Values are:

- **Working Software:** A working prototype of the software is considered to be the best means of communication between the developers and customers as it allows customers to see the product and request features, while developers can observe the different interactions
- **Responsive:** The product has to responsive to changing customer needs, and teams should be able to quickly develop the feature requested.
- **Customer Interaction:** As the requirements cannot be gathered completely during the initialisation of the project and due to requirement changes and feature requests it is considered that customer should be involved in the product to get proper requirements and criteria for the product.
- **Individuals and Interaction:** The agile methodologies tells that interactions between individuals is a good way to develop software, which allows increased motivation, self-organization and tools like pair programming helps in developing a quality product.

2.4 Agile Principles

Agile principles are the guiding rules/practices that helps in implementation and execution with agility

- The highest priority is customer satisfaction by early and continuous delivery of valuable software.
- Agile process allows changes in products at every stage. Even in late stage of development changes by customers should be entertained by the development teams.
- Delivery of working software is of utmost important, the frequency could be a few weeks or months but the shorter time period is preferred.
- Business representative and developers should work together as much as possible to ensure a product that fulfils customers requirements.
- Projects should be developed by enthusiastic individuals who are motivated, and they should be provide with proper environment to harness their best.
- The most efficient way of communication between teams is through face to face interactions.
- Progress is measure by deliveries of working software
- Agile processes depend upon sustainable development, therefore the stakeholders involved in the project should be able to maintain a constant pace.
- Attention of good programming practices and good architecture enhances agility
- Agile process promotes simplicity to maximize the amount of work not to be done.
- The best architectures, designs and requirements are developed by self organizing teams
- At subjected intervals, the development team reflect on the efficiency of development to become more effective accordingly

2.5 Software Testing

Software testing can be called as an affair which comprises several distinct activities or jobs. Of which execution is only one of these jobs

Software testing does the following:

- gauges the quality of the software
- risk of software failure in operation is reduced

Software Testing ≠ Test Execution

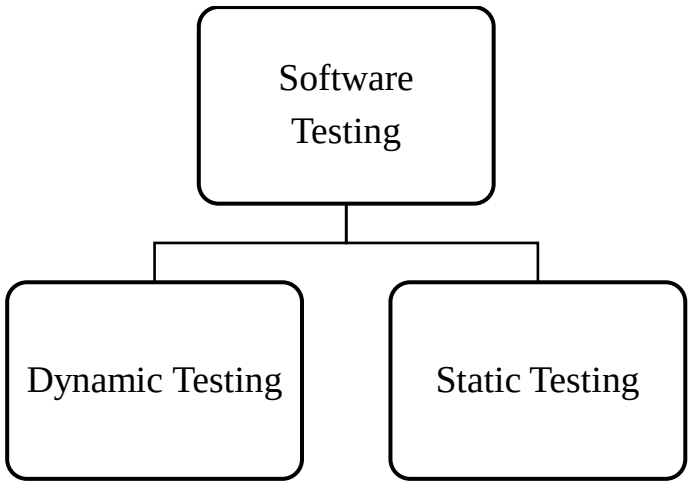

Figure 2.7 Types of Software Testing

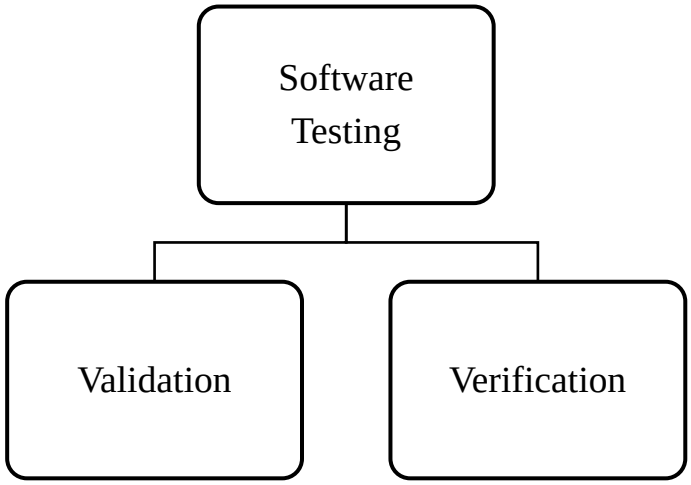

Figure 2.8 Steps in Software Testing

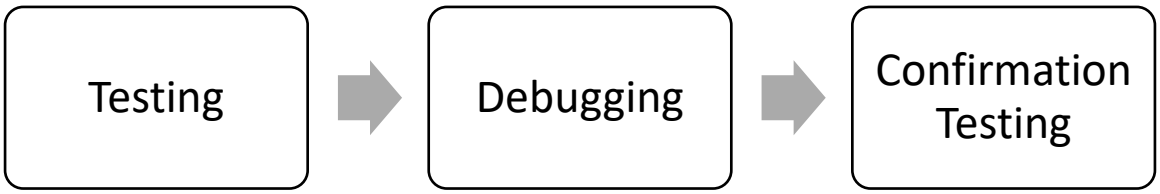

Figure 2.9 Relationship between Testing and debugging

2.6 Testing Processes

There is nobody all-inclusive programming test measure, yet there are basic arrangements of test exercises without which testing will be more averse to accomplish its set up destinations.

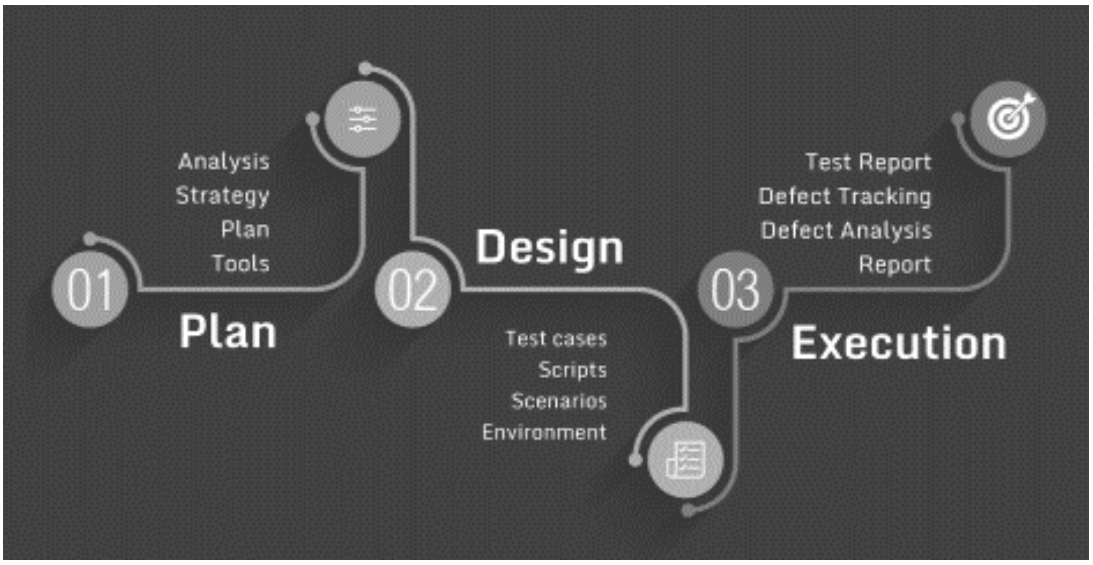

Figure 1.10 Test Process

2.7 Test Levels

Test levels are gatherings of test exercises that are coordinated and overseen together. Each test level is an occasion of the test interaction. Test levels are identified with different exercises inside the product improvement lifecycle.

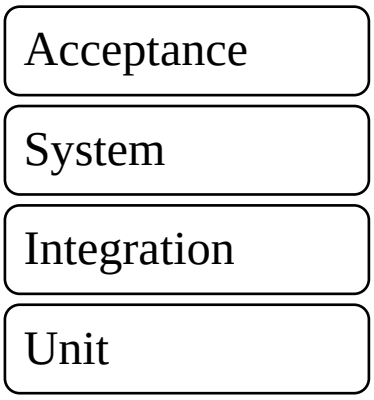

Figure 2.11 Test Levels

2.8 Test case writing

A bunch of preconditions, inputs, activities (where relevant), anticipated outcomes and post conditions, created dependent on test conditions.

It involves:

- Test Case Title
- Pre-Conditions
- Test Steps
- Expected Results
- Test Suite
- Test Environment
- Actual Results
- Status
- Defect Report

2.9 Defect Report

Defect Report - Documentation of the event, nature, and status of a deformity. Wherein a blemish or inadequacy in a work item where it doesn't meet its prerequisites or particulars is a deformity.

Chapter III

LITERATURE REVIEW

Document [4] [5] contains a detailed description of how the selenium tool works [7]. Gojare et al. Provided the Selenium Framework Utility section, steps to generate screenshots, different types of test kits, how to customize test reports, and finally a result to customize reports [8].

[5] [6] The Selenium server consists of a server component that is used to accept requests from the Remote Web Controller class of Selenium clients. Driver API for running tests for web browsers on a server. The final component is Selenium Grid, which Selenium Server implements in command line options for grid functions.

It contains a central hub and nodes for numerous scenarios and preferred browser functions. .Grid is a tool that allows parallel tests to be run on different computers and different browsers at the same time, which affects the minimized execution time.

EXAMINATION OF RESULT

After the test run, the result can be checked in the recording field. It shows that the test case passed and there is no error. When the test case is executed, error messages and information are displayed showing the development in the log.

Panel repeating even though the Record tab was not selected. These messages are often useful for debugging test cases. The Delete button deletes the recording and the Information button allows you to select different levels of information to be recorded. The Reference tab is the default selection when entering or changing Selenium commands and parameters in Table mode. 18 of 44 Documentation for the current command is displayed in table mode. When entering or modifying commands in either table or source mode, it is very important to confirm that the parameters specified in the Target and Value fields must match the parameters specified in the Parameter List in the Reference window.

RESEARCH QUESTION

How does the Selenium Framework reduce the time required for quality assurance?

The aim of this research [3][4] is to measure the time efficiency that the Selenium Framework offers when implemented in the test suite. Test suite in the case of a company.

Finally, the investigation comes to the benefit of using the Selenium framework for automating tests based on the statistical result.

In addition, the thesis aims to provide a complete guide for the implementation of the Selenium framework with language programming (Java) for testing web application automation.

This thesis suggests an explanation for the above problem (the need for test automation). However, it is not certain that this is the only contributing factor to the problem. From there, the author conducts research to identify the real cause of the problem with openness to new hypotheses or ideas (Shuttleworth 2008). With all these factors in mind, the work uses an abductive research approach.

The author of the above thesis chooses Design Science as the research method for the following reasons:

First, it is a research method that includes a solution approach and increases the need for change towards a better future (Barab & Squire 2014. Second, design exists from a research practice to create an artifact to solve the specified problem, analyze the result, and demonstrate the findings to the audience (Peffers, Tuunanen, Rothenberger & Chatterjee 2008, 6) .The researcher then makes a proposal for development A thorough evaluation of the artifact and is then performed to arrive at a conclusion on the results.

According to [3] [5] there are five different methods for evaluating data in Design Science . For the purposes of this work, an observational method is used to collect data and a descriptive method with scenarios to analyze their performance.

Throughout the development progress, the author keeps track of field notes, memos, behavioral logs, or triggers during the observations. The data is then analyzed under a descriptive scenario and compared to previous behavior before developing the artifact to measure the effectiveness of the artifact. and restriction.

The author of the work observes and collects the time data required to run the test suite. Out of 50 use cases, there are 44 automation test cases, as there can be more than one assertion in a test case. This means that there are test cases that have the same initial state. After the aforementioned time-consumption to perform the functional testing, the thesis author decided to draw out one condition to compare between the two scenarios:

Given that in two months of development (four sprints), one developer needs to perform the entire functional testing for four times each sprint, the Equation 1 refers to a method of calculating the time he/she needs to spend on**:**

*Total time consumption (Hours) = Development time + (time for 1 round of testing + maintenance time) * rounds of testing * number of sprints*

Chapter IV

SYSTEM DEVELOPMENT

4.1 Client-side Technologies

4.1.1 HTML

HTML (HyperText Markup Language), is the web standard markup language for any application that has to operate in web browser. It can be further accessorized with the help of CSS (Cascading Style Sheets) and JavaScript to add functionalities such as animations, validation of data and accessing browser storage.

The browsers receive HTML from a web server or local host and then they reproduce it into multimedia web pages. HTML along with CSS and JS are the backbone of any modern front-end. HTML elements are the basic blocks that make the web application.

Today, HTML is heavily used to format web pages. Therefore, a sound knowledge of HTML is a must for any IT professional. Given below are the few use cases for HTML.

- Creating a Website: It is the obvious choice for creating any web application/site as it the de-facto standard for rendering in web browsers.
- Documentation Pages: Being a markup language provides HTML with benefits such as that it is easy to write and will look same on any browser/machine. That's why most of the documentation for open-source, APIs, Libraries and frameworks are written in simple HTML, because they are easy to maintain and write.
- Desktop Applications: Many of the .Net and Node.js application framework like electron.js, provide the functionality to code web application and use most of the code to port the application over into a desktop application with most of the UI being the same as web app.

4.1.2 XPath

XPath is a query language that is used by selenium framework to navigate through website. XPath is very similar to regex (regular expressions) in JS, both are commonly used to search for a particular elements or attributes with matching patterns. XPath provides various expressions to matching expressions.

- **Structure definition –** It defines the parts of XML document lie attribute, text, namespace, processing-instruction, comment and document nodes.

- **Path Expression –** It provides a selections of expressions that allows the programmer to select a node or list of nodes with few lines of code.

- **Standard Functions –** It provides an elegant repository code base of standard functions that help in manipulation of dates, strings, etc. that are hard to code.

- **W3C recommendation -** It is officially recommended by W3 council for automation, and W3 Council makes regular updates on use cases and such.

RELATIVE XPATH

This involves searching in the whole document with the help of specific attributes, text or using relationships to make searching possible when unique text, attributes or other elements are not available.There are different ways to search for elements using Relative XPath as is mentioned in the previous section.

ABSOLUTE XPATH

This approach requires providing starting point to the root and provide all the child and descendants tags with precision and without missing any of them which can prove to be risky in the future. This is because a web page is dynamic and we won't be able to locate the elements as they will not stay in the same position.

COMPARING ABSOLUTE XPATH AND RELATIVE XPATH FOR USAGE ON A WEB PAGE IN REAL TIME

Since we must provide a precise information about the element when using Absolute XPath and failure to do so can result in huge errors for the future, this XPath is not recommended for usage on a real time application or web page which involves a dynamic nature of elements that keep changing positions.

Due to this particular reason , Relative XPaths are preferred to be used more often for locating or inspecting elements on a dynamic web page which is what exists in a real time scenario.

XPATH FUNCTIONS

When working in a dynamic web environment, we find it hard to locate a specific web part using common attributes like name, class, and so on. Several different elements might be having similar properties, e.g. same types of names or class names. XPath features that exist may not be very efficient because in such a case a simple XPath could return more than a single element. To overcome these kind of scenarios, XPath in Selenium provides XPath functions that can be used to write effective XPaths to uniquely identify elements.

1. Contains()
2. Starts-with()
3. Text()
4. AND operator
5. OR operator

4.1.3 CSS

Cascading Style Sheets commonly known as CSS, is a styling language that is used for describing the presentation of HTML document and other markup based languages. CSS is considered the backbone of Web-UI along with HTML and JavaScript.

CSS is developed in such a way that it allows segregation of content such as layouts, fonts, colors, etc. This allows the developer to construct customized web pages that can have different layouts based on the CSS. Earlier CSS was embedded into HTML documents but due to the rise of parent classes and heavy customization it is advised to create a separate .css file for presentation of HTML document.

This increases the code reusability and modularity, because the same styling sheet can be used for multiple pages with little to no tweaks, which allows for faster development and keeps the cost down. Due to rise in use with hand held device CSS has grid and flexbox that allows developers to write presentation code that can be used on mobile devices as well, and it fits that device well too.

CSS specifications are maintained and developed by World Wide Web Consortium (W3 C).

CSS uses selectors to establish relationship between the markup style and matching tags and attributes in the HTML. Selector can be applied on a variety of attributes as well as tags or even on the combination of both.

- All elements of a specific tag, like applying certain fonts on p tags
- Using id or class attributes to apply style to the belonging attribute. If id attribute is used it is prefixed with "#" hash symbol, and if class attribute is used then "." dot symbol is used to apply the style.
- The style itself can be applied to elements relative to their parent and document tree.

In CSS, classes and ids are case-sensitive. An id can be applied to only a single element. Whereas the class attribute maybe applied to any number of instances of any elements. If both are applied and they both have different style rules for the element then the id is preferred by the browser.

Pseudo-classes are used in CSS selectors to permit styling based on information that is not present in the HTML document. A very popular example of this is ":hover" pseudo class that allows the user/client to hover/point to a visible element and when the mouse pointer points to that elements. The applied pseudo class applies the styling to that element, resulting in changes. This is popularly used for simulation of actions like click, glow etc.

CSS has introduced custom properties as well that allows one declare properties with names that have the prefix "--" representing a value that can be used like a variable in multiple CSS classes and reduced code duplication and debugging time.

CSS also has introduced media queries that allows the programmer to specify the styling for hand held devices like mobiles, tablets, etc. Bootstrap by twitter is one of the major CSS frameworks that is used heavily to develop PWAs (Progressive Web applications) so much so that the browsers are now competing with apps on smartphones for usability and access. Use of media query allow the used to develop sites that have very specific styling based on users.

4.1.4 JavaScript

JavaScript, or JS is one of the core technologies in web development, It is a programming language that belongs to ECMAScript specification. ECMAScript does not include any storage, networking, input/output like features or libraries like traditional programming languages like C++, or Java do. Therefore, JS seems very difficult for the beginners but it has own quirks and can be easy to use too. It uses APIs for standard data structures, regex, etc. The web browser provides API for JS I/O.

JS is heavily used in web applications for client side features like animations, validation etc. The majority of web browsers have JS engines built using C++ for executing JS. It is high level language that allows the dynamic typing, prototype based object orientation, functional programming , etc.

It was created at Netscape corporation by Brendan Eich. It was created to add dynamic capabilities to static HTML documents, JS was then submitted to ECMA international for standardization and then it was adopted heavily by Microsoft and other browser development companies.

JavaScript is still the most dominant client-side scripting language of the Web. Initially JS, just like CSS was embedded into HTML documents but due rapid development, it was decided that it would be a better practice to use modularization and store JS code as ".js" files that allows one to reuse and tweak the code without having to work about ruining HTML code.

It is heavily used for these client side applications:

- **Validation:** Input values in forms and other such entries are validated on the client side then are sent to server.
- **Streaming Media:** Used for controlling the playback of streaming media.
- **Generating pop-ups:** UI based site use pop-ups as a traditional way to show updates of certain processes.
- **Logging data:** The modern Web is huge market for advertising companies therefore many of the website use "cookies" that allows them to store user's behaviour and send it to the server this allows them to serve customized ads. And whatnot.
- **AJAX:** AJAX is the bread and butter of JS, because of it's ability to provide updated content without having to reload the document this allows one to code applications that have reduced load on the sever as well as the client.
- **Animations:** JS is heavily used for browser animations like fading out, resizing etc. that provide a unique look to website and allows the users to spend more time on site.
- **Games:** Most of the current browser based games rely on a combination of JS and unity for developing games that can be rendered and run by client's browsers.

4.2 Server-side Technologies

4.2.1 Java

Introduced in 1995 by Sun microsystems, Java was developed by James Gosling. It is a high-level, purely object oriented language. One of the main benefits of using Java was portability which allowed the programs written in Java to executed on any machine, it introduced *write once, run anywhere* (WORA) meaning that complied Java code can run on all platforms that support Java without recompilation.

Java applications are compiled to bytecode that can run of any Java virtual machine (JVM). Which made Java the go-to language for enterprise development as the developers did not have to waste time for optimizing or customizing the software for particular models, it provided machine abstraction to developers and in the process saved time and money. Java syntax is similar to C and C++, but it does not have low-level supports like C and C++ .

REAL WORLD APPLICATIONS

Java being a object oriented programming language is immensely valuable to application engineers, both open-source enthusiast and enterprise developers use Java extensively and it is one of the most impactful languages that are there. It is heavily used to develop multiple applications which range from desktop applications, web applications to mobile applications. It is also used by Minecraft which is a games developed using Java. The real world usage of Java cannot be described in few pages it the most influential language for the earlier days of development and still continues to be developed and released by Oracle.

JAVA VIRTUAL MACHINE

Java Virtual Machine popularly known as JVM, it runtime that can converts the Java bytecode into lower language such as machine language that can be used by the machine. JVM is the essence of WORA methodology and it is was marvellous piece of software that allowed developers to enhance and work on core features of their applications rather than working on portability for different machines. While compilers of other languages such as C,C++ compiled the source code directly into machine code for specific machine. The Java compiler compiled the source for JVM and not the host machine.

DATA TYPES

PRIMITIVE DATA TYPES	NON-PRIMITIVE DATA TYPES
Primary data types are integer, character, short, large, float and double.	These consist of classes, interfaces and arrays.

OBJECT ORIENTED PROGRAMMING SYSTEM

Object-oriented programming system (OOPS) is a programming paradigm that uses “objects” as a way to relate functions and data between the objects, the relations are derived like the relation that are present in real world objects. This provides the developers to construct more sound relations between the data and functions that are used with them as well as providing easy debugging and architecture construction for developers.

CONCEPTS OF OBJECT-ORIENTED PROGRAMMING SYSTEM

Class: It is a conference of near components. For instance, you had a class called "Costly Cars". Its properties (data) can be cost or speed of these vehicles. While the systems may be performed with these vehicles are driving, easing back down, etc.

Objects: An object can be designated as a development of a class, and there can be different adaptations of a class in a program. For example - seat, bike, marker, pen, table, vehicle, etc.

Inheritance: Classes can share, acquire or "acquire" properties and techniques that have a place with existing classes. This allows you to reuse existing code and reduces the time you spend coding. A class that gets from another is known as a derived class or a young person class. A class that shares its properties and methodologies is known as a base class or parent class.

Polymorphism: alludes to the capacity of a strategy to be utilized in various manners, that is, it can take various structures at various occasions (poly + morphs). There are two sorts of polymorphism: compile time polymorphism and run time polymorphism.

Compile time (static) polymorphism happens when a technique is over-burden; that is, the point at which the contention utilized with the strategy is changed. This is done to get various outcomes. A case of this would propose various names for being the President of a nation, which would get you various outcomes each time – yet they would in any case be known as the President.

Run time (dynamic) polymorphism happens when the techniques itself are changed. At the point when you needn't bother with a President yet a Prime Minister, you would need to supersede the current strategy.

Abstraction: Information deliberation alludes to the procedure of just showing applicable properties and techniques to deal with an item, while concealing the rest. Information deliberation lets you lessen the multifaceted nature (clearly) of a program and is an enormous bit of leeway offered by classes in OOP dialects.

Encapsulation: Embodiment alludes to keeping objects with their strategies in a single spot. It likewise ensures the trustworthiness of the information – keeps it from being unnecessarily modified by confining access to the information, ideally by concealing it from outside components.

INTERFACES IN JAVA

An interface in Java is blueprint of class it has static variables which are constants and uses abstract methods. Interface in Java provides technique to achieve abstraction. Interface allows only abstract methods to be defined. Java 8 provided default and static method in an interface. And Java 9 added private methods in interface.

Reasons for using interfaces:

- It can be used for achieving Abstraction.
- It can be used as a technique for implementation of multiple inheritance.
- It can be used to achieve loose coupling in modules.

DECLARATION OF INTERFACE

An interface is declared with the use interface keyword. It provides absolute abstraction. Which implies that all the methods have to be abstract and their bodies are to be coded in child classes and static variables as well.

Syntax:

interface <interface_name>{

//declaration of abstract methods

//declaration of static variables

};

EXCEPTION HANDLING

The Exception Handling in Java is one of the incredible instrument to deal with the runtime blunders so typical progression of the application can be kept up.

The java.lang hrowable class is the root class of Java Exception order which is acquired by two subclasses Exception and Error.

Types of Exceptions:

1. Built-in Exceptions
2. User Defined Exceptions

JAVA EXCEPTION KEYWORDS

Try	The "try" watchword is utilized to determine a square where we should put an exemption code. The attempted square should be trailed by either get or at last. That is to say, we can't utilize the square alone.
catch	The "catch" square is utilized to deal with the exemption. It must be gone before by the attempt square which implies we can't utilize the catch square alone. It tends to be trailed by a long last square later.
finally	The "finally" square is utilized to execute the significant code of the program. It is executed whether a special case is dealt with or not.
throw	The "throw" catchphrase is utilized to toss a special case.
throws	The "throws" catchphrase is utilized to announce exemptions. It doesn't toss a special case. It determines that there may happen to be a special case in the technique. It is constantly utilized with strategy signature.

STRINGS

String is an arrangement of characters. In java, objects of String are permanent which implies a steady and can't be changed once made.

1. char charAt(int list) - Restores the character at the predefined list.
2. int compareTo(Object o) - Examines this String to another Object.
3. int compareTo(String anotherString) -Examines two strings lexicographically.

4. int compareToIgnoreCase(String str) - Examines two strings lexicographically, disregarding case contrasts.
5. String concat(String str) - Connects the predefined string as far as possible of this string.
6. boolean equals(Object anObject) -Looks at this string to the predetermined item.
7. int indexOf(int ch) -Returns the list inside this string of the principal event of the predetermined character.
8. int indexOf(String str) -Restores the file inside this string of the primary event of the predefined substring.
9. int lastIndexOf(int ch, int fromIndex) -Restores the file inside this string of the last event of the predetermined character, looking in reverse beginning at the predefined record.
10. int lastIndexOf(String str) -Restores the file inside this string of the furthest right event of the predetermined substring.

STRINGBUFFER

Java StringBuffer class is an alterable (modifiable) string. The StringBuffer class in java is similar to the String class with the exception that it is impermanent. For example, it very well may be changed.

CONSTRUCTOR	**DESCRIPTION**
StringBuffer()	makes an unfilled string support with the underlying limit of 16.
StringBuffer(String str)	creates a string support with the predetermined string.
StringBuffer(int capacity)	creates an unfilled string support with the predefined limit as length.

ARRAYS IN JAVA

An array is a holder object that holds a fixed number of estimations of a solitary kind. The length of a cluster is set up when the exhibit is made. After creation, its length is fixed.

In Java all exhibits are powerfully allocated.

Exhibits can contain native's information types just as objects of a class contingent upon the meaning of cluster. If there should arise an occurrence of natives information types, the real qualities are put away in bordering memory areas. If there should be an occurrence of objects of a class, the genuine items are put away in the load section.

COLLECTIONS IN JAVA

Collection framework in Java provides an architecture to handle and manipulate objects. It has implementations for various data structures, which have very different use cases some are faster for storage or retrieval others store data in a certain way and so on.

Java collection is a bundle of single objects. It provides many interfaces like Set, List, Queue, HashSet, etc.

ARRAYLIST

ArrayList class in java is a resizable array which very similar to vectors in C++. It is implemented in java.util package. ArrayList provides many different functions for manipulating ArrayList from adding elements, removing elements, sorting elements.

JAVA DATABASE CONNECTIVITY WITH MYSQL

To connect Java applications with MySQL database, we have to do the following steps:

1. Driver class : The driver class for the MySQL database is com.mysql.jdbc.driver.
2. Connection URL: The association URL for the mysql database is jdbc: mysql://localhost:3306/sonoo where jdbc is the API is running, we may likewise utilize IP address. We may utilize any database, in such case, we have to supplant the sonoo with our database name.
3. Username: The default username for the mysql database is root.
4. Password: It is the secret phrase given by the client at the hour of introducing the MySQL database. In this model, we are going to utilize root as the secret key.

4.2.2 SQL

SQL stands for Structured Query Language, is query language that is used for data storage, data manipulation and data analysis as well. It is designed for managing relational database management systems (RDBMS). SQL is based on relational algebra and tuple relational calculus. It was one of the first languages that used Edgar F. Codd's relational model. The model was described to be used by large scale data banks.

SQL became a standard on in 1986 by American National Standards Institute (ANSI), and is extensively used by many web applications as well as desktop application for data storage and retrieval. SQL is used by Database Management Software (DBMS) like MySQL, PostgreSQL, SQL Server as the de-facto standard database language although some of them may have slight syntax differences.

SQL is an essential part of web as we know it. As it provides the ability to describe data, fetch data, delete data, create views, run procedures on database and much more. These functionalities are heavily used by many different software enterprises and have been the industry standard for almost 4 decades.

DATA DEFINITION LANGUAGE

Information definition language is a grammar for manufacturing and switching data set items like tables, lists, and clients. DDL manifestations are like a PC programming language for setting apart information frameworks, particularly data set blueprints. The common statements used are: CREATE, ALTER, DROP, TRUNCATE.

DATA TYPES

Numeric Data type:
INT: Whole numbers
FLOAT(M,D): Decimal numbers(approx.)
DECIMAL(M,D): Decimal numbers(precise)

Non-Numeric Data type:
CHAR(N): Fixed length character
VARCHAR(N): Varying length character
ENUM('M','F'): Value from a characterized list
BOOLEAN: True or False qualities

Date and Time type:
DATE: Date(YYYY-MM-DD)
DATETIME: Date and time (YYYY-MM-DD HH-MM-SS)
TIME: Time(HH-MM-SS)
YEAR: Year(YYYY)

PRIMARY AND FOREIGN KEYS

PRIMARY KEY	FOREIGN KEY
An essential key is a field in a table which exceptionally recognizes each column/record in a data set table. Essential keys should contain unusual calibre. An essential key segment is not allowed to have NULL qualities. A table has just one essential key, which may contain single or various fields.	This imperative is utilized to forestall activities that would annihilate joins between tables.

MODIFYING TABLES

Adding and Removing Tables To include another segment in the current made table the language structure is: "Include COLUMN <COL NAME> <DATATYPE>".

To expel the section from a table the grammar is: "DROP COLUMN <COL NAME>".

Furthermore, to eradicate all the data from inside the tables abbreviate request is used.

DATA MANIPULATION LANGUAGE

A DML is customarily a sublanguage of a more sizeable data set language like SQL, with the DML containing a chunk of the controllers in the language. Read-only choosing of data is some of the time accepted as being vital for a different DQL, however it is steadily allied and at times likewise thought to be a part of a DML. The common commands under DML are: INSERT, SELECT, UPDATE, DELETE.

JOINS

Joins permit to recover information from different tables in a solitary select articulation. To join two tables there should be a related segment between them. There are various sorts of joins, for example, inward join, left join, right join.

INNER JOIN	**LEFT JOIN**	**RIGHT JOIN**
Inward join will recover information just when there is coordinating qualities in both the tables.	Left join will recover all the information from the left table and the coordinating lines from the correct side of the table.	The correct join will recover the information from the correct table and coordinating columns of the left table.

SUBQUERIES

Subqueries are the inquiries that are settled inside different questions. The subqueries can be utilized in a SELECT, INSERT, UPDATE, or DELETE question. The settled question could be in the WHERE provision or in the FROM. There are two kinds of subqueries to be specific, non-corresponded subquery and related subquery.

NON-CORRELATED SUBQUERY

In this sort of subquery, the inward question can run freely of the external inquiry. Inward questions run first and produce an outcome set and which is then utilized by the external inquiry.

CORRELATED SUBQUERY

In this sort of subquery, the internal question runs for each line in the external inquiry. Here the internal question cannot run freely of the external inquiry.

NORMALIZATION

Standardization is the procedure of effectively sorting out the information into the database. It is fundamentally done to expel the excess information and to just store the related information in a table. The advantages of standardization are:

1. Reduce the extra room
2. Reduce addition, update, and cancellation inconsistencies
3. Improve inquiry execution
4. Reduce the extra room
5. Reduce addition, update, and cancellation inconsistencies
6. Improve inquiry execution

Following are the degrees of standardization:

1st typical structure (1NF)	2nd typical structure (2NF)
3rd typical structure (3NF)	Boyce and Codd typical structure (BCNF)

FIRST NORMAL FORM (1NF)

The standards in the main typical structure are that a table is in the 1NF if:

1. There are no rehashed lines of information
2. The sections just contain a solitary worth
3. The table has an essential key

SECOND NORMAL FORM (2NF)

The standards in the subsequent ordinary structure are that a table is in the 2NF if:

1. They fit in with 1NF.
2. Every segment that is anything, but an essential key of the table is subject to the entire of the essential key

THIRD NORMAL FORM (3NF)

The guidelines in the third typical structure are that a table is in the 3NF if:

1. They fit in with 2NF .
2. Every segment that is not the essential key is just subject to the entire of the essential key.

MySQL

MySQL is an open source RDBMS (Relational Database Management System) available for free use under GNU General Public License, and is also available under a variety of licenses. It is maintained by Oracle.

It gives a UI to us to connect with the database.The application is employed for a vast scope of causes, counting details warehousing, online trading, and logging applications. The most familiar use for MySQL notwithstanding is with the final intent of a web information base.

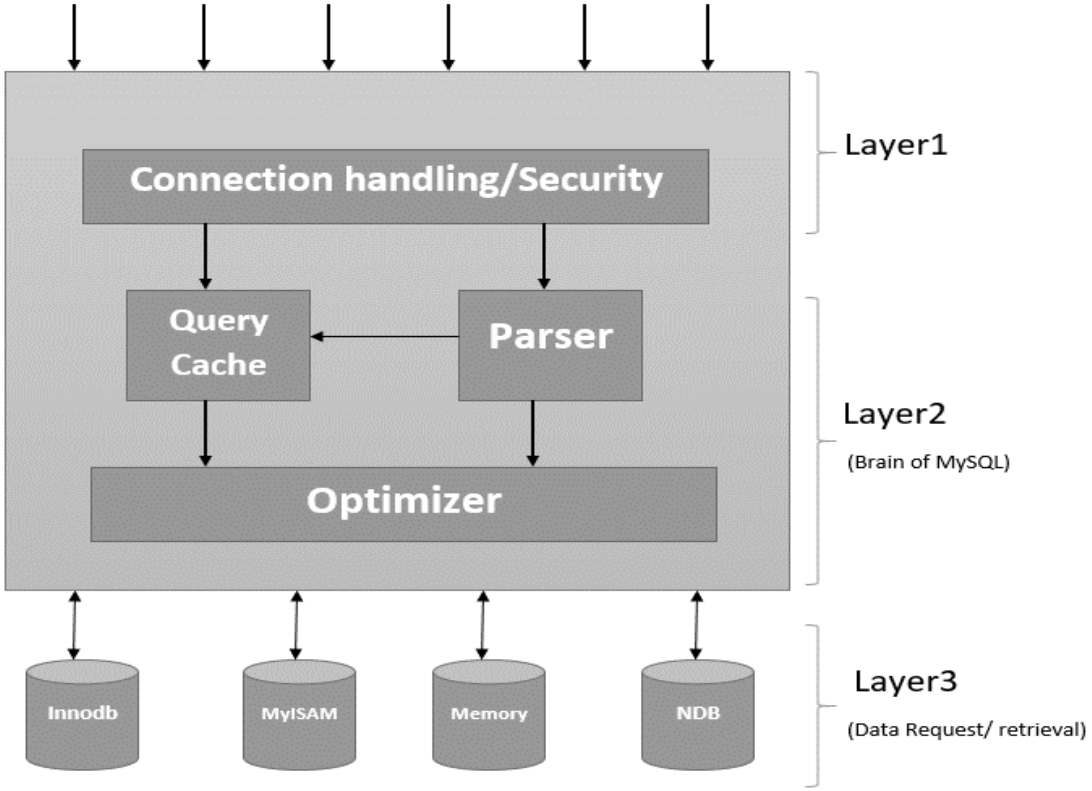

Figure 2.1 MySQL CLIENT

RELATIONAL DATABASE MANAGEMENT SYSTEM

A relational data set touches on to a data set that reserves statistics in a well-structured group, availing lines, and segments. Hence it is easier to find and ingrain obvious traits under the details base. The social design makes it tenable to sprint doubts across unrelated tables immediately.

Installation of MySQL

Step1: The initial step is to go to the site www.dev.sql.com and introduce MySQL for the necessary working framework.

Step2: Ensuing to acquaint the MySQL with your system, fire setting up the workbench stage where you can create the inquiries.

Step3: At the point when you open the workbench, a secret phrase brief will spring up and you must enter the root secret word that you made during the establishment procedure.

Step4: Then comes the time when you can make your first database inside the workbench.

4.2.3 JSON/XML for APIs

JSON

JSON stands for JavaScript Object Notation, it is a light data exchange format. Which is heavily used in modern APIs for data. It easier to read for humans and easier to write as well. It is based on JS and was introduced on 1999. It is one of the text formats that is independent of language and it is interchangeably used by many languages such as JS, Python, C, C++, Java, etc. JSON is considered the most user friendly data-interchange format.

JSON stores data in key-value pairs, most of the modern programming languages have these as either a collection of name/value pairs. In python this structure is called a dictionary, whereas C++ has hash table. Some languages also have vectors, list or sequence which can used. These are universal data structures that essentially present in all modern programming languages, this allows the faster access time as well as interchangeability.

JSON Syntax Rules

- Data has to be stored in key-value pairs
- Every data entry has to be separated by ","(comma).
- Objects are held using curly brackets
- Arrays are described by the use of square brackets.
- Keys must be string.

For AJAX web applications, JSON is faster than XML, because the process only involves the user to fetch the JSON and then parse it into string, whereas for XML, it has to fetched then looped through XML DOM, and then the values can be stored in variables.

XML

XML stands for extensible markup language. It is a markup language that is used for encoding data to be used by applications independent of their programming languages they were developed in, it human readable as well.

It is software and hardware independent, and similar to HTML, and was designed to store and interchange data between various systems. It is self descriptionary and has W3C recommendation. At first sight XML looks a bit difficult to grasp, but XML is just data which has been wrapped in tags.

XML does not use any predefined tags like HTML does, the tags used in XML are written by the author of the document. When compared to JSON, the tags are the keys and the wrapped data in XML is the value. XML needs both the ending and closing tags to be wrapped around the data. It is truly Extensible, meaning that the XML applications will work as expected by the developers even if the new data is added(or removed). Which helps to save time as the developers do not have to waste their time be porting new versions of applications to work with older versions of applications.

XML provides simplification of data transmission as exchanging data between incompatible systems is time intensive process and cost are likely to increase with the complexity of the data involved. XML is a great way for storing data as it provides simple text based storage that is independent of hardware and software , it also makes it easy for the users to upgrade to newer systems without having to worry about issues relating data and package installation. XML is widely used in web development and It is considered to segregate data from presentation as it does not contain the presentation information, therefore it provides an excellent choice for data separation. Just like HTML documents are described as trees, XML documents are too element trees. XML tree starts at the root element and branches out from the root to child. It heavily uses self describing syntax.

Chapter V

SELENIUM WEBDRIVER

AUTOMATED TESTING

Automated testing or Test automation is a popular testing methodology in which by the use of certain automated framework test case suites are tested on applications and softwares. Compared to manual testing where the human has to sit in front of a computer to carefully executing the tests.

Automated testing is used extensively for developing mission critical software that has to be checked thoroughly and has to very strict criteria for passing the inspection. Successive development cycles require execution of same tests over the updated application and the testing system has to be consistent with the results. Automation is the perfect tool for consistency and speed as the machine much more capable to repeat same test with same accuracy in every iteration of the test and development cycle.

WHEN TO USE AUTOMATED TESTING

Automation provides an efficient way conduct tests on the applications, excellent test coverage as well as execution speed all are the factors that make automated testing a very effective tool. Therefore, Automated testing should be considered for various cases some are listed below.

- When testing multi-lingual software, or software that has a very wide variety of users the number of test cases rise for each class of user, therefore each class has to be created with their own unique test cases, this is the exact scenario where automated testing can reduce testing time. Therefore reducing the cost to market as well as the development costs as well.
- Manual testing is prone to errors. Therefore it is highly likely that the tester while testing the application manually can report a false testcase in the report. Which wastes time and effort of the development team.
- Testing using automated framework can help increase test coverage and increase the robustness of software/application.

WHICH TESTCASES TO AUTOMATE

Although it is possible to automate every tests, but the automation of test has to programmed and is costly, henceforth it advisable to consider some tests as priorities that are to be performed first, and if the budget permits execute the rest. The following testcase should be automated.

- System critical cases which are high risks, like login, signup, etc.
- Testcase which are time-consuming like, chat application test cases.
- Testcase that difficult to done manually.
- Testcase that are highly repeated.

The list of test cases given below should not be prioritised for testing.

- Test cases that have ad-hoc elements.
- Test cases which have frequent changes in criteria.
- Test cases that are newly design and have not been tested even once manually.

INTRODUCTION TO SELENIUM

Selenium is a collection of different range of tools and libraries that allow the developers to automate web browsers. It provides different extension that emulate user interaction with browsers. It provides drivers that allow the developers to automate the browser. More than that it provides infrastructure for implementations of W3C Specification of WebDriver that allows the developer to write code for all major web browsers. It is an Open-Source UI automation tool. It was created in 2004 by a ThoughtWorks engineer. Selenium WebDriver was later introduced later in 2006.

COMPONENTS OF SELENIUM

SELENIUM IDE

IDE stands for Integrated Development Environment; it is a tool that allows a developer to Selenium test cases. It is an add-on/extension for browsers and is considered the most efficient way to develop testcases. It logs the user's actions in the browser using existing Selenium commands, with parameters defined by the element. The is a huge time saver for testing.

SELENIUM RC

RC is a fundamental part of Selenium framework. It enables the developer to write tests in different programming languages that can be automated for UI for web applications against any HTTP website.

Selenium RC mainly consists of two parts:

- Client Libraries of the preferred programming language.
- A server that launches and kills browsers after completion of test.

SELENIUM WEBDRIVER

WebDriver provides the developer to use the browser automation APIs, which is provided by browser vendors to control the browser and emulate user interaction and run tests. This is as if the browser is used by a real user. The WebDriver is not intrusive at all because it not require it's API to be compiled with application code. Which provides the user to test the same application for test and deployment as well.

SELENIUM GRID

Grid allows to run test cases, in different machines across different platforms. The controls for execution of automation tasks are on the local end while the host is on the remote end for automation. Grid allows one to test the application on multiple clients which are them different operating systems.

SELENIUM INSTALLATION SYTEM REQUIREMENTS

To Install Selenium test suite with Java, one must have Java environment running, the following are the system requirements:

1. Java Runtime Environment (JRE) on the host machine: Java Software Development Kit (JDK) comes bundled with JRE integration. Download and install JDK from oracle official website for Java select based on the Operating system.
2. Install Eclipse IDE (Integrated Development Environment) from Eclipse official website
3. Download Selenium WebDriver based on the browser, to run test scripts on a specific browser, and place the driver in path linked.

Chapter VI

CONCLUSION AND FUTURE WORK

CONCLUSION

Over the past few years, developers all over the world have been constantly working and developing the applications to provide better software as well, quality software for users. With the use of different methodologies as well as philosophies that help in development. Over the years Agile methodology has come forward as a way to for better development and customer satisfaction.

Selenium is considered the first choice for automation for web based applications for testing them. Ever since the inception of Selenium it has been the primary choice for automation and testing because of the popular languages it supports and use of selenium is easy and should be considered if testing of web application is to be done as the tests can be replicated on various machines and the test coverages provides extensive coverage that allow the developers to make robust and quality software within budget and providing customer satisfaction and well built products.

Through this Internship, Software testing and automation of testing using selenium was performed and learning process was immense and the learning and aid provided was sufficient for learning development for automation and testing. Selenium was not the only technology that was used during this internship. Many different technologies like JavaScript, SQL, HTML and CSS were also heavily used in this internship. Overall the learning process was immensely yielding and the learning gathered from the were extremely beneficial.

FUTURE WORK

As Softwares are being developed and most of them are web based applications, this makes the testing more important for the software to provides a reliable way to develop software and that makes a quality product and due to huge amount of applications with varying levels of complexity makes automation as a perfect candidate for providing vital test coverage with speed as well as efficiency that makes a quality product.

Software testing, just like software development is an important part of the whole process of getting a product or an application to get to market, henceforth automation of testing is the way to be taken to reduce time to market time and increase the quality of software as well as decreasing the cost of development.

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END TERM MAJOR PROJECT REPORT
(28th February 2021 – 25th June 2021)

ON

QUALITY ENGINEER WITH SELENIUM AND JAVA

Under the guidance of
Ms. Rohini Priya E

AT

Cognizant

COGNIZANT TECHNOLOGY SOLUTIONS
INTERNATIONAL CONVENTION CENTER (ICC) TRADE TOWER,
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Submitted by:

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B. TECH (COMPUTER SCIENCE AND ENGINEERING)

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SESSION (2017-2021)

CERTIFICATE

PROJECT REPORT UNDERTAKING

I Mr. Deepesh Yadav Roll No 171380 Branch CSE is doing my internship with **COGNIZANT TECHNOLOGY SOLUTIONS** from 28th February 2021 to 25th June 2021.

As per procedure I have to submit my project report to the university related to my work that I have done during this internship.

I have compiled my project report. But due to COVID-19 situation my project mentor in the company is not able to sign my project report.

So, I hereby declare that the project report is fully designed/developed by me and no part of the work is borrowed or purchased from any agency. And I'll produce a certificate/document of my internship completion with the company to Training and Placement Cell whenever COVID-19 situation gets normal.

Deepesh Yadav
Enrolment No.: 171380
B. Tech (CSE)

DECLARATION

I hereby declare that the work reported in this report entitled **"QUALITY ENGINEER WITH SELENIUM AND JAVA"** is submitted in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering/Information Technology** submitted in the department of Computer Science and Engineering and Information Technology, Jaypee University of Information Technology Waknaghat is an authentic record of my own work

Cognizant does not allow the project material to be used beyond the said guidelines, I Deepesh Yadav am aware of the fact and appropriately created the project report without violating any compliance.

Allocation of technology track depends on the following – student capability, business demand and location where it can be offered. Student capability is assessed through –electives completed by the student, participation in other technical forums and performance in Internship.

The projects completed in the internship duration (full) will vary from development, to enhancements, research, scripting across technologies like Java, Dot net, AWS, Cloud, FSD, DW, Selenium, SFDC, SAP. Project in Application Development space requires good programming skills. Some of them would require Digital skills as well. These projects are a combination of business aligned business case that we deliver to our clients or internal projects to address Cognizant's business needs

Internship is for a period of 3 to 6 months, during 8th semester. Actual Internship dates and duration would be based on the business demands and aligned skill tracks offered. Thus, I am in middle of the internship program.

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Deepesh Yadav
Enrolment No.: 171380
B. Tech (CSE)

ACKNOWLEDGEMENT

It was a privilege for me to work as a full-time intern at **"COGNIZANT TECHNOLOGY SOLUTIONS"** under the supervision of Ms. Rohini Priya E.

This report describes the training that underwent, for the duration of 28 February 2021 - 25th June 2021 at intern at "**COGNIZANT TECHNOLOGY SOLUTIONS**" an American multinational technology company that provides business consulting, information technology and outsourcing services.

I would like to express our sincere gratitude of the all the people who have helped and supported me throughout. I am deeply indebted to Ms. Rohini Priya E (Programmer Trainee Techno Campus Office (TCO)STPI), Mr. Rakesh & Ms. Sonal (External Trainers), Mr. Yuvraj C (Mentor) and other fellow colleagues at **COGNIZANT TECHNOLOGY SOLUTIONS** for organizing an effortless internship program, efficiently and providing me valuable resources and for their cooperation and willingness to share their expertise and knowledge and to devote their precious time to discuss related topics.

The help and co-operation extended by the staff at **COGNIZANT TECHNOLOGY SOLUTIONS** is fully acknowledged. I thoroughly enjoyed my entire internship program and would like to thank everyone at **COGNIZANT TECHNOLOGY SOLUTIONS** for their guidance and support.

Deepesh Yadav
Enrolment No.: 171380
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ABSTRACT

This report describes the internship that I did with "**COGNIZANT TECHNOLOGY SOLUTIONS**", Pune Office, during the period of February to June 2021. The project assigned to me was "**QUALITY ENGINEER WITH SELENIUM AND JAVA**". The report itself sheds light on the various process and concepts I have learned as a full-time intern.

The primary objective of the internship was to learn software testing and automation using a web automation tool called "**Selenium**". Selenium driver serves as an interface that allows programmer to write scripts in languages such as Python, JavaScript, Java, etc. to automate various tasks on browsers such as Chrome, Firefox, etc.

During the project Selenium driver along with java was to used automate testing of web applications. Also, JSON/XML formats were used to communicate with APIs and JavaScript was used for form validation in various hands-on task provided to us.

Other than this, I was trained on SQL and basics of Java for database management and writing testing scripts using selenium and java.

Chapter I

INTRODUCTION

1.1 About Cognizant

Cognizant (Nasdaq-100: CTSH) is one of the world's leading professional services companies, transforming clients' business, operating, and technology models for the digital era. Our unique industry-based, consultative approach helps clients envision, build, and run more innovative and efficient businesses. Headquartered in the U.S., Cognizant is ranked 194 on the Fortune 500 and is consistently listed among the most admired companies in the world.

India is a crucial piece of our global business strategy, with global delivery centres in Mumbai, Bangalore, Chennai, Coimbatore, Gurgaon, Hyderabad, Kochi, Kolkata, and Pune.

Domain	: Information technology consulting company
Company website	: https://www.cognizant.com/
CEO	: Brian Humphries (1 Apr 2019–)
Revenue	: 1,680 crores USD (2019)
Founded	: 26 January 1994
Headquarters	: Teaneck, New Jersey, United States
Subsidiaries	: Soft Vision, TriZetto Group, Inc. (The), MORE
Founders	: Kumar Mahadeva, Francisco D'Souza

1.2 Training Program

The learning journey contains two stages, followed by a Business Aligned Project.

STAGE 1 –QEA BASICS

- Functional Testing and Soft Skills
- Java Programming and Soft Skills
- Web UI, Data Source and Soft Skills

STAGE 2 –AUTOMATION TESTING –SELENIUM, CUCUMBER, DEVOPS.

- Automation Concepts, Selenium configuration, WebDriver Basics
- Selenium Automation Techniques, Dynamic XPath
- Selenium Web driver With POM and Apache POI
- Automation Testing - Selenium with TestNG
- Digital Technologies

Business Aligned Project is providing for an experience of real time problem solving in Agile methodology.

Cognizant has collaborated with Udemy to provide world class learning videos for the evolving future of work. These Udemy programs are woven into a learning path, empowering you to plan and learn at your style.

The program also connects you with Subject Matter Experts to get the professional guidance on your queries in the learning journey.

The program continuously evaluates if you can apply those self-learnt skills to solve a business problem. Depicted below are the three key learning components, which are distributed across the learning journey for the purpose of continuous evaluation.

SCHEDULING OF LEARNING COMPONENTS

The overall duration of this program is 12 weeks. From the day 1 of the program, every day will have some learning components to be completed by the GEN C.

The detailed student handbook will have the day-wise schedule. All the learning components have to be completed as specified in the day-wise schedule. These components will be auto scheduled in your specific learning paths as per the given schedule.

INNOVATIVE LEARNING MODELS IN 2020

The Gen C (Generation Cognizant) Program stretches across the entire timeline of a campus hire's learning journey from the time he/she accepts the offer letter from the company -to the first year of his/her tenure in the organization. There is a robust learning strategy put in place across each of the stages.

- Modern Flipped Classroom
- Branding @ Campus Events
- Leader Engagement
- Heartfulness Workshops & Webinars Active Volunteering

1.3 Software Testing and Development

In the information age, all businesses rely heavily on information for day to day use, but information itself, has to analysed to be acted upon by human actors. This is where software comes in software helps in everything from ticket booking to delicate medical procedure, softwares have provided users to do things efficiently and save time.

Software itself is a vast topic and software development and testing is at the heart of every software company. Software development refers to the processes and models that help in making of the software, these processes and models provide a through understanding of what is to be done, how it should be done. Software testing is vast and complex field of testing software applications.

Automation of testing procedure helps the software development firms and business to cut down on cost and make effective decisions and development is easier and more robust. Web applications are the perfect candidates for automation as they have to serve many different types of browsers as well as different clients as well. Therefore, Automated testing of websites is huge cost saving strategy for businesses.

An automated site perceives the interesting requirements of guests and upgrades content for every watcher. The product assists with aiding support contacts all the more productively. It is responsive (versatile agreeable) out-of-the-case, completely incorporated with each showcasing channel, and

versatile to the changing necessities of leads and clients.

Java is characterized by a determination and comprises of a programming language, a compiler, center libraries and a runtime (Java virtual machine) The Java runtime permits programming engineers to compose program code in different dialects than the Java programming language which despite everything runs on the Java virtual machine. The Java stage is typically connected with the Java virtual machine and the Java center libraries.

Similarly SQL has the capacity to perceive the various sorts of information bases. It has the capacity to interface with the information base utilizing distinctive SQL association customers. Comprehension of the connection between data set tables, keys, and records. Capacity to compose a basic select or SQL articulation alongside more intricate join inquiries

Selenium is an open source tool that automates web browsers. Selenium is Open Source UI Automation Tool. It is used to Automate the Web-Application but not for Desk-Top Base Application Automation. It was created in 2004 by a ThoughtWorks Engineer. Selenium Web-driver was introduced later in 2006.

Chapter II

SOFTWARE DEVELOPMENT

2.1 Software Development Lifecycle

A Software Development Lifecycle Model tells us about the types of activities executed at every stage in a software development project, and how the ventures relate to one another aptly and chronologically.

- SDLC is the elision of Software Development Life Cycle.
- It is furthermore called as Software Development Process.
- SDLC is a complex set apart assignments executed at each parade in the product up gradation measure.
- ISO/IEC 12207 is a global typical for programming wheel of life measures. It is said to be the streamer that sets every one of the assignments needed for fabricating and looking after programming.

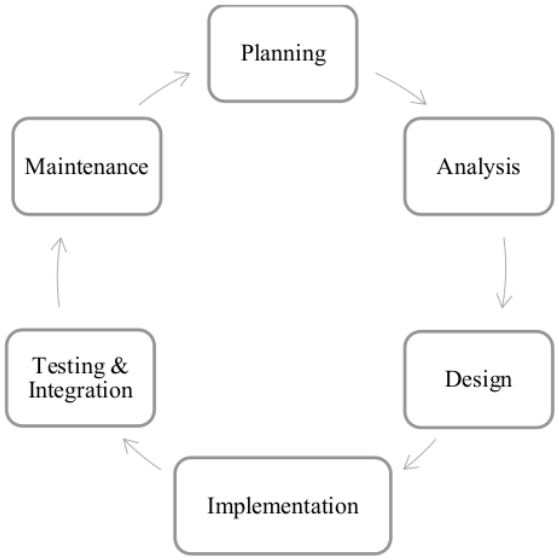

Figure 2.1 Graphical representation of the processes of SDLC

2.2 Software Development Models

Software Development is generally of two types:

1. Sequential
2. Iterative and Incremental

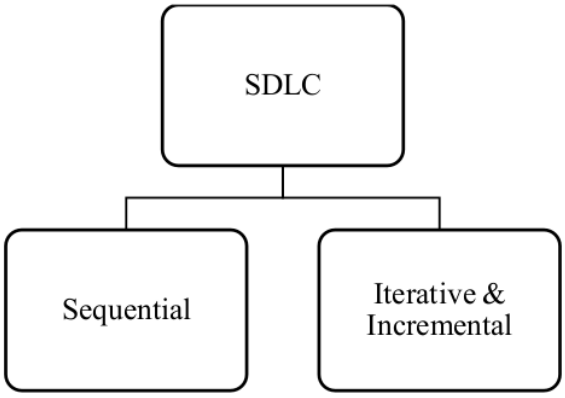

Figure 2.2 Types of SDLC

2.1.2 Sequential Software Development

A sequential development model expresses the software development process as a continuous, progressive flow of activities. This implies that any stage in the advancement, interaction should start when the past stage is finished. In principle, there is as such no cover of stages, yet by and by, it is useful to have early input from the accompanying stage.

Advantages

- Cost Effective
- Less time taking
- Suitable for different geographical positions
- It's linear
- Maximized customer satisfaction
- No pre knowledge required

Disadvantages

- Rigid
- Absence of central authority
- Lack of intuitiveness
- No centrality of the client

Waterfall Model

In the Waterfall model, the maturing ventures are completed one after another. In this model, test ventures only occur after all other maturing activities have finally been out righted.

Its diagrammatic portrayal looks like a course of cascades.

Figure 2.3 Stages in waterfall model

V-Model

Disparate the Waterfall model, the V-model mingles the test operations all round the development process, executing the principle of before time testing.

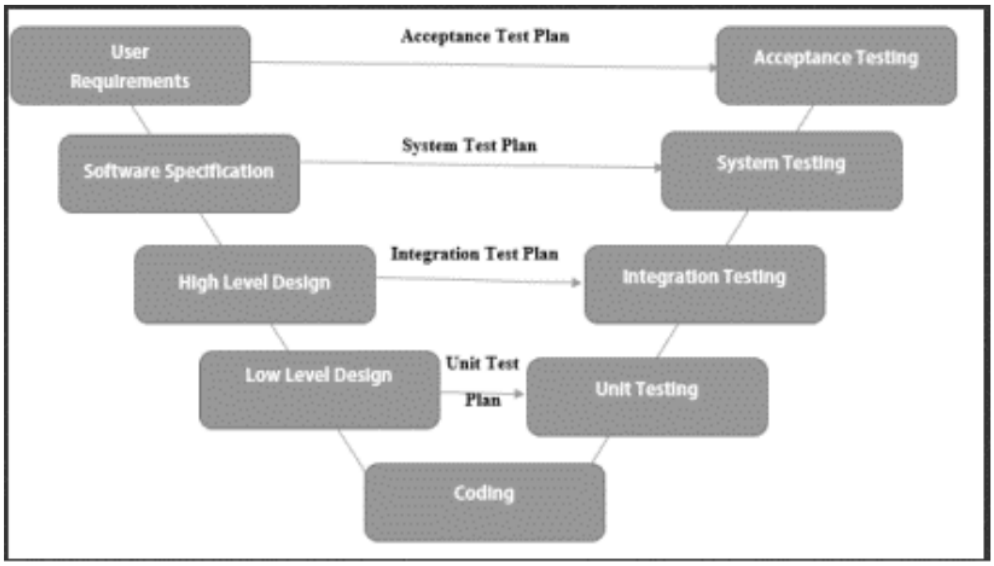

Figure 2.4 Stages in V-model

Incremental and Iterative Development

Incremental Model is an interaction of programming advancement where prerequisites isolated into numerous independent modules of the product improvement cycle. In this replica, every single module goes through the necessities, intent, execution, and trial stages. Each ensuing advent of the segment adds magnitude to the earlier discharge. The interaction gets going until the entire skeleton attained.

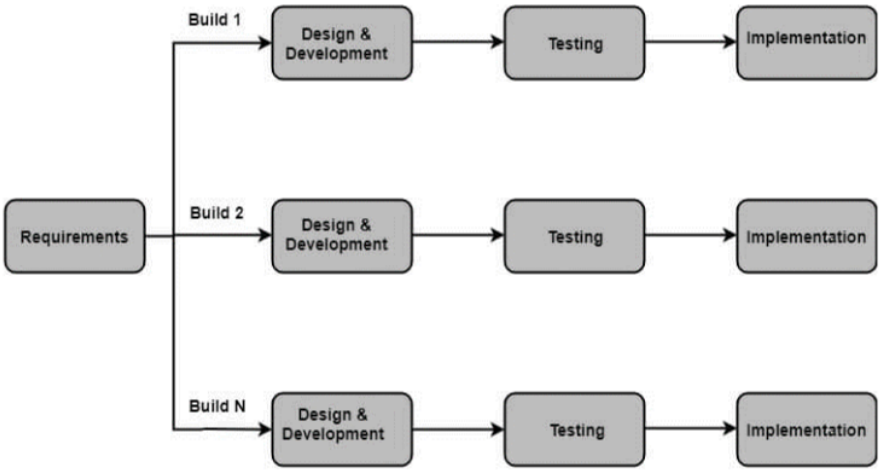

Figure 2.5 Incremental Model

In Iterative Model, you can begin with a portion of the product determinations and build up the main adaptation of the product. After the main form on the off chance that there is a need to change the product, another rendition of the product is made with another emphasis. Each arrival of the Iterative Model will result in a definite and fixed period that is called cycle.

This replica sanctions the coming by to antecedent stages, in which the diversities made discretely. The rearmost yield of the venture recharged towards the varnish of the Software Development Life Cycle measure.

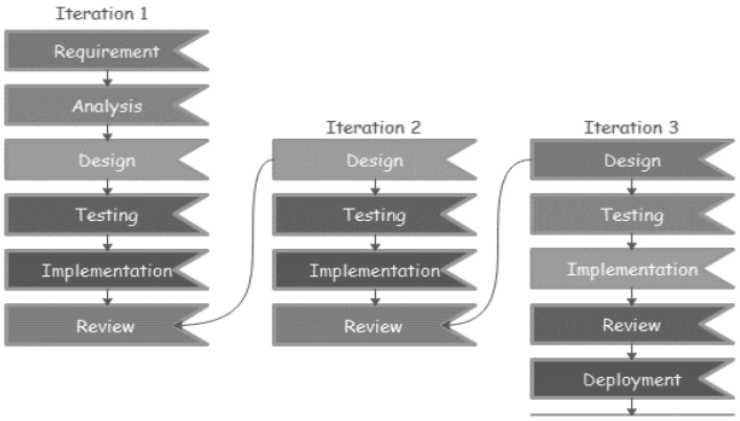

Figure 2.6 Iterative model

2.3 Agile Methodology

Agile methodology for software development is a combination of incremental and iterative processes. With Agile the main objective of the developers is on adaptability and customer satisfaction by rapid delivery of working software products. These products are developed in rounds of weeks, which are then iterated over and over, keeping customer's priorities in mind.

Every agile iteration involves, cross functional teams working simultaneously on different areas like:

- Planning
- Requirement Analysis
- Design
- Coding/Development
- Unit Testing
- Acceptance testing

Agile model relies on the belief that every project has different requirements and has to be handled differently, therefore, the methods have to suit the project requirements.

In the earlier days of software development, there were different methodologies that were synonymous to agile, but there were few differences because each of these methodologies were developed by different groups with varying project requirements.

Popular methods like Extreme Programming (XP), Scrum, feature driven development, etc, are now collectively known as Agile Methodologies, after the agile manifesto came into existence in 2001.

Agile Values are:

- **Working Software:** A working prototype of the software is considered to be the best means of communication between the developers and customers as it allows customers to see the product and request features, while developers can observe the different interactions
- **Responsive:** The product has to responsive to changing customer needs, and teams should be able to quickly develop the feature requested.
- **Customer Interaction:** As the requirements cannot be gathered completely during the initialisation of the project and due to requirement changes and feature requests it is considered that customer should be involved in the product to get proper requirements and criteria for the product.
- **Individuals and Interaction:** The agile methodologies tells that interactions between individuals is a good way to develop software, which allows increased motivation, self-organization and tools like pair programming helps in developing a quality product.

2.4 Agile Principles

Agile principles are the guiding rules/practices that helps in implementation and execution with agility

- The highest priority is customer satisfaction by early and continuous delivery of valuable software.
- Agile process allows changes in products at every stage. Even in late stage of development changes by customers should be entertained by the development teams.
- Delivery of working software is of utmost important, the frequency could be a few weeks or months but the shorter time period is preferred.
- Business representative and developers should work together as much as possible to ensure a product that fulfils customers requirements.
- Projects should be developed by enthusiastic individuals who are motivated, and they should be provide with proper environment to harness their best.
- The most efficient way of communication between teams is through face to face interactions.
- Progress is measure by deliveries of working software
- Agile processes depend upon sustainable development, therefore the stakeholders involved in the project should be able to maintain a constant pace.
- Attention of good programming practices and good architecture enhances agility
- Agile process promotes simplicity to maximize the amount of work not to be done.
- The best architectures, designs and requirements are developed by self organizing teams
- At subjected intervals, the development team reflect on the efficiency of development to become more effective accordingly

2.5 Software Testing

Software testing can be called as an affair which comprises several distinct activities or jobs. Of which execution is only one of these jobs

Software testing does the following:

- gauges the quality of the software
- risk of software failure in operation is reduced

Software Testing ≠ Test Execution

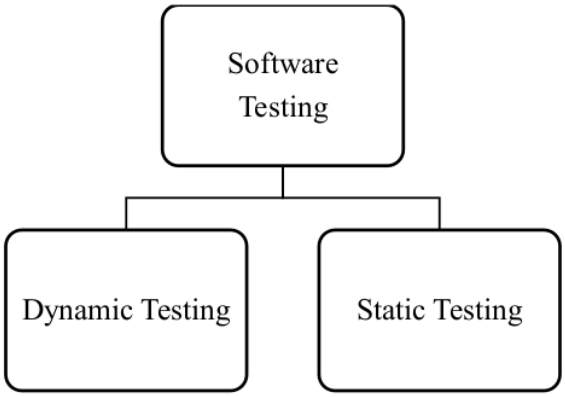

Figure 2.7 Types of Software Testing

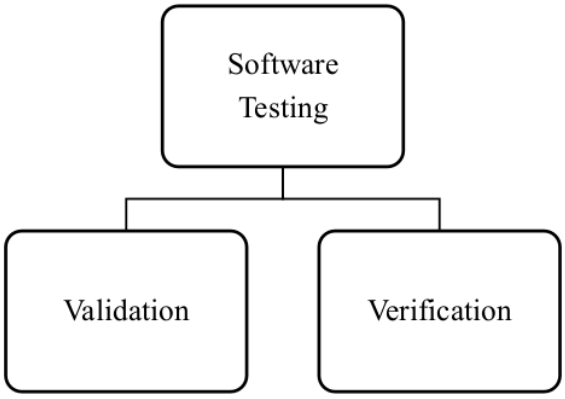

Figure 2.8 Steps in Software Testing

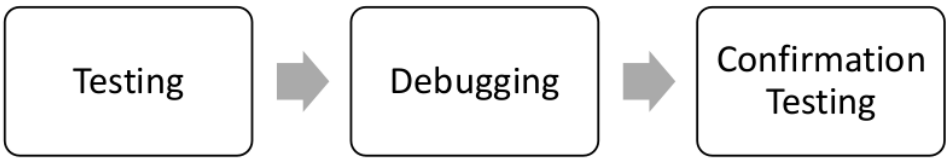

Figure 2.9 Relationship between Testing and debugging

2.6 Testing Processes

There is nobody all-inclusive programming test measure, yet there are basic arrangements of test exercises without which testing will be more averse to accomplish its set up destinations.

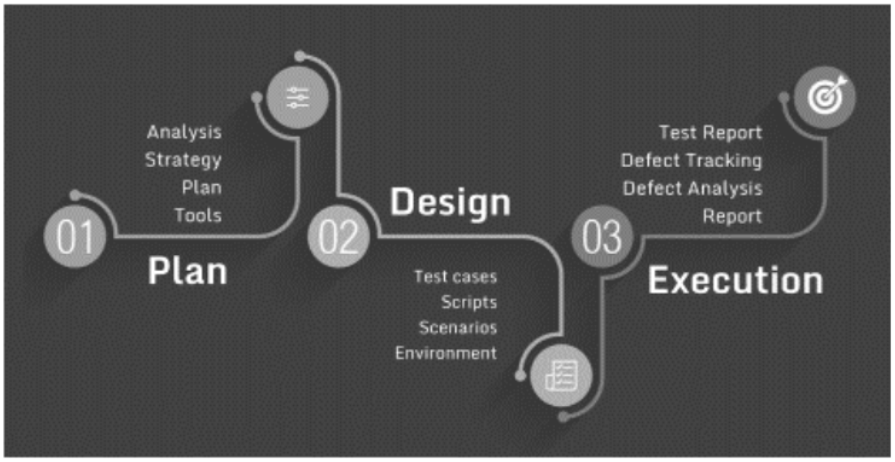

Figure 1.10 Test Process

2.7 Test Levels

Test levels are gatherings of test exercises that are coordinated and overseen together. Each test level is an occasion of the test interaction. Test levels are identified with different exercises inside the product improvement lifecycle.

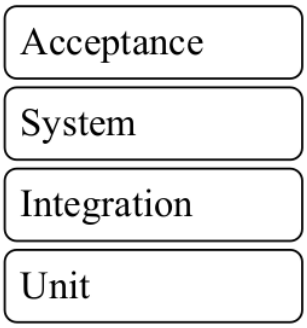

Figure 2.11 Test Levels

2.8 Test case writing

A bunch of preconditions, inputs, activities (where relevant), anticipated outcomes and post conditions, created dependent on test conditions.

It involves:

- Test Case Title
- Pre-Conditions
- Test Steps
- Expected Results
- Test Suite
- Test Environment
- Actual Results
- Status
- Defect Report

2.9 Defect Report

Defect Report - Documentation of the event, nature, and status of a deformity. Wherein a blemish or inadequacy in a work item where it doesn't meet its prerequisites or particulars is a deformity.

Chapter III

LITERATURE REVIEW

Document [4] [5] contains a detailed description of how the selenium tool works [7]. Gojare et al. Provided the Selenium Framework Utility section, steps to generate screenshots, different types of test kits, how to customize test reports, and finally a result to customize reports [8].

[5] [6] The Selenium server consists of a server component that is used to accept requests from the Remote Web Controller class of Selenium clients. Driver API for running tests for web browsers on a server. The final component is Selenium Grid, which Selenium Server implements in command line options for grid functions.

It contains a central hub and nodes for numerous scenarios and preferred browser functions. .Grid is a tool that allows parallel tests to be run on different computers and different browsers at the same time, which affects the minimized execution time.

EXAMINATION OF RESULT

After the test run, the result can be checked in the recording field. It shows that the test case passed and there is no error. When the test case is executed, error messages and information are displayed showing the development in the log.

Panel repeating even though the Record tab was not selected. These messages are often useful for debugging test cases. The Delete button deletes the recording and the Information button allows you to select different levels of information to be recorded. The Reference tab is the default selection when entering or changing Selenium commands and parameters in Table mode. 18 of 44 Documentation for the current command is displayed in table mode. When entering or modifying commands in either table or source mode, it is very important to confirm that the parameters specified in the Target and Value fields must match the parameters specified in the Parameter List in the Reference window.

RESEARCH QUESTION

How does the Selenium Framework reduce the time required for quality assurance?

The aim of this research [3][4] is to measure the time efficiency that the Selenium Framework offers when implemented in the test suite. Test suite in the case of a company.

Finally, the investigation comes to the benefit of using the Selenium framework for automating tests based on the statistical result.

In addition, the thesis aims to provide a complete guide for the implementation of the Selenium framework with language programming (Java) for testing web application automation.

This thesis suggests an explanation for the above problem (the need for test automation). However, it is not certain that this is the only contributing factor to the problem. From there, the author conducts research to identify the real cause of the problem with openness to new hypotheses or ideas (Shuttleworth 2008). With all these factors in mind, the work uses an abductive research approach.

The author of the above thesis chooses Design Science as the research method for the following reasons:

First, it is a research method that includes a solution approach and increases the need for change towards a better future (Barab & Squire 2014. Second, design exists from a research practice to create an artifact to solve the specified problem, analyze the result, and demonstrate the findings to the audience (Peffers, Tuunanen, Rothenberger & Chatterjee 2008, 6) .The researcher then makes a proposal for development A thorough evaluation of the artifact and is then performed to arrive at a conclusion on the results.

According to [3] [5] there are five different methods for evaluating data in Design Science . For the purposes of this work, an observational method is used to collect data and a descriptive method with scenarios to analyze their performance.

Throughout the development progress, the author keeps track of field notes, memos, behavioral logs, or triggers during the observations. The data is then analyzed under a descriptive scenario and compared to previous behavior before developing the artifact to measure the effectiveness of the artifact. and restriction.

The author of the work observes and collects the time data required to run the test suite. Out of 50 use cases, there are 44 automation test cases, as there can be more than one assertion in a test case. This means that there are test cases that have the same initial state. After the aforementioned time-consumption to perform the functional testing, the thesis author decided to draw out one condition to compare between the two scenarios:

Given that in two months of development (four sprints), one developer needs to perform the entire functional testing for four times each sprint, the Equation 1 refers to a method of calculating the time he/she needs to spend on:

*Total time consumption (Hours) = Development time + (time for 1 round of testing + maintenance time) * rounds of testing * number of sprints*

Chapter IV

SYSTEM DEVELOPMENT

4.1 Client-side Technologies

4.1.1 HTML

HTML (HyperText Markup Language), is the web standard markup language for any application that has to operate in web browser. It can be further accessorized with the help of CSS (Cascading Style Sheets) and JavaScript to add functionalities such as animations, validation of data and accessing browser storage.

The browsers receive HTML from a web server or local host and then they reproduce it into multimedia web pages. HTML along with CSS and JS are the backbone of any modern front-end. HTML elements are the basic blocks that make the web application.

Today, HTML is heavily used to format web pages. Therefore, a sound knowledge of HTML is a must for any IT professional. Given below are the few use cases for HTML.

- Creating a Website: It is the obvious choice for creating any web application/site as it the de-facto standard for rendering in web browsers.
- Documentation Pages: Being a markup language provides HTML with benefits such as that it is easy to write and will look same on any browser/machine. That's why most of the documentation for open-source, APIs, Libraries and frameworks are written in simple HTML, because they are easy to maintain and write.
- Desktop Applications: Many of the .Net and Node.js application framework like electron.js, provide the functionality to code web application and use most of the code to port the application over into a desktop application with most of the UI being the same as web app.

4.1.2 XPath

XPath is a query language that is used by selenium framework to navigate through website. XPath is very similar to regex (regular expressions) in JS, both are commonly used to search for a particular elements or attributes with matching patterns. XPath provides various expressions to matching expressions.

- **Structure definition** – It defines the parts of XML document lie attribute, text, namespace, processing-instruction, comment and document nodes.
- **Path Expression** – It provides a selections of expressions that allows the programmer to select a node or list of nodes with few lines of code.
- **Standard Functions** – It provides an elegant repository code base of standard functions that help in manipulation of dates, strings, etc. that are hard to code.
- **W3C recommendation -** It is officially recommended by W3 council for automation, and W3 Council makes regular updates on use cases and such.

RELATIVE XPATH

This involves searching in the whole document with the help of specific attributes, text or using relationships to make searching possible when unique text, attributes or other elements are not available.There are different ways to search for elements using Relative XPath as is mentioned in the previous section.

ABSOLUTE XPATH

This approach requires providing starting point to the root and provide all the child and descendants tags with precision and without missing any of them which can prove to be risky in the future. This is because a web page is dynamic and we won't be able to locate the elements as they will not stay in the same position.

COMPARING ABSOLUTE XPATH AND RELATIVE XPATH FOR USAGE ON A WEB PAGE IN REAL TIME

Since we must provide a precise information about the element when using Absolute XPath and failure to do so can result in huge errors for the future, this XPath is not recommended for usage on a real time application or web page which involves a dynamic nature of elements that keep changing positions.

Due to this particular reason , Relative XPaths are preferred to be used more often for locating or inspecting elements on a dynamic web page which is what exists in a real time scenario.

XPATH FUNCTIONS

When working in a dynamic web environment, we find it hard to locate a specific web part using common attributes like name, class, and so on. Several different elements might be having similar properties, e.g. same types of names or class names. XPath features that exist may not be very efficient because in such a case a simple XPath could return more than a single element. To overcome these kind of scenarios, XPath in Selenium provides XPath functions that can be used to write effective XPaths to uniquely identify elements.

1. Contains()
2. Starts-with()
3. Text()
4. AND operator
5. OR operator

4.1.3 CSS

Cascading Style Sheets commonly known as CSS, is a styling language that is used for describing the presentation of HTML document and other markup based languages. CSS is considered the backbone of Web-UI along with HTML and JavaScript.

CSS is developed in such a way that it allows segregation of content such as layouts, fonts, colors, etc. This allows the developer to construct customized web pages that can have different layouts based on the CSS. Earlier CSS was embedded into HTML documents but due to the rise of parent classes and heavy customization it is advised to create a separate .css file for presentation of HTML document.

This increases the code reusability and modularity, because the same styling sheet can be used for multiple pages with little to no tweaks, which allows for faster development and keeps the cost down. Due to rise in use with hand held device CSS has grid and flexbox that allows developers to write presentation code that can be used on mobile devices as well, and it fits that device well too.

CSS specifications are maintained and developed by World Wide Web Consortium (W3 C).

CSS uses selectors to establish relationship between the markup style and matching tags and attributes in the HTML. Selector can be applied on a variety of attributes as well as tags or even on the combination of both.

- All elements of a specific tag, like applying certain fonts on p tags
- Using id or class attributes to apply style to the belonging attribute. If id attribute is used it is prefixed with "#" hash symbol, and if class attribute is used then "." dot symbol is used to apply the style.
- The style itself can be applied to elements relative to their parent and document tree.

In CSS, classes and ids are case sensitive. An id can be applied to only a single element. Whereas the class attribute maybe applied to any number of instances of any elements. If both are applied and they both have different style rules for the element then the id is preferred by the browser.

Pseudo-classes are used in CSS selectors to permit styling based on information that is not present in the HTML document. A very popular example of this is ":hover" pseudo class that allows the user/client to hover/point to a visible element and when the mouse pointer points to that elements. The applied pseudo class applies the styling to that element, resulting in changes. This is popularly used for simulation of actions like click, glow etc.

CSS has introduced custom properties as well that allows one declare properties with names that have the prefix "--" representing a value that can be used like a variable in multiple CSS classes and reduced code duplication and debugging time.

CSS also has introduced media queries that allows the programmer to specify the styling for hand held devices like mobiles, tablets, etc. Bootstrap by twitter is one of the major CSS frameworks that is used heavily to develop PWAs (Progressive Web applications) so much so that the browsers are now competing with apps on smartphones for usability and access. Use of media query allow the used to develop sites that have very specific styling based on users.

4.1.4 JavaScript

JavaScript, or JS is one of the core technologies in web development, It is a programming language that belongs to ECMAScript specification. ECMAScript does not include any storage, networking, input/output like features or libraries like traditional programming languages like C++, or Java do. Therefore, JS seems very difficult for the beginners but it has own quirks and can be easy to use too. It uses APIs for standard data structures, regex, etc. The web browser provides API for JS I/O.

JS is heavily used in web applications for client side features like animations, validation etc. The majority of web browsers have JS engines built using C++ for executing JS. It is high level language that allows the dynamic typing, prototype based object orientation, functional programming , etc.

It was created at Netscape corporation by Brendan Eich. It was created to add dynamic capabilities to static HTML documents, JS was then submitted to ECMA international for standardization and then it was adopted heavily by Microsoft and other browser development companies.

JavaScript is still the most dominant client-side scripting language of the Web. Initially JS, just like CSS was embedded into HTML documents but due rapid development, it was decided that it would be a better practice to use modularization and store JS code as ".js" files that allows one to reuse and tweak the code without having to work about ruining HTML code.

It is heavily used for these client side applications:

- **Validation:** Input values in forms and other such entries are validated on the client side then are sent to server.
- **Streaming Media:** Used for controlling the playback of streaming media.
- **Generating pop-ups:** UI based site use pop-ups as a traditional way to show updates of certain processes.
- **Logging data:** The modern Web is huge market for advertising companies therefore many of the website use "cookies" that allows them to store user's behaviour and send it to the server this allows them to serve customized ads. And whatnot.
- **AJAX:** AJAX is the bread and butter of JS, because of it's ability to provide updated content without having to reload the document this allows one to code applications that have reduced load on the sever as well as the client.
- **Animations:** JS is heavily used for browser animations like fading out, resizing etc. that provide a unique look to website and allows the users to spend more time on site.
- **Games:** Most of the current browser based games rely on a combination of JS and unity for developing games that can be rendered and run by client's browsers.

4.2 Server-side Technologies

4.2.1 Java

Introduced in 1995 by Sun microsystems, Java was developed by James Gosling. It is a high-level, purely object oriented language. One of the main benefits of using Java was portability which allowed the programs written in Java to executed on any machine, it introduced *write once, run anywhere* (WORA) meaning that complied Java code can run on all platforms that support Java without recompilation.

Java applications are compiled to bytecode that can run of any Java virtual machine (JVM). Which made Java the go-to language for enterprise development as the developers did not have to waste time for optimizing or customizing the software for particular models, provided machine abstraction to developers and in the process saved time and money. Java syntax is similar to C and C++, but it does not have low-level supports like C and C++ .

REAL WORLD APPLICATIONS

Java being a object oriented programming language is immensely valuable to application engineers, both open-source enthusiast and enterprise developers use Java extensively and it is one of the most impactful languages that are there. It is heavily used to develop multiple applications which range from desktop applications, web applications to mobile applications. It is also used by Minecraft which is a games developed using Java. The real world usage of Java cannot be described in few pages it the most influential language for the earlier days of development and still continues to be developed and released by Oracle.

JAVA VIRTUAL MACHINE

Java Virtual Machine popularly known as JVM, it runtime that can converts the Java bytecode into lower language such as machine language that can be used by the machine. JVM is the essence of WORA methodology and it is was marvellous piece of software that allowed developers to enhance and work on core features of their applications rather than working on portability for different machines. While compilers of other languages such as C,C++ compiled the source code directly into machine code for specific machine. The Java compiler compiled the source for JVM and not the host machine.

DATA TYPES

PRIMITIVE DATA TYPES	NON-PRIMITIVE DATA TYPES
Primary data types are integer, character, short, large, float and double.	These consist of classes, interfaces and arrays.

OBJECT ORIENTED PROGRAMMING SYSTEM

Object-oriented programming system (OOPS) is a programming paradigm that uses “objects” as a way to relate functions and data between the objects, the relations are derived like the relation that are present in real world objects. This provides the developers to construct more sound relations between the data and functions that are used with them as well as providing easy debugging and architecture construction for developers.

CONCEPTS OF OBJECT-ORIENTED PROGRAMMING SYSTEM

Class: It is a conference of near components. For instance, you had a class called "Costly Cars". Its properties (data) can be cost or speed of these vehicles. While the systems may be performed with these vehicles are driving, easing back down, etc.

Objects: An object can be designated as a development of a class, and there can be different adaptations of a class in a program. For example - seat, bike, marker, pen, table, vehicle, etc.

Inheritance: Classes can share, acquire or "acquire" properties and techniques that have a place with existing classes. This allows you to reuse existing code and reduces the time you spend coding. A class that gets from another is known as a derived class or a young person class. A class that shares its properties and methodologies is known as a base class or parent class.

Polymorphism: alludes to the capacity of a strategy to be utilized in various manners, that is, it can take various structures at various occasions (poly + morphs). There are two sorts of polymorphism: compile time polymorphism and run time polymorphism.

Compile time (static) polymorphism happens when a technique is over-burden; that is, the point at which the contention utilized with the strategy is changed. This is done to get various outcomes. A case of this would propose various names for being the President of a nation, which would get you various outcomes each time – yet they would in any case be known as the President.

Run time (dynamic) polymorphism happens when the techniques itself are changed. At the point when you needn't bother with a President yet a Prime Minister, you would need to supersede the current strategy.

Abstraction: Information deliberation alludes to the procedure of just showing applicable properties and techniques to deal with an item, while concealing the rest. Information deliberation lets you lessen the multifaceted nature (clearly) of a program and is an enormous bit of leeway offered by classes in OOP dialects.

Encapsulation: Embodiment alludes to keeping objects with their strategies in a single spot. It likewise ensures the trustworthiness of the information – keeps it from being unnecessarily modified by confining access to the information, ideally by concealing it from outside components.

INTERFACES IN JAVA

An interface in Java is blueprint of class it has static variables which are constants and uses abstract methods. Interface in Java provides technique to achieve abstraction. Interface allows only abstract methods to be defined. Java 8 provided default and static method in an interface. And Java 9 added private methods in interface.

Reasons for using interfaces:

- It can be used for achieving Abstraction.
- It can be used as a technique for implementation of multiple inheritance.
- It can be used to achieve loose coupling in modules.

DECLARATION OF INTERFACE

An interface is declared with the use interface keyword. It provides absolute abstraction. Which implies that all the methods have to be abstract and their bodies are to be coded in child classes and static variables as well.

Syntax:

interface <interface_name>{

//declaration of abstract methods

//declaration of static variables

};

EXCEPTION HANDLING

The Exception Handling in Java is one of the incredible instrument to deal with the runtime blunders so typical progression of the application can be kept up.

The java.lang hrowable class is the root class of Java Exception order which is acquired by two subclasses Exception and Error.

Types of Exceptions:

1. Built-in Exceptions
2. User Defined Exceptions

JAVA EXCEPTION KEYWORDS

Try	The "try" watchword is utilized to determine a square where we should put an exemption code. The attempted square should be trailed by either get or at last. That is to say, we can't utilize the square alone.
catch	The "catch" square is utilized to deal with the exemption. It must be gone before by the attempt square which implies we can't utilize the catch square alone. It tends to be trailed by a long last square later.
finally	The "finally" square is utilized to execute the significant code of the program. It is executed whether a special case is dealt with or not.
throw	The "throw" catchphrase is utilized to toss a special case.
throws	The "throws" catchphrase is utilized to announce exemptions. It doesn't toss a special case. It determines that there may happen to be a special case in the technique. It is constantly utilized with strategy signature.

STRINGS

String is an arrangement of characters. In java, objects of String are permanent which implies a steady and can't be changed once made.

1. char charAt(int list) - Restores the character at the predefined list.
2. int compareTo(Object o) - Examines this String to another Object.
3. int compareTo(String anotherString) -Examines two strings lexicographically.

4. int compareToIgnoreCase(String str) - Examines two strings lexicographically, disregarding case contrasts.
5. String concat(String str) - Connects the predefined string as far as possible of this string.
6. boolean equals(Object anObject) -Looks at this string to the predetermined item.
7. int indexOf(int ch) -Returns the list inside this string of the principal event of the predetermined character.
8. int indexOf(String str) -Restores the file inside this string of the primary event of the predefined substring.
9. int lastIndexOf(int ch, int fromIndex) -Restores the file inside this string of the last event of the predetermined character, looking in reverse beginning at the predefined record.
10. int lastIndexOf(String str) -Restores the file inside this string of the furthest right event of the predetermined substring.

STRINGBUFFER

Java StringBuffer class is an alterable (modifiable) string. The StringBuffer class in java is similar to the String class with the exception that it is impermanent. For example, it very well may be changed.

CONSTRUCTOR	DESCRIPTION
StringBuffer()	makes an unfilled string support with the underlying limit of 16.
StringBuffer(String str)	creates a string support with the predetermined string.
StringBuffer(int capacity)	creates an unfilled string support with the predefined limit as length.

ARRAYS IN JAVA

An array is a holder object that holds a fixed number of estimations of a solitary kind. The length of a cluster is set up when the exhibit is made. After creation, its length is fixed.

In Java all exhibits are powerfully allocated.

Exhibits can contain native's information types just as objects of a class contingent upon the meaning of cluster. If there should arise an occurrence of natives information types, the real qualities are put away in bordering memory areas. If there should be an occurrence of objects of a class, the genuine items are put away in the load section.

COLLECTIONS IN JAVA

Collection framework in Java provides an architecture to handle and manipulate objects. It has implementations for various data structures, which have very different use cases some are faster for storage or retrieval others store data in a certain way and so on.

Java collection is a bundle of single objects. It provides many interfaces like Set, List, Queue, HashSet, etc.

ARRAYLIST

ArrayList class in java is a resizable array which very similar to vectors in C++. It is implemented in java.util package. ArrayList provides many different functions for manipulating ArrayList from adding elements, removing elements, sorting elements.

JAVA DATABASE CONNECTIVITY WITH MYSQL

To connect Java applications with MySQL database, we have to do the following steps:

1. Driver class : The driver class for the MySQL database is com.mysql.jdbc.driver.
2. Connection URL: The association URL for the mysql database is jdbc: mysql://localhost:3306/sonoo where jdbc is the API is running, we may likewise utilize IP address. We may utilize any database, in such case, we have to supplant the sonoo with our database name.
3. Username: The default username for the mysql database is root.
4. Password: It is the secret phrase given by the client at the hour of introducing the MySQL database. In this model, we are going to utilize root as the secret key.

4.2.2 SQL

SQL stands for Structured Query Language, a query language that is used for data storage, data manipulation and data analysis as well. It is designed for managing relational database management systems (RDBMS). SQL is based on relational algebra and tuple relational calculus. It was one of the first languages that used Edgar F. Codd's relational model. The model was described to be used by large scale data banks.

SQL became a standard on in 1986 by American National Standards Institute (ANSI), and is extensively used by many web applications as well as desktop application for data storage and retrieval. SQL is used by Database Management Software (DBMS) like MySQL, PostgreSQL, SQL Server as the de-facto standard database language although some of them may have slight syntax differences.

SQL is an essential part of web as we know it. As it provides the ability to describe data, fetch data, delete data, create views, run procedures on database and much more. These functionalities are heavily used by many different software enterprises and have been the industry standard for almost 4 decades.

DATA DEFINITION LANGUAGE

Information definition language is a grammar for manufacturing and switching data set items like tables, lists, and clients. DDL manifestations are like a PC programming language for setting apart information frameworks, particularly data set blueprints. The common statements used are: CREATE, ALTER, DROP, TRUNCATE.

DATA TYPES

Numeric Data type:
INT: Whole numbers
FLOAT(M,D): Decimal numbers(approx.)
DECIMAL(M,D): Decimal numbers(precise)

Non-Numeric Data type:
CHAR(N): Fixed length character
VARCHAR(N): Varying length character
ENUM('M','F'): Value from a characterized list
BOOLEAN: True or False qualities

te and Time type:
DATE: Date(YYYY-MM-DD)
DATETIME: Date and time (YYYY-MM-DD HH-MM-SS)
TIME: Time(HH-MM-SS)
YEAR: Year(YYYY)

PRIMARY AND FOREIGN KEYS

PRIMARY KEY	FOREIGN KEY
An essential key is a field in a table which exceptionally recognizes each column/record in a data set table. Essential keys should contain unusual cal e. An essential key segment is not allowed to have NULL qualities. A table has just one essential key, which may contain single or various fields.	This imperative is utilized to forestall activities that would annihilate joins between tables.

MODIFYING TABLES

Adding and Removing Tables To include another segment in the current made table the language structure is: "Include COLUMN <COL NAME> <DATATYPE>".

To expel the section from a table the grammar is: "DROP COLUMN <COL NAME>".

Furthermore, to eradicate all the data from inside the tables abbreviate request is used.

DATA MANIPULATION LANGUAGE

A DML is customarily a sublanguage of a more sizeable data set language like SQL, with the DML containing a chunk of the controllers in the language. Read-only choosing of data is some of the time accepted as being vital for a different DQL, however it is steadily allied and at times likewise thought to be a part of a DML. The common commands under DML are: INSERT, SELECT, UPDATE, DELETE.

JOINS

Joins permit to recover information from different tables in a solitary select articulation. To join two tables t[43]e should be a related segment between them. There are various sorts of joins, for example, inward join, left join, right join.

INNER JOIN	LEFT JOIN	RIGHT JOIN
Inward join will recover information just when there is coordinating qualities in both the tables.	Left join will recover all the information from the left table and the coordinating lines from the correct side of the table.	The correct join will recover the information from the correct table and coordinating columns of the left table.

SUBQUERIES

Subqueries are the inquiries that are settled inside different questions. The subqueries can be utilized in a SELECT, INSERT, UPDATE, or DELETE question. The settled question could be in the WHERE provision or in the FROM. There are two kinds of subqueries to be specific, non-corresponded subquery and related subquery.

NON-CORRELATED SUBQUERY

In this sort of subquery, the inward question can run freely of the external inquiry. Inward questions run first and produce an outcome set and which is then utilized by the external inquiry.

CORRELATED SUBQUERY

In this sort of subquery, the internal question runs for each line in the external inquiry. Here the internal question cannot run freely of the external inquiry.

NORMALIZATION

Standardization is the procedure of effectively sorting out the information into the database. It is fundamentally done to expel the excess information and to just store the related information in a table. The advantages of standardization are:

1. Reduce the extra room
2. Reduce addition, update, and cancellation inconsistencies
3. Improve inquiry execution
4. Reduce the extra room
5. Reduce addition, update, and cancellation inconsistencies
6. Improve inquiry execution

Following are the degrees of standardization:

1st typical structure (1NF)	2nd typical structure (2NF)
3rd typical structure (3NF)	Boyce and Codd typical structure (BCNF)

FIRST NORMAL FORM (1NF)

The standards in the main typical structure are that a table is in the 1NF if:

1. There are no rehashed lines of information
2. The sections just contain a solitary worth
3. The table has an essential key

SECOND NORMAL FORM (2NF)

The standards in the subsequent ordinary structure are that a table is in the 2NF if:

1. They fit in with 1NF.
2. Every segment that is anything, but an essential key of the table is subject to the entire of the essential key

THIRD NORMAL FORM (3NF)

The guidelines in the third typical structure are that a table is in the 3NF if:

1. They fit in with 2NF .
2. Every segment that is not the essential key is just subject to the entire of the essential key.

MySQL

MySQL is an open source RDBMS (Relational Database Management System) available for free use under GNU General Public License, and is also available under a variety of licenses. It is maintained by Oracle.

It gives a UI to us to connect with the database.The application is employed for a vast scope of causes, counting details warehousing, online trading, and logging applications. The most familiar use for MySQL notwithstanding is with the final intent of a web information base.

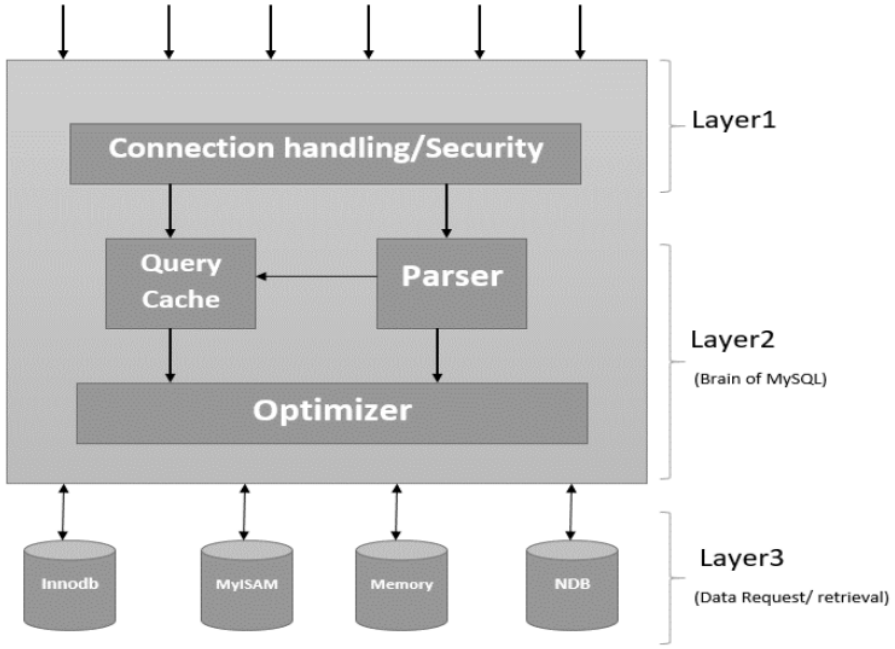

Figure 2.1 MySQL CLIENT

RELATIONAL DATABASE MANAGEMENT SYSTEM

A relational data set touches on to a data set that reserves statistics in a well-structured group, availing lines, and segments. Hence it is easier to find and ingrain obvious traits under the details base. The social design makes it tenable to sprint doubts across unrelated tables immediately.

Installation of MySQL

Step1: The initial step is to go to the site www.dev.sql.com and introduce MySQL for the necessary working framework.

Step2: Ensuing to acquaint the MySQL with your system, fire setting up the workbench stage where you can create the inquiries.

Step3: At the point when you open the workbench, a secret phrase brief will spring up and you must enter the root secret word that you made during the establishment procedure.

Step4: Then comes the time when you can make your first database inside the workbench.

4.2.3 JSON/XML for APIs

JSON

JSON stands for JavaScript Object Notation, it is a light data exchange format. Which is heavily used in modern APIs for data. It easier to read for humans and easier to write as well. It is based on JS and was introduced on 1999. It is one of the text formats that is independent of language and it is interchangeably used by many languages such as JS, Python, C, C++, Java, etc. JSON is considered the most user friendly data-interchange format.

JSON stores data in key-value pairs, most of the modern programming languages have these as either a collection of name/value pairs. In python this structure is called a dictionary, whereas C++ has hash table. Some languages also have vectors, list or sequence which can used. These are universal data structures that essentially present in all modern programming languages, this allows the faster access time as well as interchangeability.

JSON Syntax Rules

- Data has to be stored in key value pairs
- Every data entry has to be separated by ","(comma).
- Objects are held using curly brackets
- Arrays are described by the use of square brackets.
- Keys must be string.

For AJAX web applications, JSON is faster than XML, because the process only involves the user to fetch the JSON and then parse it into string, whereas for XML, it has to fetched then looped through XML DOM, and then the values can be stored in variables.

XML

XML stands for extensible markup language. It is a markup language that is used for encoding data to be used by applications independent of their programming languages they were developed in, it human readable as well.

It is software and hardware independent, and similar to HTML, and was designed to store and interchange data between various systems. It is self descriptionary and has W3C recommendation. At first sight XML looks a bit difficult to grasp, but XML is just data which has been wrapped in tags.

XML does not use any predefined tags like HTML does, the tags used in XML are written by the author of the document. When compared to JSON, the tags are the keys and the wrapped data in XML is the value. XML needs both the ending and closing tags to be wrapped around the data. It is truly Extensible, meaning that the XML applications will work as expected by the developers even if the new data is added(or removed). Which helps to save time as the developers do not have to waste their time be porting new versions of applications to work with older versions of applications.

XML provides simplification of data transmission as exchanging data between incompatible systems is time intensive process and cost are likely to increase with the complexity of the data involved. XML is a great way for storing data as it provides simple text based storage that is independent of hardware and software , it also makes it easy for the users to upgrade to newer systems without having to worry about issues relating data and package installation. XML is widely used in web development and It is considered to segregate data from presentation as it does not contain the presentation information, therefore it provides an excellent choice for data separation. Just like HTML documents are described as trees, XML documents are too element trees. XML tree starts at the root element and branches out from the root to child. It heavily uses self describing syntax.

Chapter V

SELENIUM WEBDRIVER

AUTOMATED TESTING

Automated testing or Test automation is a popular testing methodology in which by the use of certain automated framework test case suites are tested on applications and softwares. Compared to manual testing where the human has to sit in front of a computer to carefully executing the tests.

Automated testing is used extensively for developing mission critical software that has to be checked thoroughly and has to very strict criteria for passing the inspection. Successive development cycles require execution of same tests over the updated application and the testing system has to be consistent with the results. Automation is the perfect tool for consistency and speed as the machine much more capable to repeat same test with same accuracy in every iteration of the test and development cycle.

WHEN TO USE AUTOMATED TESTING

Automation provides an efficient way conduct tests on the applications, excellent test coverage as well as execution speed all are the factors that make automated testing a very effective tool. Therefore, Automated testing should be considered for various cases some are listed below.

- When testing multi-lingual software, or software that has a very wide variety of users the number of test cases rise for each class of user, therefore each class has to be created with their own unique test cases, this is the exact scenario where automated testing can reduce testing time. Therefore reducing the cost to market as well as the development costs as well.
- Manual testing is prone to errors. Therefore it is highly likely that the tester while testing the application manually can report a false testcase in the report. Which wastes time and effort of the development team.
- Testing using automated framework can help increase test coverage and increase the robustness of software/application.

WHICH TESTCASES TO AUTOMATE

Although it is possible to automate every tests, but the automation of test has to programmed and is costly, henceforth it advisable to consider some tests as priorities that are to be performed first, and if the budget permits execute the rest. The following testcase should be automated.

- System critical cases which are high risks, like login, signup, etc.
- Testcase which are time-consuming like, chat application test cases.
- Testcase that difficult to done manually.
- Testcase that are highly repeated.

The list of test cases given below should not be prioritised for testing.

- Test cases that have ad-hoc elements.
- Test cases which have frequent changes in criteria.
- Test cases that are newly design and have not been tested even once manually.

INTRODUCTION TO SELENIUM

Selenium is a collection of different range of tools and libraries that allow the developers to automate web browsers. It provides different extension that emulate user interaction with browsers. It provides drivers that allow the developers to automate the browser. More than that it provides infrastructure for implementations of W3C Specification of WebDriver that allows the developer to write code for all major web browsers. It is an Open-Source UI automation tool. It was created in 2004 by a ThoughtWorks engineer. Selenium WebDriver was later introduced later in 2006.

COMPONENTS OF SELENIUM

SELENIUM IDE

IDE stands for Integrated Development Environment; it is a tool that allows a developer to Selenium test cases. It is an add-on/extension for browsers and is considered the most efficient way to develop testcases. It logs the user's actions in the browser using existing Selenium commands, with parameters defined by the element. The is a huge time saver for testing.

SELENIUM RC

RC is a fundamental part of Selenium framework. It enables the developer to write tests in different programming languages that can be automated for UI for web applications against any HTTP website.

Selenium RC mainly consists of two parts:

- Client Libraries of the preferred programming language.
- A server that launches and kills browsers after completion of test.

SELENIUM WEBDRIVER

WebDriver provides the developer to use the browser automation APIs, which is provided by browser vendors to control the browser and emulate user interaction and run tests. This is if the browser is used by a real user. The WebDriver is not intrusive at all because it not require it's API to be compiled with application code. Which provides the user to test the same application for test and deployment as well.

SELENIUM GRID

Grid allows to run test cases, in different machines across different platforms. The controls for execution of automation tasks are on the local end while the host is on the remote end for automation. Grid allows one to test the application on multiple clients which are them different operating systems.

SELENIUM INSTALLATION SYTEM REQUIREMENTS

To Install Selenium test suite with Java, one must have Java environment running, the following are the system requirements:

1. Java Runtime Environment (JRE) on the host machine: Java Software Development Kit (JDK) comes bundled with JRE integration. Download and install JDK from oracle official website for Java select based on the Operating system.
2. Install Eclipse IDE (Integrated Development Environment) from Eclipse official website
3. Download Selenium WebDriver based on the browser, to run test scripts on a specific browser, and place the driver in path linked.

Chapter VI

CONCLUSION AND FUTURE WORK

CONCLUSION

Over the past few years, developers all over the world have been constantly working and developing the applications to provide better software as well, quality software for users. With the use of different methodologies as well as philosophies that help in development. Over the years Agile methodology has come forward as a way to for better development and customer satisfaction.

Selenium is considered the first choice for automation for web based applications for testing them. Ever since the inception of Selenium it has been the primary choice for automation and testing because of the popular languages it supports and use of selenium is easy and should be considered if testing of web application is to be done as the tests can be replicated on various machines and the test coverages provides extensive coverage that allow the developers to make robust and quality software within budget and providing customer satisfaction and well built products.

Through this Internship, Software testing and automation of testing using selenium was performed and learning process was immense and the learning and aid provided was sufficient for learning development for automation and testing. Selenium was not the only technology that was used during this internship. Many different technologies like JavaScript, SQL, HTML and CSS were also heavily used in this internship. Overall the learning process was immensely yielding and the learning gathered from the were extremely beneficial.

FUTURE WORK

As Softwares are being developed and most of them are web based applications, this makes the testing more important for the software to provides a reliable way to develop software and that makes a quality product and due to huge amount of applications with varying levels of complexity makes automation as a perfect candidate for providing vital test coverage with speed as well as efficiency that makes a quality product.

Software testing, just like software development is an important part of the whole process of getting a product or an application to get to market, henceforth automation of testing is the way to be taken to reduce time to market time and increase the quality of software as well as decreasing the cost of development.

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