Abstract

There are various functional process involved to operate a web application effectively. This project’s functional process involved in designing and development of a generalized add-on library module or package for web application. Main purpose is to build such an API that will provides a user defined information system with a great interface.

Despite of having difference in functional purpose of many web application; web app can contains similar task of information storing and finding efficiently based of the web app’s purpose. But unfortunately we don’t have any. Actual motive is to solve the problem by creating an API which can be used almost every web application as a functional component. Spring boot framework technology is used to develop the API.

This generalized add-on library package can easily access the web app component and deliver the services with more flexibility. It will result an excellent API which is capable of providing a dynamicity in information managing with user interface. As this is a library package it will be used as a component and can save a lot of time and work. It help to open access in faster method than traditional publishing.

Acknowledgement

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Introduction

An API can be viewed as a public contract because the author defines how it must be used and what it will return without necessarily exposing how the functionality is implemented. One of the most powerful features of any library or service is the ability to be integrated with other applications. An API facilitates these types of integrations by defining public interfaces which can be easily used.

The interfaces mentioned can be of different types. One way to use a library could be by using a class, static methods, or simply sending a message to a centralized message queue. In our library package, we use static methods. Managing all information is an essential part of any organization .Our project takes the concern of making a standard library package in an automated way.

In every organizations, all of the functional components, it is needed to collect essential records .And it takes much time and effort of the staffs of the organizations to collect information repeat about the same persons for their needs. If all the information can be recorded automatically in a computerized way it becomes much helpful, less complicated and time saving for all the staffs concerned.

Background and Motivation

Removing redundancy has been one of the oldest challenge for computer science since computer was introduced. Information management system is an important part for almost every web application and here comes the question of static work. Developers need to create their own information management system but having an automated system can solve the problem easily.

So introducing dynamicity in information management to several web application is the reason for the developing this API. Replacing static work with dynamic can save the lot of work and time. In will a new dimension in the field of development and research. This generalized library package will provide ease to access the web app component and deliver the services with more reliability. This can improve a lot of web app that uses information system management as component. Additionally, it gives an ID card generation feature for specific type of information management system.

Objectives

Project objectives are:-

* Create an API for generalized use for developer.
* Handling dynamic information management system.
* Find information record by QR code.
* Generate ID card for specific field.
* User authentication with spring security.

Scope

As library package is nothing more than a container of compiled programs it can be used any web app by importing.

* Development purpose: Web application that needs to have a function of information management system can use the library and save their lot of work.
* Research purpose: Can be useful for research like medicine, technology, economy etc.
* Educational purpose: Certain educational institute can use this library package to manage information like:

1. University Information Management System.
2. Department Information Management System.
3. Teachers Information Management System.
4. Student Information Management System.
5. Library Information Management System.
6. Staff Information Management System.

* Organizational purpose: Almost every organization needs an information base of their employee and this can be easily done through this API. Some example fields can be:

1. Employee Information management system.
2. Doctor Information management system.
3. Transection Information management system;
4. Product information management system.

Literature Review

Literature review is the related works that has been done in this field. This can be said as the related works to the field.

What is Literature review?

Literature review is the related works to the project concerned. These are the works those are done before this project was initiated. Literature reviews are the previous works that inspired and helped modeling the current project with many tips. As much as related works are reviewed, there is chance of less failure and less time consumption. And after implementation less complaints may be expected.

Related works

(This section will be improvised by our supervisor sir)

System Description

System description includes the description of the system as it develops.It is necessarily going to specify how the system is how the systen is going to be and how will be work from the perspective of the server and clients.

Existing System

The existing system of making a list for individual system in a conventional way and it takes much time. It has the following features :-

\*Need to make individual form to collect information for individual project or functional components.

\*Process becomes slow

\*Sometimes, records are uncertain.

\*Unnecessary waste of time.

\*It is arised in big organisation system.

System proposal

The system is built with one way work process of clients and servers. The system includes all of the persons involved in an organisation.

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System Proposal

The system is built with a two way process of server and client site. System includes static classes for dynamic information management. It’s almost developer and server site system. System work as interface between client and implemented system. Two performed system site are describing follow:

* Server Site

Server site is controlled by API which contains the interface for information management system and related task. After integrating the API to developer’s web app server site will provides the feature for the client directly. In this providing it renders the authentication page for user to registration. After sing up it will provide the developer to create their own form and generate a link for users of that project.

* Client Site

In this project our client site will be the developer. Developer will integrate the library to their project. After integrating the library developer can access the API server and create his own form by providing the information needed for creating a form like form name and number of field. After that developer will provide the filed type for every filed. Then the form will be created for the developer to use.

Requirement analysis

The chapter introduces to the requirements analysis, which is the basic for building the system. According to the requirements specified the requirement of tools and Technologies are decided.

What is the Requirement Analysis?

The description of the services and constraints are the requirements for the system. Requirements are the basics for any system building. Requirements need to be very clear and a clear understanding of the requirements make the project successful. System's services, constraints and goals are established consulting with the system users, they are defined in details and used as a system specification.

Software system requirements are:

1.Functional system requirement.

2.Non-functional system requirement.

3.Domain requirements.

Functional Requirements

These are statements of services the system should provide, how the system should react to particular inputs, and how the system should behave in particular situations.

Non-Functional Requirements

These are constraints on the services or functions offered by the system, e.g., timing constraints.

Domain Requirements

These requirements come from the application domain of the system and that reflect characteristics of that domain. They may be functional or non-functional requirements.

Required Tools and Technologies

To develop the project, following tools and technologies are used here:

* Spring Boot
* SQL
* Bootstrap
* Thymleaf
* HTML
* CSS
* Hibernate
* Java

[Spring Boot](https://www.tutorialspoint.com/spring_boot/spring_boot_introduction)

[Spring Boot is a project built on the top of the spring framework. It provides a simpler and faster way to set up, configure, and run both simple and web-based applications.](https://www.tutorialspoint.com/spring_boot/spring_boot_introduction)

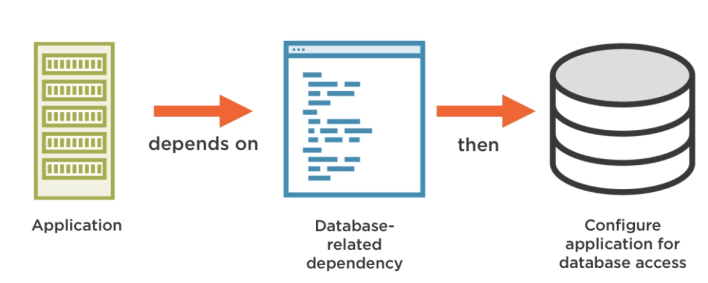
[Notable features:](https://www.tutorialspoint.com/spring_boot/spring_boot_introduction)

[Auto-configuration: It sets up your application based on the surrounding environment, as well as hints what the developers provide.](https://www.tutorialspoint.com/spring_boot/spring_boot_introduction)

[Standalone: Literally, it's completely standalone. Hence, you don’t need to deploy your application to a web server or any special environment. Your only task is to click on the button or give out the run command, and it will start.](https://www.tutorialspoint.com/spring_boot/spring_boot_introduction)

[Opinionated: This means that the framework chooses how to things for itself.](https://www.tutorialspoint.com/spring_boot/spring_boot_introduction)

[Let’s see an example according to a database. If we add a dependency to the pom.xml, which relates to a database, the framework assumes that we probably would like to use a database. Then, it auto-configures our application for database access. Furthermore, if the dependency appears for a very specific database, for example, Oracle or MySQL. It can make a more certain assumption and probably will configure that specific database access what we exactly need.](https://www.tutorialspoint.com/spring_boot/spring_boot_introduction)

[](https://www.tutorialspoint.com/spring_boot/spring_boot_introduction)

HTML

Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications .With Cascading Style Sheets (CSS) and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web (WWW). Web browsers receive HTML documents from a web server or from local storage and render them into multimedia web pages. HTML describes the structures of a web page semantically and originally included cues for the appearance of the document.

HTML elements are the building blocks of HTML pages .With HTML constructs, images and other objects, such as interactive forms, may be embedded into the rendered page .It provides a means to create structured documents by denoting structural semantics for text such as headings paragraphs, lists ,links ,quotes and other items.HTML elements are delineated by tags, written using angle brackets. Tags such as img / and input / introduce content into the page Directly. Others such as p.... /p surround and provide information about document text and may include others tags as sub-elements. Browsers don not display the HTML tags, but use them to interpret the content of the page.

Source: HTML (HTML, n. d.)

Thymleaf

Thymleaf is a Java XML/XHTML/HTML5 template engine that can work both in web and non-web environments. It is better suited for serving XHTML/HTML5 at the view layer of MVC-based web applications, but it can process any XML file even in offline environments. It provides full Spring Framework integration. Thymleaf develops free and premium Twitter Bootstrap themes and website templates for general business applications. The Leaf theme is a stylish and customizable WordPress theme. Make it ours with the easy customizable theme options. Uses Super fish menu effects, built-in pagination for post pages, special styles for eight different post formats, and a responsive layout for mobile devices.

SQL

SQL is a standard language for accessing and manipulating databases. SQL is a domain-specific language used in programming and designed for managing data held in a relational database management system, or for stream processing in a relational data stream management system.

* SQL stands for Structured Query Language
* SQL lets you access and manipulate databases
* SQL became a standard of the American National Standards Institute (ANSI) in 1986, and of the International Organization for Standardization (ISO) in 1987.

Hibernate

Hibernate is an open source object relational mapping ([ORM](https://searchwindevelopment.techtarget.com/definition/object-relational-mapping)) tool that provides a [framework](https://whatis.techtarget.com/definition/framework) to map [object-oriented](https://searchmicroservices.techtarget.com/definition/object-oriented-programming-OOP) domain models to relational databases for web applications.

Hibernate ORM is an object-relational mapping tool for the Java programming language. It provides a framework for mapping an object-oriented domain model to a relational database.

The Hibernate ORM framework guides mapping [Java](https://www.theserverside.com/definition/Java) [classes](https://whatis.techtarget.com/definition/class) to database tables and Java [data types](https://searchmicroservices.techtarget.com/definition/data-type) to SQL data types and provides querying and retrieval.

CSS

Cascading Style Sheets (CSS) is a stylesheet language used to describe the presentation of a document in HTML or XML dialects such as (SVG or XHTML).CSS describes how elements should be rendered on screen, on paper, in speech or on other media.CSS is one of the core of the open web and is standardized across browsers according to the W3C specification.

Source: CSS (CSS, n. d.)

Bootstrap

Bootstrap is a free and open-source front-end library for designing websites and web applications. It contains (HTML and CSS)-based design templates for typography, forms, buttons, navigation and other interface components, as well as optional JavaScript extensions. Unlike many web frameworks, it concerns itself with front-end development only.

Source: Bootstrap (front-end-framework) (Bootstrap (front-end-framework),n.d.)

System Development

This chapter consists of the brief description of how the system is developed under which environment, the Stages of the system development etc. These are all important topics with respect to system construction.

Why perform System Development?

System development is the process of defining, designing, testing and implementing a new system. It could include the internal development of customized systems, the creation of database systems or the acquisition of third party developed system.

Development Strategies

There are various development approaches, like-

. Structured approach,

. Object oriented approach etc.

Our project is analyzed and preformed the development process in the object oriented approach. Object oriented approach views a system as collections of interacting objects that work together to accomplish a task, this interactions are known as use cases. Object-oriented development uses a UML class diagram to show all the classes of objects that are in the system. It has two features that shows the usefulness of using the object-oriented approach, they are- naturalness and re-usability. Naturalness is that we usually think anything in the form of tangible objects. Re-usability is that this objects or classes can be used again and again.

System Environment

System environment is primarily the set of variables that define or control certain aspects of process execution. They are set or reset each time a shell is started. The system environment is the term commonly uses to refer to support an application. A system environment for a particular application could include:

\*Operating system: Windows 10.

\*Database system: SQLite.

\*Development Tools or Compiler: Bootstrap, CSS, HTML.

Stages of system development

System development has 5 Stages for the entire development of the system. They are:

1. Planning:

Planning is the requirements gathering phase. The requirements for our project has been gathered through questionnaires, brain storming etc.

2. Analysis:

Analysis of our project has followed the object-oriented analysis approach. Drawing different UML diagrams a visualization has been made.

3. Design:

Design of our project has followed also the object-oriented approach.

4. Implementation:

The implementation of the project has been done with Java and spring boot.

5. Maintenance:

Maintenance of the project is done through different perspectives. Maintenance like- corrective, adaptive, perfective.

Implementation of System

Implementation of the system has been done with MVT pattern, about which a description has been given in previous chapters. The framework is the essential supporting structures, in our project, it is spring boot. A simple glimpse of the use of the Spring boot is given in the following sections.

Spring boot framework

The Spring Framework is an application framework and inversion of control container for the Java platform. The framework's core features can be used by any Java application, but there are extensions for building web applications on top of the Java EE platform.

Spring Boot provides a good platform for Java developers to develop a stand-alone and production-grade spring application that we can just run. We can get started with minimum configurations without the need for an entire Spring configuration setup.

Goals of Spring Boot:

Spring Boot is designed with the following goals −

1. To avoid complex XML configuration in spring,

2. To develop a production ready spring applications in an easier way,

3. To reduce the development time and run the application independently,

4. Offer an easier way of getting started with the application.

How does it work?

Spring Boot automatically configures your application based on the dependencies you have added to the project by using @EnableAutoConfiguration annotation. For example, if MySQL database is on your classpath, but you have not configured any database connection, then Spring Boot auto-configures an in-memory database.

The entry point of the spring boot application is the class contains @SpringBootApplication annotation and the main method.

Spring Boot automatically scans all the components included in the project by using @ComponentScan annotation.

Spring Boot Starters

Handling dependency management is a difficult task for big projects. Spring Boot resolves this problem by providing a set of dependencies for developer’s convenience.

For example, if we want to use Spring and JPA for database access, it is sufficient if we include spring-boot-starter-data-jpa dependency in our project.

Note that all Spring Boot starters follow the same naming pattern spring-boot-starter- \*, where \* indicates that it is a type of the application.

Examples

Look at the following Spring Boot starters explained below for a better understanding –

Spring Boot Starter Actuator dependency is used to monitor and manage your application. Its code is shown below −

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-actuator</artifactId>

</dependency>

Spring Boot Starter Security dependency is used for Spring Security. Its code is shown below −

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-security</artifactId>

</dependency>

Spring Boot Starter web dependency is used to write a Rest Endpoints. Its code is shown below −

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-web</artifactId>

</dependency>

Spring Boot Starter Thyme Leaf dependency is used to create a web application. Its code is shown below −

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-thymeleaf</artifactId>

</dependency>

Spring Boot Starter Test dependency is used for writing Test cases. Its code is shown below −

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-test<artifactId>

</dependency>

Source: (https://www.tutorialspoint.com/spring\_boot/spring\_boot\_introduction)

Advantages of Spring Boot:

1. It is very easy to develop Spring Based applications with Java or Groovy.
2. It reduces a lot of development time and increases productivity.
3. It avoids writing of boilerplate Code, Annotations and XML Configuration.
4. It is very easy to integrate Spring Boot Application with its Spring Ecosystem like Spring JDBC, Spring ORM, Spring Data, Spring Security etc.
5. It follows “Opinionated Defaults Configuration” Approach to reduce Developer effort
6. It provides Embedded HTTP servers like Tomcat, Jetty etc. to develop and test our web applications very easily.
7. It provides CLI (Command Line Interface) tool to develop and test Spring Boot (Java or Groovy) Applications from command prompt very easily and quickly.
8. It provides lots of plugins to develop and test Spring Boot Applications and it uses Build Tools like Maven and Gradle.
9. It provides lots of plugins to work with embedded and in-memory Databases very easily.

Source of advantages: (http://www.pro-tekconsulting.com/blog/what-are-the-advantages using-spring-boot).

Functionalities of the system

The system has 3 actor.

* API Admin
* Developer
* Integrated web app’s user

Functions performed by API Admin are:

* Providing interface for system access.
* Develop dynamic form management.
* Add authentication system to the system.
* Create default ID card generation technique for specific field.
* Arrange record using QR code.
* Create QR based search system for records.

Functions performed by Developers are:

* Integrate library to required web application.
* Perform registration for form generation.
* Create custom form for information system.
* Can generate ID card if it’s permitted by API.
* Update form according to purpose.
* Perform CRUD operation into integrated system’s user data.

Functions performed by User are:

* Fill up form.
* Can update only his/her own record.

Testing and Maintenance of the System

This chapter encloses the after works of system construction. It gives a brief view of the testing of the system and the maintenance strategy. It is a very important State for the success of the system.

System Testing

System Testing is testing the components of the system and the overall testing of the system. It comprises of various types of testing. The figure below shows the testing strategy required for a system testing:

System Testing Activities

System Testing activities include:

1. Unit Testing : Performed on unit or simple components of code.

2. Integration Testing : Performed on a module, consisting of different units.

3. Validation Testing :

Performed to identify if the requirements are fulfilled or not.

4. System Testing : it is the overall testing to check if the system is working or not.

Necessity of System Testing :

It is necessary to assure the correct functioning of the system, so system testing is necessary. To ensure that the system is built with less complexity and if there is any fault or error that can be recovered in this stage. Testing is a vital to the success of the system. System testing makes a logical assumption that if all the parts of the system are correct, the goal will be successfully achieved. System testing is its utility as a user-oriented vehicle before implementation. The best Program is worthless if it does not meet user needs.

Maintenance

Maintaining the system is an important aspect. As key personal change positions in the Organization, new changes will be implemented. The need for maintenance is severe when it comes the need for future update according to the need of future situation.

Different Types of Maintenance

There are different types of maintenance for any system. They are :

1. Corrective Maintenance .

2. Adaptive Maintenance .

3. Perfective Maintenance.

Corrective Maintenance

It is correction of software faults and failures.In case of our project it will be :

\* Correcting the google form if any change found from the collection of updated information.

\*Make the Corrections if any case becomes wrong in different circumstances.

\*Control database redundancy as database manipulators are many.

Adaptive Maintenance

Adapting the current system to additional circumstances without changing the system is adaptive maintenance. In case of our project adaptive maintenance will be :

\* In case of redundant information, managing huge number of students, employees, staff and multiple sectors.

\*Reorganizing the google form, if unwanted changes come up.

Perfective Maintenance

Enhancement and improvement of the existing system with respect to locally limited issues. This will answer the further requirements of the users. This maintenance answers to the outside or environmental changes.

Necessity of Maintenance

Maintenance has a vital role in system construction and upgrading. The system requires regular update, which maintenance does. In case of any failure because of any faults cinducted by the users, maintenance is required. To handle a vast amount of users then the regular user amount maintenance is required.