Software Requirements Specification

for

Interactive simulation of various Data structures and Algorithms

Version 1.0 approved

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# Introduction

## Purpose

This document will propose all features and procedures to develop the Interactive Simulation of Data Structures and Algorithms. This Document presents detailed idea of the application. This document mentions interfaces and functionality of working application.

## Document Conventions

SRS: Software Requirements Specification

DNF: Disjunctive Normal Form

GUI: Graphical User Interface

CRUD: create, read, update and delete operations

DSA: Data Structure and Algorithms

OS: Operating System

RAM: Random Access Memory

ROM: Read Only Memory

API: Application programming interface.

## Intended Audience and Reading Suggestions

This Document is meant to be ready by the end-users, developer, project manager, marketing staff, testers and documentation writers.

## Product Scope

The aim behind the implementation of this project to make a clear understandability of various data structures and Algorithms. This will really help learners to understand the concepts really well. This web-application will simulate the data structure operations such as searching, sorting, insertion, deletion, etc., and algorithms like Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, etc.

## References

IEEE Std 830-1998(Revision of IEEE Std 830-1993)

This project will take the [given](https://www.cs.usfca.edu/~galles/visualization/Algorithms.html) project as a reference:

<https://www.cs.usfca.edu/~galles/visualization/Algorithms.html>

# Overall Description

## Product Perspective

This is a self-contained independent application. This application is made for educational purpose. This application will help students to understand the concepts of data structure and algorithm very well as can take advantage of visual representation of DSA.

## Product Functions

1. Simulation of Data Structure
2. Simulation of Algorithms
3. Interaction with Visualization

## User Classes and Characteristics

End users can visit and use the web-application and take all the advantages without any authentication.

## Operating Environment

**Software Requirements:**

* Operating System: Windows 8 or above, Linux, Max OS.
* Internet connectivity is required
* Latest version of browsers like Chrome, Firefox and Safari.

**Hardware Requirements:**

* 4 GB RAM
* 1 GB secondary memory
* Processor: Pentium

## Design and Implementation Constraints

* System will work on wireless network. This is a light application very less amount of RAM is consumed
* Technology used in development are:

Angular Framework

Express.js

Node.js

## Assumptions and Dependencies

* End-Users should have a general knowledge of basic computer and internet skills.
* Server should be working every time.
* Application must have user-friendly interface.

# External Interface Requirements

## User Interfaces

* Messages have green color for success and red color for failure.
* Speed slider is provided to increase or decrease animation speed.
* Previous step and next step button for simulation.
* Play and Pause button to toggle the simulation.
* Navigation bar at the top.
* Arrows to denote pointer.
* Bar-chart to represent array with varying values.

## Hardware Interfaces

Screen size should be at least medium (641px to 1007px) for better GUI experience.

# Functional Requirements

The entire project mainly consists of 3 modules, which are as follows:

1. Data Structure
2. Algorithm
3. Simulation

## Manage Data Structure

This module will manage properties of each data structure and manage different operation of each data structure. Available data structure will be Array, Linked List, Stack, Queue, Graph, Tree.

### Selection of Data Structure.

Description: Users can choose a Data structure from the provided options.

Input: Option to choose Data Structure.

Output: Acknowledgement message.

### Select Implementation category.

Description: Some data structures can be implemented in different manner. For example, Stack can be implemented using array and Linked list both.

Input: implementation category

Output: implementation of data structure using that basic element.

Next: user will be asked to add data to current node.

### Add element to data structure

Description: Users can add element of any data value and insert it to data structure.

Input: Data, Option to add.

Output: Simulation of addition of element.

Process: The element would be added to the data structure according to the properties of that specific data structure and simulation would be done for the same.

Next: User is allowed to perform other operations on data structure.

### Remove element from data structure

Description: Users can remove element from any data structure according to property of that specific data structure. Example: Pop operation on stack.

Input: Option to remove.

Output: Simulation of removal of element.

Process: The element would be removed from data structure according to the properties of that specific data structure.

Next: User is allowed to perform other operations on data structure.

## Manage Algorithms

This module will manage the methods of each Algorithm. Available algorithms will be sorting algorithms like bubble sort, insertion sort, quick sort and merge sort. All the sorting algorithms will be performed on array.

### Selection of Algorithm

Description: Users can choose a sorting algorithm from the provided options.

Input: Option to choose algorithm.

Output: Acknowledgement message.

### Add element.

Description: Users can add numerical values to array.

Input: Space separated numerical values, user selection on add button.

Output: Array with given numerical values will be added and displayed as bar chart.

Process: New array with given values will be created and representation of same array using bar-char would be done.

Next: User is allowed to sort the array and observe the simulation.

### Remove element from data structure

Description: Users can remove the specific element from the array.

Input: option to remove.

Output: Updated array would be represented in form of bar chart.

Process: The element would be removed from array and representation of same array using bar-char would be done.

### Executing Algorithm

Description: After users maintains the desired values in the array. He can choose to sort the array.

Input: Option to sort.

Output: Visual Representation of Sorting algorithm would be done.

## Manage Simulation

Users are provided with various options to simulate like play, pause, previous step, next step and speed of simulation.

### Speed of Simulation

Input: Adjusting speed slider.

Output: Acknowledgement message.

Process: The speed of simulation is updated.

### Play and Pause

Description: User can toggle between playing and pausing the simulation.

Input: Option to toggle between play and pause.

Output: Acknowledgement message.

### Next step and Previous step

Description: User can use this functionality to perform step by step execution of algorithm. Previous step may not be available for some algorithms.

Input: Option to select next step and previous step.

Output: Next step or Previous step is executed.

# Non-functional Requirements

## Availability

System shall be available all the time.

## Portability

As software just needs a browser and is available to almost any type of desktop operating system user can access it from any device anytime.

## Performance Requirements

The software gives high performance as it is light weight and proper designing techniques are used.

## Low Cost

This is a light weight application. This application does not need a database as it does not deal with any user data.

# Future Extensions

User Registration/login functionality using [OAuth](https://oauth.net/2/) API. Text Editor to be added for user to note down concepts and save them for future. User can save current state of the application.