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**PROJECT REPORT**

on

**“SORTING VISUALIZER USING JAVASCRIPT”**

PRESENTED BY

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UNDER THE GUIDANCE OF  
**Dr. Balshetwar S. V.**



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**YASHODA TECHNICAL CAMPUS, WADHE, SATARA**



## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

### Certificate

**This is to certify that the project entitled “SORTING VISUALIZER USING JAVASCRIPT” is prepared and submitted by**

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**Students of B.Tech (COMPUTER SCIENCE AND ENGINEERING), in partial fulfillment of the requirements for the award of Bachelor of Technology in Computer Science and Engineering as prescribed by the Dr. Babasaheb Ambedkar Technological University, Lonere at Yashoda Technical Campus during academic year 2022-2023.**

#### PROJECT GUIDE

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#### HOD

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## DECLARATION

We hereby declare that the project work entitled “SORTING VISUALIZER USING JAVASCRIPT” submitted to the Yashoda Technical Campus’s College of Engineering, Satara is a record of an original work done by us under the guidance of our project guide **Dr. Balshetwar S. V.** and this project work is submitted in the partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science & Engineering. This project report has not been copied, duplicated or plagiarized from any other paper, journal, document or book and has not been submitted to any educational institute or otherwise for the award of any certificate, diploma, degree or recognition.

## ACKNOWLEDGEMENT

We take this opportunity to express our deep sense of gratitude to our guide, **Dr. Balshetwar S. V.** for her continuous guidance and encouragement during this study. Without her valuable suggestion and encouragement this would not have been possible. It is because of her experience and wonderful knowledge we can fulfill the partial requirement of completing the Field Training report within the stipulated time.

We express our deep gratitude to **Dr. Balshetwar S. V.** Head of Computer Engineering Department, for his valuable guidance and constant encouragement. We are very much thankful to **Dr. Badadapure P. R.** Principal, YSPM's Yashoda Technical Campus, Faculty of Engineering, Satara. We find our self- spellbound to acknowledge thanks to our father and mother for their silent support, patience, encouragement and affection without which this work would never have been possible and we thank all my colleagues for their valuable co- operation and coordinate which was available time to time.

**PAPER PUBLICATIONS**

<b>Sr. No</b>	<b>Title Of Paper</b>	<b>Publication Details</b>
1.	Sorting Techniques Visualizer	Bharati Vidyapeeth's College Of Engineering, Kolhapur and International Association of Research and Developed Organization (March 2023)

## **ABSTRACT**

The purpose behind this project is to study how to perform different operations of sorting algorithm on data structure so student can easily learn various types of algorithm through an graphical view it will make a data structure learning more interesting. Data Structure design and analysis of the algorithm is big challenge for both computer and Science Students. Implementation of this project to make clear understanding of various algorithm of data structure such as an bubble sort Insertion sort selection Sort and so on .The various tools is used for the study are case analysis of sorting algorithm such as best case average case.

<b>INDEX</b>		
<b>Chapter No</b>	<b>Description</b>	<b>Page No.</b>
	<b>CERTIFICATE</b>	I
	<b>DECLARATION</b>	Ii
	<b>ACKNOWLEDGEMENT</b>	Iii
	<b>PAPER PUBLICATIONS</b>	Iv
	<b>ABSTRACT</b>	V
	<b>INDEX</b>	Vi
	<b>LIST OF TABLES</b>	Vii
	<b>LIST OF FIGURES</b>	Viii
<b>1</b>	<b>INTRODUCTION</b>	1
1.1	Motivation	1
1.2	Project Overview	1
1.3	Need of project	1
1.4	Literature survey (at least 5)	2
<b>2</b>	<b>PROBLEM DEFINITION &amp; SCOPE</b>	4
2.1	Problem statement	4
2.2	Scope	4
2.3	Area of project	4
2.4	Goals & objectives	4
<b>3</b>	<b>SOFTWARE REQUIREMENT SPECIFICATION</b>	5
3.1	Software requirement	5
3.2	Hardware requirement	5
<b>4</b>	<b>PROJECT PLAN</b>	6
4.1	Project schedule	6
4.2	Project cost estimation	6

4.3	SDLC	7
4.4	Feasibility Study	8
<b>5</b>	<b>SOFTWARE DESIGN</b>	9
5.2	Flow chart	10
5.4	Use Case Diagram	11
5.5	Activity Diagram	12
5.6	System Architecture	13
<b>6</b>	<b>IMPLEMENTATION DETAILS</b>	14
6.1	Modules and Their Functionalities	14
<b>7</b>	<b>SYSTEM TESTING</b>	16
7.1	Interface Testing	16
7.2	Performance Testing	16
7.3	Compatibility Testing	19
<b>8</b>	<b>SNAPSHOTS / GUI</b>	20
<b>9</b>	<b>CONCLUSION</b>	27
<b>10</b>	<b>BIBLIOGRAPHY</b>	28
<b>11</b>	<b>PUBLICATIONS OF PAPER</b>	29



**LIST OF TABLES**

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
1.4	Literature Survey	2
4.1	Project Plan	6
4.2	Project Cost Estimate	7

## LIST OF FIGURES

Figure No.	Title	Page No.
4.1	Project Schedule	6
5.1	Data Flow Diagram 5.1.1 : DFD Level 0 5.1.2 : DFD Level 1	9
5.2	Flow Chart	10
5.3	Use-Case Diagram	11
5.4	Activity Diagram	12
5.5	System Architecture	13
8.1	Home Page	20
8.2	Bubble Sort 8.2.1 Bubble Sort 8.2.2 Enter Elements Of Array 8.2.3 Generated Bar 8.2.4 Comparison Between Elements 8.2.5 Swapping Between Elements 8.2.6 Previous Sort 8.2.7 Successfully Sorted	21
8.3	Insertion Sort	24
8.4	Selection Sort	25
8.5	Quick Sort	25
8.6	Merge Sort	26

# **CHAPTER 1**

## **INTRODUCTION**

# 1. INTRODUCTION

## 1.1 Motivation:-

The motivation behind this project is to study how the operations on data structure are performed. So that students can learn various algorithms through animation. To get a clear knowledge about various data structures and their operations on it. It will makes data structures learning more interesting. The main goal of this project is to implement a system for various sorting algorithm. User run sorting algorithm by giving custom array. During the demonstration run, the application visualizes pseudo code and current information about some comparison of elements, swapping of elements, previous sorting elements and completion of sorting elements..

## 1.2 Project Overview:-

This project is a study that tested the benefits of animated sorting algorithms for teaching. To visualize sorting algorithms, a web-based animation application was constructed. Aim behind implementation of this project to make a clear understanding ability of various algorithms of data Structure.

Using a web page this will simulates the Sorting algorithm of data structure such as Bubble Sort, selection sort, insertion sort. And so on. Thus our web page provides effective and efficient knowledge of data structures.

It is web-based application for visualize different sorting algorithm with their functionality of:

- Custom – To enter size of array and element of array.
- Random – To generate bar of random element of array.
- Size - To enter size of array in range up to 5-300.
- Speed – To select speed of algorithm such as 1x, 2x, 4x, 8x, 16x, 32x.
- Run Algorithm – Execution of sorting algorithm will start.
- Reset - It can be used to generate default bars.

This also provides some theoretical knowledge regarding the data structure.

## 1.3 Need Of Project:-

As we know Data structure and algorithms (DSA) are one of the important topic in technology field and along with that one more crystal truth is that each and every student goes through each concept of DSA but student get confused and DSA getting hard to understand for students because of everyone do programming but didn't know how it will be working so In this project. We will take one concepts that is sorting algorithm and off course we implement it and by using animations and visualization it will be helpful for students to understand that how actually sorting methods like bubble sort, selection sort, insertion sort, merge sort and so on works.

### 1.4 Literature Survey:

Sr. No.	Paper	Year	Author	Review
1.	Sorting Algorithm visualizer	2022	Thakkar, Kavita, S. Dash and S. K. Joshi	It is E-learning platform which helps to improve theoretical concept regarding Data structure and algorithm. Data can be represented by Bar graph, and then sorting algorithm may be apply on that. In Sorting Visualizer, take input data from user and show that data as bar graph. Then choose animation tool and after that algorithm can be apply on it.
2.	Algorithm Visualizer: Its features and working	2021	Goswami, A. Dhar, A. Gupta and A. Gupta	Some learners can't understand theory with clarity. From this work student can visualize several algorithms and learn new concepts. This visualizer is easy to operate and implement. It contain stepwise representation of visualization of algorithm which makes it easy to understand.
3.	Comparative of Advanced Sorting Algorithms Based on Time and Memory Usage	2021	Marcellino Marcellino, Davin William Pratama Kristien Margi	In this paper, it compare different type of advance sorting algorithm such as Quick sort, Heap sort, Merge sort, introspective sort. A algorithm compare on the bases of time and memory require to perform data sorting. Application write using VS code and satisfy using python language. In this it show introspective sort good at time and heap sort is good for memory.
4.	Creating Engaging Online Learning Material with the JSAV JavaScript Algorithm Visualization Library	2016	V. Karavirta and C. A. Shaffer	DSA is complicated to learn for most of the students. Learners can improve their DSA topics with JavaScript Algorithm Visualization. In this contain JavaScript Algorithm Visualization library. This library helps to visualize data structures algorithms. Learners can see previous step of visualization with actual current step.
5.	Interactive visualization of high dimensional marketing data	2015	Alfa Yohannis Yulius Prabowo	Interactive visualization, it is used to associate all types of variable and also describe visualization of huge amount of data for financial organization. We use matrix visualization as a selection tool, its simple for find the data. The client select data of selected variable and start a analysis by using 5 variable. Using this we give good customer behavior knowledge.

6.	Sort Attack: Visualization and Gamification of Sorting Algorithm Learning	2015	Alfa Yohannis, Yulius Prabowo	Sorting algorithm is perform fundamental role in the field of computer science, which are not understandable to everyone to defeat this problem it has been moving toward the game visualization. The combining algorithm gaming tool and instructional or graphical design is an minor task, so it require attentive design, because of that it developed conceptual model for learning instruction and improve visualization learning.
7.	Sorting visualization using ViSA (visualization of sorting algorithm)	2012	Tihomir Orehovački	In this paper, ViSA (Visualization of sorting algorithm) it describe a tool and different type of technique for visualization of algorithm. The ViSA is simple and self operating visualization system, it explain and compare step by step every sorting algorithm which is more useful to every educational student for analyze the sorting algorithm also for faculty member for teaching.
8.	Visualizing Sequence of Algorithms for Searching and Sorting	2009	Bremananth R., Radhika V. Thenmozhi S.	Visualizing sequence of algorithm for searching and sorting in this paper. It help to understand how perform the sorting method in easy way. The main pros of algorithm visualization is acquire the knowledge through performing with set of data, technique of manage time and use of memory. It shows nine type of sorting algorithm form this one of animataion system is BALSAB(Brown Algorithm and animator).
9.	DAVE: A Dynamic Algorithm Visualization Environment for Novice Learners	2008	E. Vrachnos And A. Jimoyiannis	Sorting algorithm represent sorted array through animation. This tool shows sorted data and unsorted data with different color. It helps student to see how sorting function actually work to sort data at backend
10.	A system for algorithms' animation	1999	D. Merlini, S. Petrucci, R. Sprugnoli and M. C. Verri	Data structure related complicated concept are diificult to understand for student. So, visualization technique helps teacher to teach them veryeasily Sorting algorithm show user input data through animation. This tool shows sorted data and unsorted data with different color. It helps student to understand, how data can be sorted dynamically.

#### 1.4: Literature Review

# **CHAPTER 2**

## **PROBLEM DEFINATION AND SCOPE**

## **2.PROBLEM DEFINATION AND SCOPE**

### **2.1 Problem Statement:-**

Aim behind implementation of this project to make a clear understand ability of various algorithms of data structures. Using a web page this will simulates the Sorting algorithm of data structure such as sorting such as bubble sort, selection sort, radix sort. Thus our web page provides effective and efficient knowledge of data structures.

It is web based application for visualize different sorting algorithm with their functionality of speed control, Array size control. This also provide some theoretical knowledge regarding the data structure.

### **2.2 Scope:-**

The main goal of this project is to create teaching support software with visualization of the most known sorting algorithms and their variations. The application supports a graphic visualization of selected algorithms on randomly generated or manually created array, step-by-step execution possibility, pseudo code.

### **2.3 Area Of Project: -**

#### **Web based application**

A web application is application software that is accessed using a web browser. Web applications are delivered on the World Wide Web to users with an active network connection.

A Web application (Web app) is an application program that is stored on a remote server and delivered over the Internet through a browser interface.

### **2.4 Goals and Objectives: -**

The main objective of this project is to help beginners to be able to visualize the basic algorithms and get a better understanding of the underlying operations.

- Creative making the visualizations even better and attractive.
- This project is for educational purpose.



# **CHAPTER 3**

# **SOFTWARE REQUIREMENT SPECIFICATION**

## **3.SOFTWARE REQUIREMENT SPECIFICATION**

### **3.1 Hardware Requirements**

Processor: core i3

Hard disk: 5 GB

Memory: 1 GBRAM

### **3.2Software Requirements**

Browser: Chrome, Mozilla Firefox

IDE: Visual Studio Code

Frontend: HTML, CSS

# **CHAPTER 4**

# **PROJECT PLAN**

## 4. PROJECT PLAN

### 4.1 Project Schedule (Aug 2022 to May 2023)

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Discussion With Guide											
Planning											
Research											
Synopsis											
Discussion With Guide											
Implementation											
Testing											
Submission											

Fig 4.1 Project Schedule

### 4.2 Project Cost Estimation

Sr. No	Project Stage	Formulae used	Effort in Days
1	Planning	20 percent of Project Life Cycle effort	20 Days
2	Requirement Gathering Requirement Analysis Design	80 percent of Project Life Cycle effort	90 days
3	Development Or Coding Effort	25percent of Project Life Cycle effort	30 days
4	Testing	20 percent of Project Life Cycle effort	23 days
5	Project Management Effort	25 percent of Project Life Cycle effort	29
6	User Testing	20 percent of Project Life Cycle effort	23
Total No of days Effort Required			215days

Fig4.2: Project Cost Estimation

Sr. No.	Title	Calculation
1	Number of Hours Per Day	3 Hours
2	Totals Hours Required	Hours * Days 3 * 215 645 Hours
3	Cost per hour	81Rs
4	Total cost	645*81 52,245Rs

### 4.3 SDLC:

Software Development Life Cycle (SDLC) is a process used by the software industry to design, develop and test high quality software. The SDLC aims to produce high-quality software that meets or exceeds customer expectations, reaches completion within times and cost estimates.

- SDLC is the acronym of Software Development Life Cycle.
- It is also called as Software Development Process.
- SDLC is a framework defining tasks performed at each step in the software development process.
- ISO/IEC 12207 is an international standard for software life-cycle processes. It aims to be the standard that defines all the tasks required for developing and maintaining software.

#### SDLC: Agile Model

Agile SDLC model is a combination of iterative and incremental process models with focus on process adaptability and customer satisfaction by rapid delivery of working software product. Agile Methods break the product into small incremental builds. These builds are provided in iterations. Each iteration typically lasts from about one to three weeks. Every iteration involves cross functional teams working simultaneously on various areas like –

- Planning
- Requirements Analysis
- Design
- Coding
- Unit Testing and Acceptance Testing.

At the end of the iteration, a working product is displayed to the customer and important stakeholders.

#### **4.4: Feasibility Study:**

A feasibility study evaluates a project's or system's practicality. As part of a feasibility study, the objective and rational analysis of a potential business or venture is conducted to determine its strengths and weaknesses, potential opportunities and threats, resources required to carry out, and ultimate success prospects. Two criteria should be considered when judging feasibility: the required cost and expected value.

A feasibility study is a comprehensive evaluation of a proposed project that evaluates all factors critical to its success in order to assess its likelihood of success.

- **Operational Feasibility**

We have searched 5 to 10 research papers then we got 50% to 60% idea for project. Now we have added some other functionality and it is working successfully.

- **Scheduling Feasibility**

We had scheduled time for project up to Aug 2022 - May 2023 and our project successfully done on decided time. Now project is ready and it is feasible to launch.

# **CHAPTER 5**

# **SOFTWARE DESIGN**

## 5.SOFTWARE DESIGN

### 5.1 Data Flow Diagram:

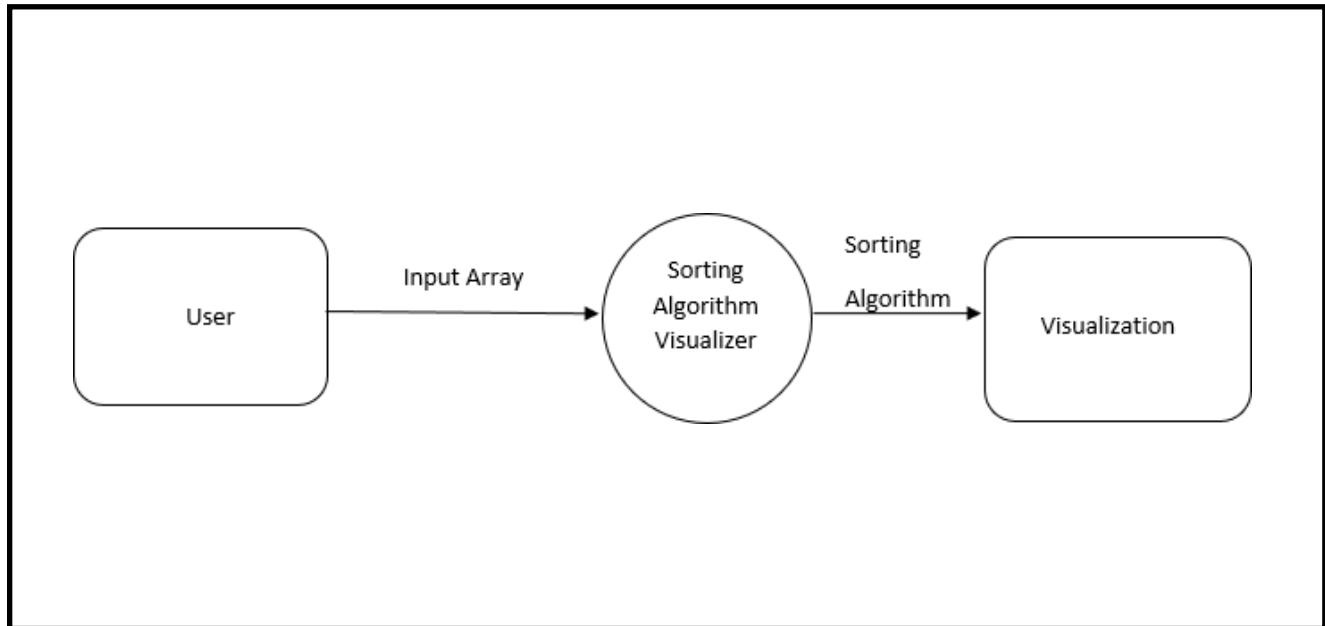


Fig 5.1.1: DFD Level 0

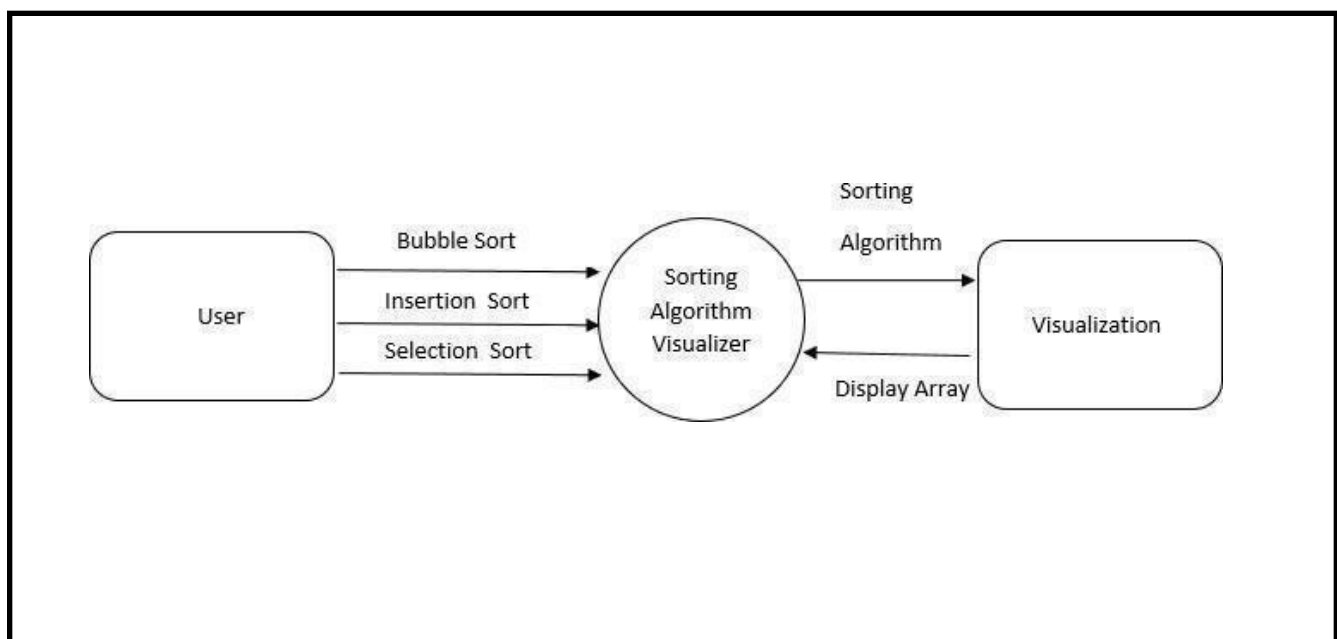


Fig 5.1.2: DFD Level 1



## 5.2 : Flow Chart:

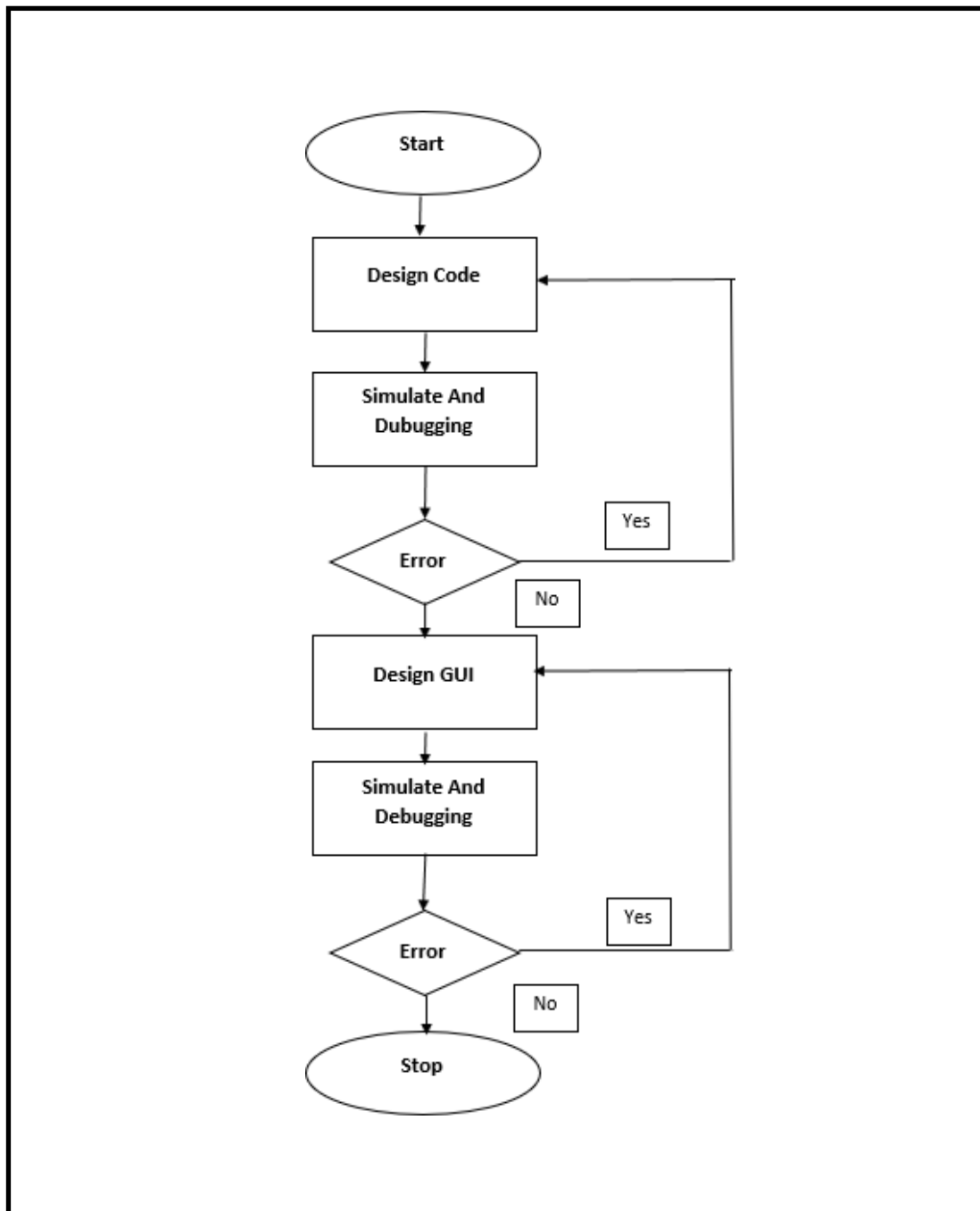


Fig 5.2: Flow Chart

### 5.3: Use Case Diagram:

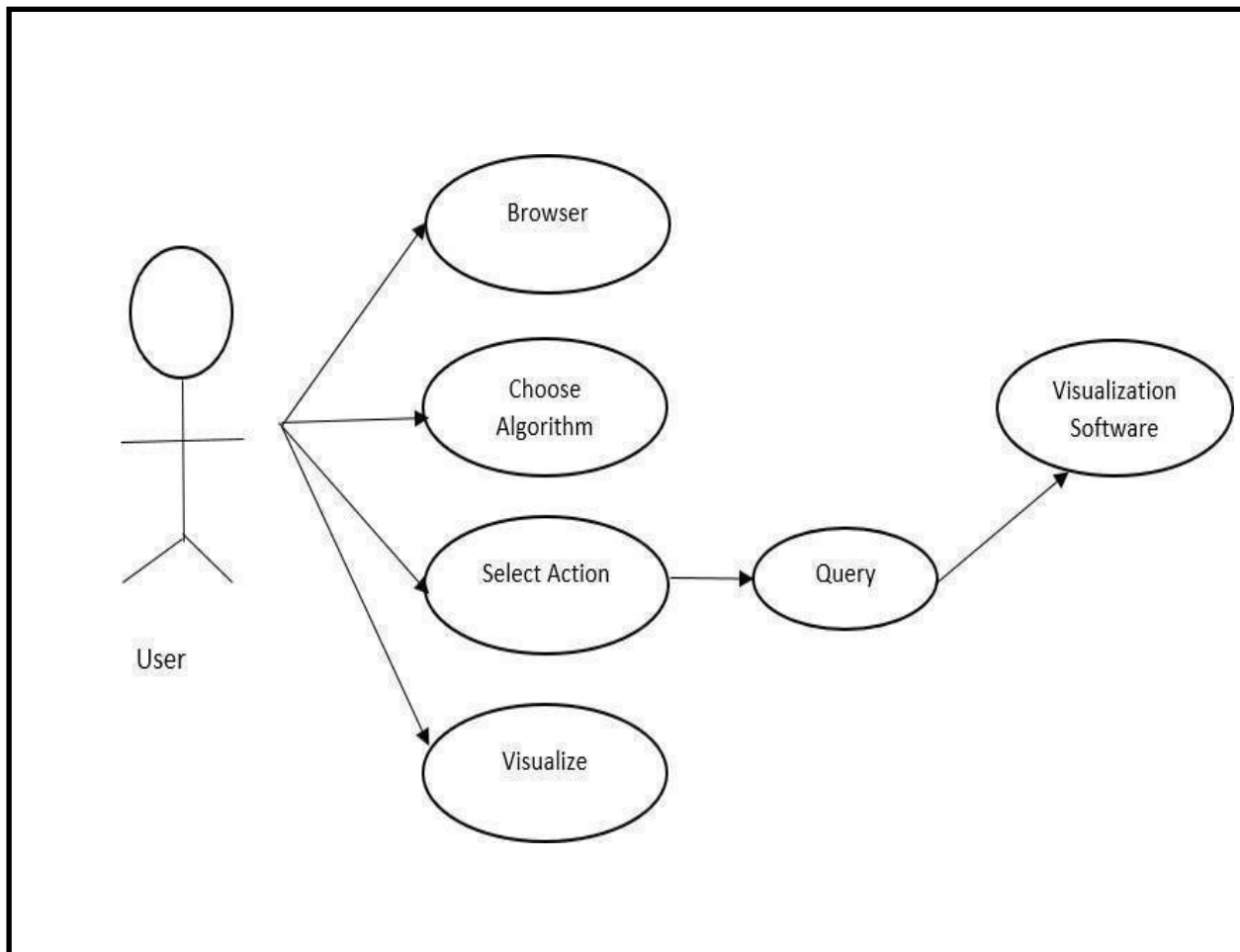


Fig 5.3: Use Case Diagram

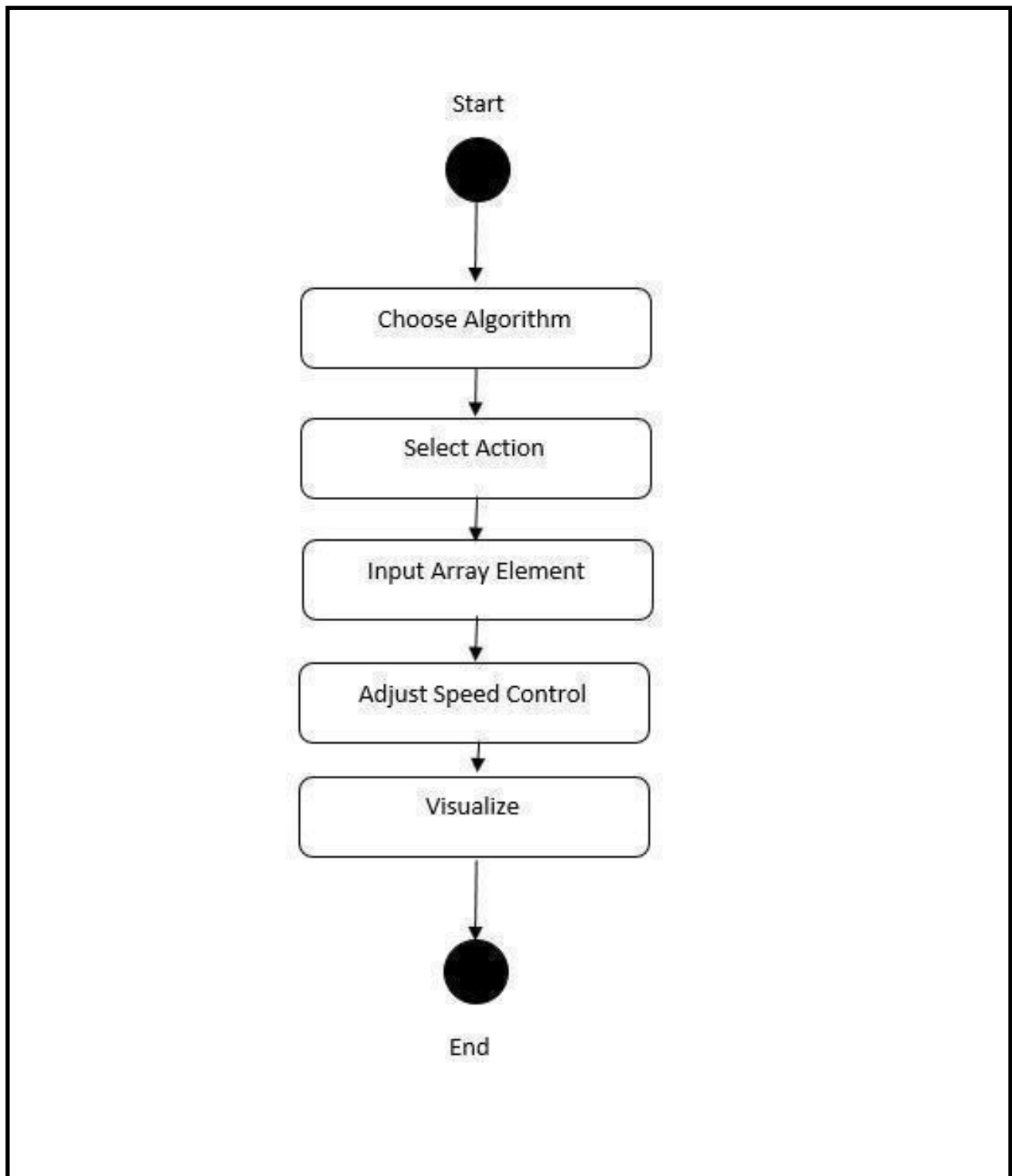
**5.4: Activity Diagram:**

Fig 5.4: Activity Diagram

## 5.5: System Architecture

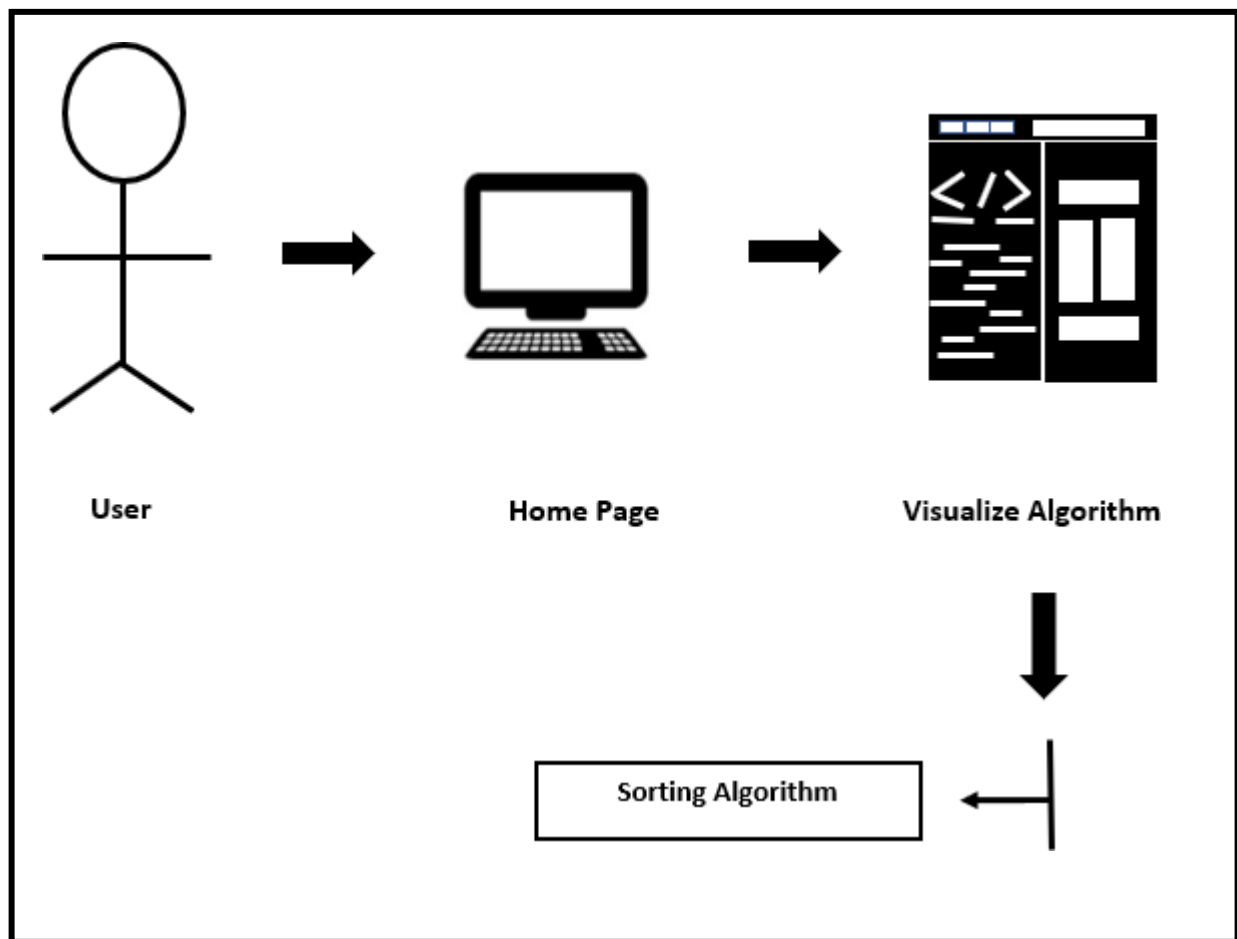


Fig 5.5: System Architecture

# **CHAPTER 6**

# **IMPLEMENTATION DETAILS**

## 6. IMPLEMENTATION DETAILS

### 6.1 Modules and their functions:

#### ❖ Home Page:

User can see various sorting algorithm and its abstract information.

#### ❖ Bubble Sort Page:

- Custom - To enter size of array and element of array.
- Random - To generate bar of random element of array.
- Size - To enter size of array in range up to 5-300.
- Speed - To select speed of algorithm such as 1x, 2x, 4x, 8x, 16x, 32x.
- Run Algorithm - Execution of bubble sort algorithm will start.
- Reset - It can be used to generate default bars.

#### ❖ Insertion Sort Page:

- Custom - To enter size of array and element of array
- Random - To generate bar of random element of array
- Size - To enter size of array in range up to 5-300
- Speed - To select speed of algorithm such as 1x, 2x, 4x, 8x, 16x, 32x.
- Run Algorithm - Execution of insertion sort algorithm will start
- Reset - It can be used to generate default bars.

#### ❖ Selection Sort Page:

- Custom - To enter size of array and element of array.
- Random - To generate bar of random element of array.
- Size - To enter size of array in range up to 5-300.
- Speed - To select speed of algorithm such as 1x, 2x, 4x, 8x, 16x, 32x.
- Run Algorithm - Execution of selection sort algorithm will start.
- Reset - It can be used to generate default bars.

#### ❖ Quick Sort Page:

- Custom - To enter size of array and element of array.
- Random - To generate bar of random element of array.
- Size - To enter size of array in range up to 5-300.
- Speed - To select speed of algorithm such as 1x, 2x, 4x, 8x, 16x, 32x.
- Run Algorithm - Execution of quick sort algorithm will start.
- Reset - It can be used to generate default bars.

**❖ Merge Sort Page:**

- Custom - To enter size of array and element of array.
- Random - To generate bar of random element of array.
- Size - To enter size of array in range up to 5-300.
- Speed - To select speed of algorithm such as 1x, 2x, 4x, 8x, 16x, 32x.
- Run Algorithm - Execution of merge sort algorithm will start.
- Reset - It can be used to generate default bars.

**Designing:**

For proper visualization we have used different colors to differentiate between the sorted bars and unsorted bars and even for bars which are currently in the process of comparison and sorting. After sorting the colors of bars will change to same color which will be different from initial colors of array and array elements will be arrange in ascending order.

# **CHAPTER 7**

# **SYSTEM TESTING**



## 7. SYSTEM TESTING

### What is Web Testing?

Web Testing or website testing is checking your web application or website for potential bugs before it's made live and is accessible to general public. Web Testing checks for functionality, usability, security, compatibility, performance of the web application or website.

#### a. User Interface Testing:

These areas to be tested here are –Web Application

Test Case No.	Test Cases	Solution
1	How much user can enter size of array?	Only enter size of array in range (5-300).
2	How much user can enter element of array?	Only enter element within range (5-550).
3	Does Text field allow comma?	No, It allows only space between elements.
4	Does Text Field accept alphabet & special symbol?	It allows only Integer value

#### b. Performance Testing:

Basically this prototype design for 5 element. Now performance testing done for 150 element and successfully executed.

#### 7.1.1 Generate bar of 5 element of array:

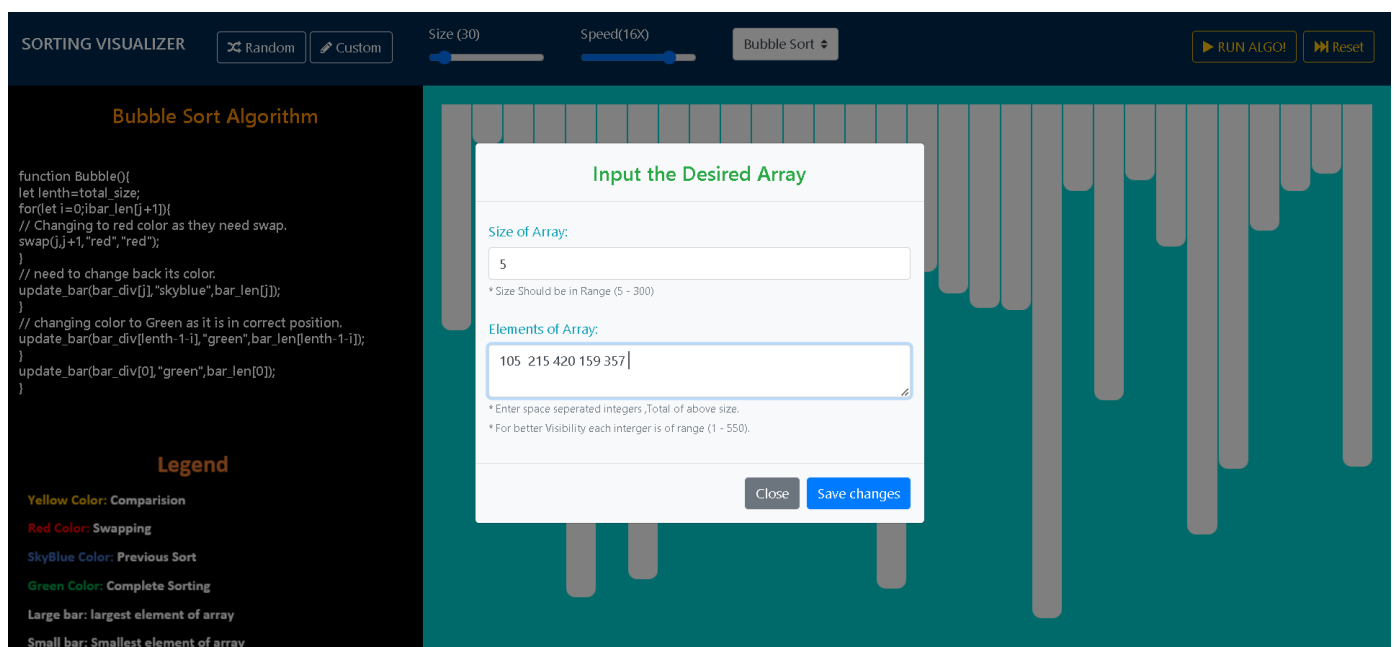


Fig 7.1.1 Enter 5 element of array

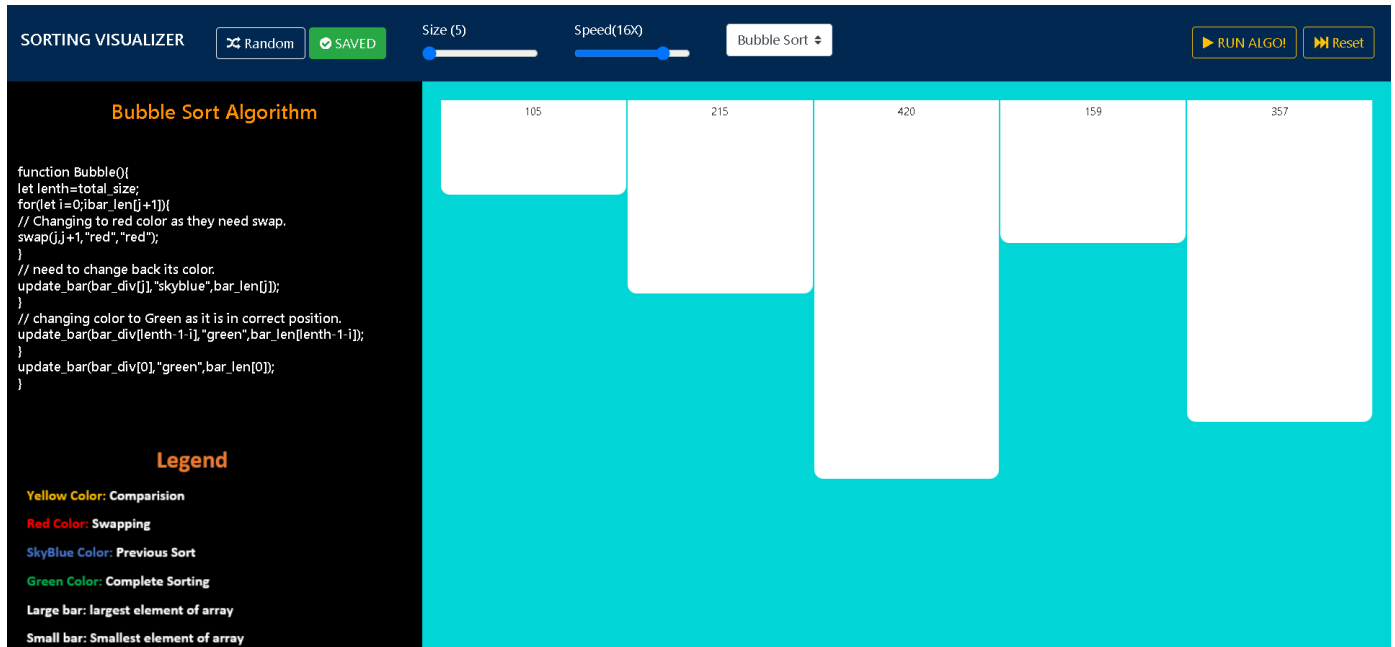


Fig 7.1.2 Generated bar for 5 element of array

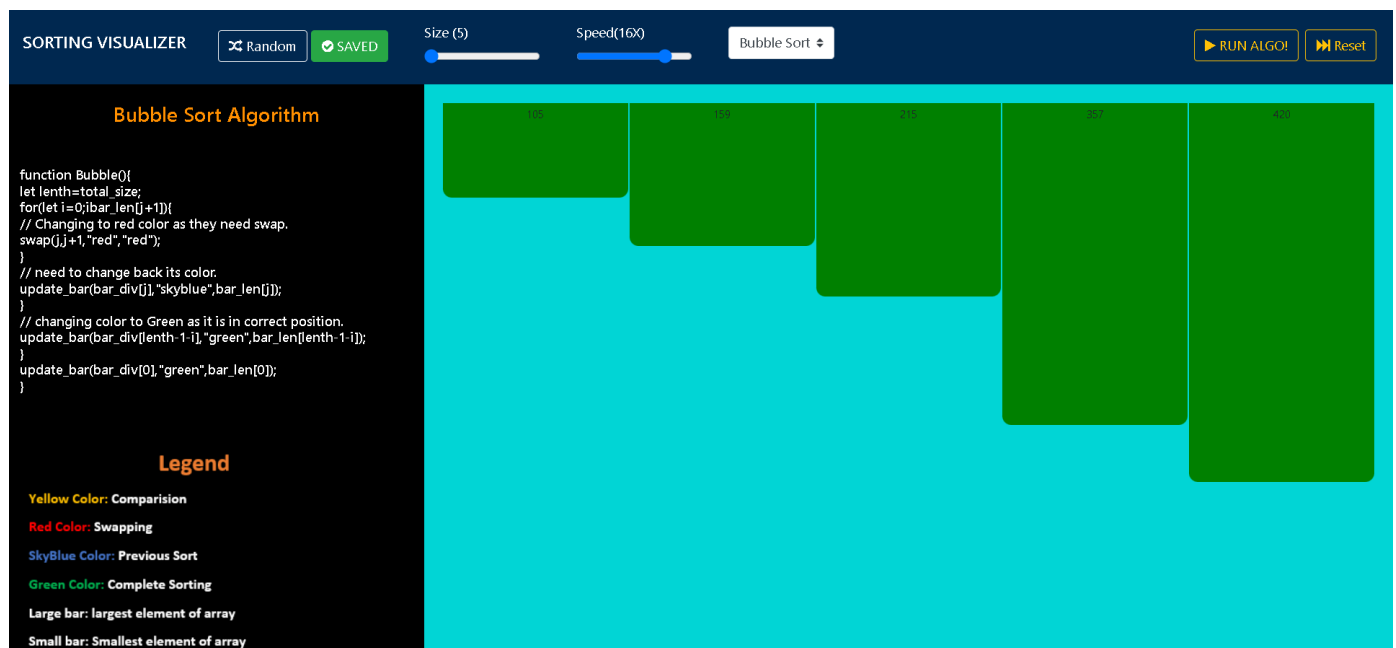


Fig 7.1.3 Successfully Sorted array of 5 elements

## 7.1.2 Generate bar of 150 element of array:

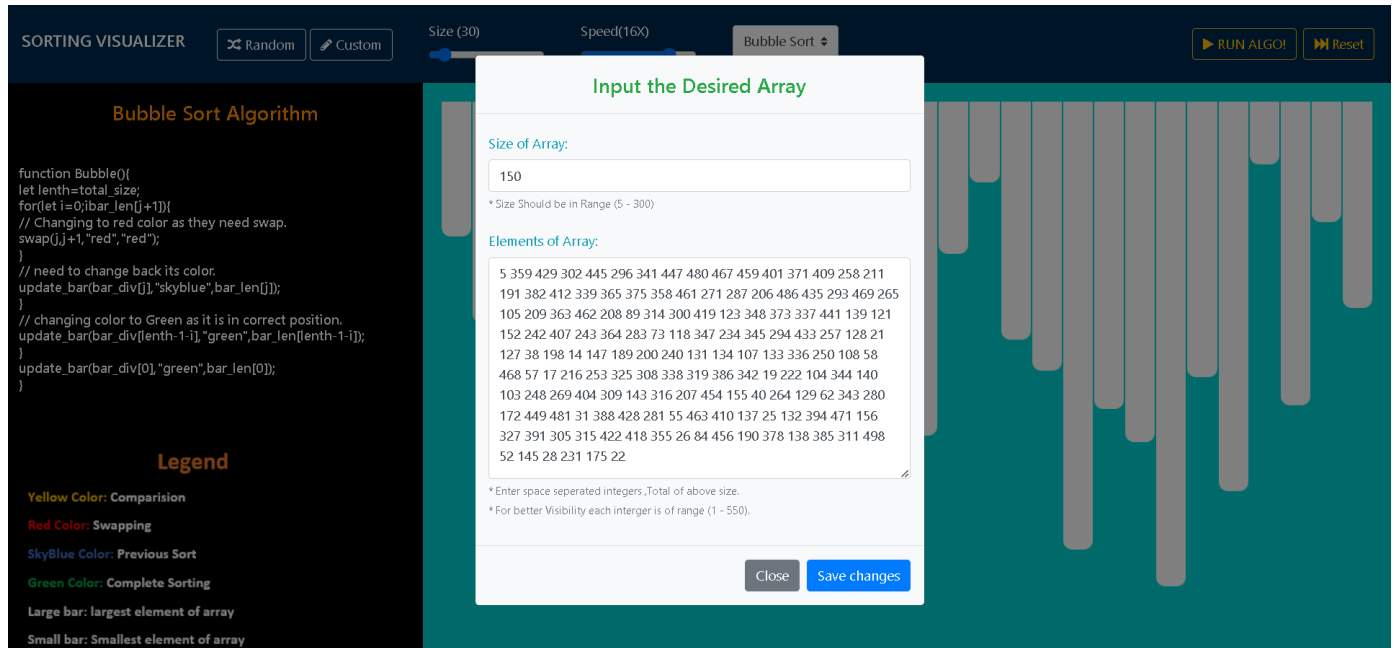


Fig 7.1.4 Enter 150 element of array

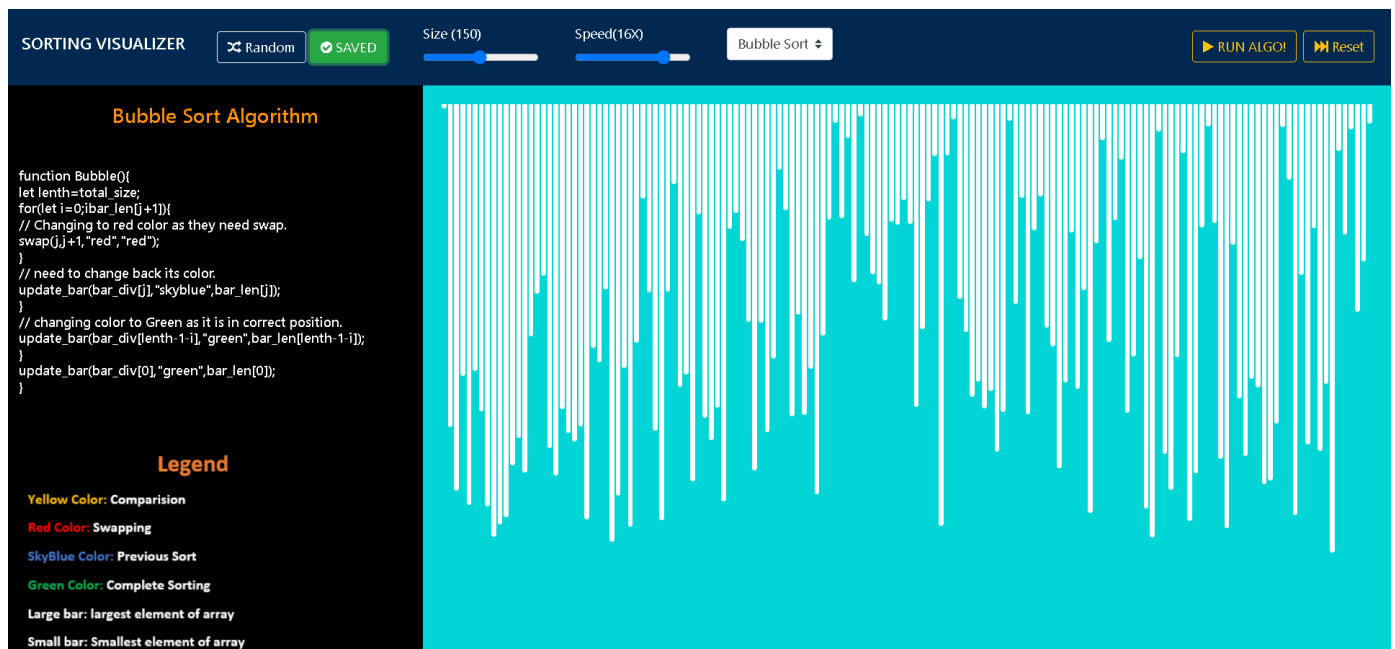


Fig 7.1.5 Generated bar for 150 element of array

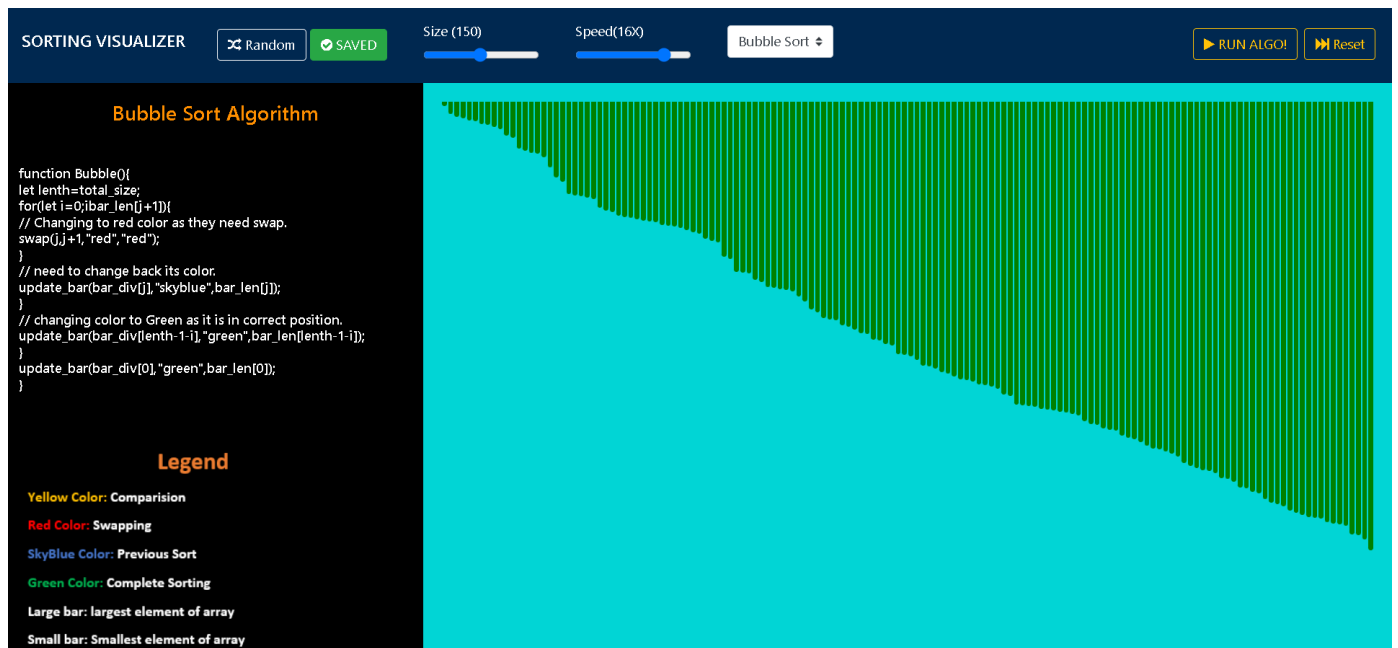


Fig 7.1.6 Successfully Sorted array of 150 elements

### c. Compatibility testing:


Project is ready and it is feasible to launch. This project support windows as well as android operating system.

# **CHAPTER 8**

## **SNAPSHOTS / GUI**

## 8. SNAPSHOTS / GUI

### 8.1 Home Page:




YSPM's Yashoda Technical  
Campus, Satara.  
Final Year Project [ CSE ]  
Guided By: Dr. Balshetwar S. V.

Visualize the sorting algorithms and performs the operation

SORTING VISUALIZER

Developed By:  
 Aishwarya Kumbhar  
 Rutuja Mane  
 Aarti Palande  
 Muskan Shaikh


#### Bubble Sort



Bubble sort is a data sorting algorithm that works by randomly copying elements from the first array into a smaller second array, and then reversing the order of these arrays. After this process has been repeated multiple times, the sorted data will be located in the middle of the larger array.

Bubble Sort


#### Insertion Sort



An insertion sort compares values in turn, starting with the second value in the list. If this value is greater than the value to the left of it, no changes are made. Otherwise this value is repeatedly moved left until it meets a value that is less than it.

Insertion Sort


#### Selection Sort



Selection sort finds the smallest element in the array and place it on the first place on the list, then it finds the second smallest element in the array and place it on the second place. This process continues until all the elements are moved to their correct ordering.

Selection Sort


#### Quick Sort



Quicksort is a divide-and-conquer algorithm. It works by selecting a 'pivot' element from the array and partitioning the other elements into two sub-arrays, according to whether they are less than or greater than the pivot.

Quick Sort

#### Merge Sort



Merge sort follows divide and conquer approach in which, the list is first divided into the sets of equal elements and then each half of the list is sorted by using merge sort. The sorted list is combined again to form an elementary sorted array.

Merge Sort

Fig 8.1. Home Page

## 8.2.1 Bubble Sort:

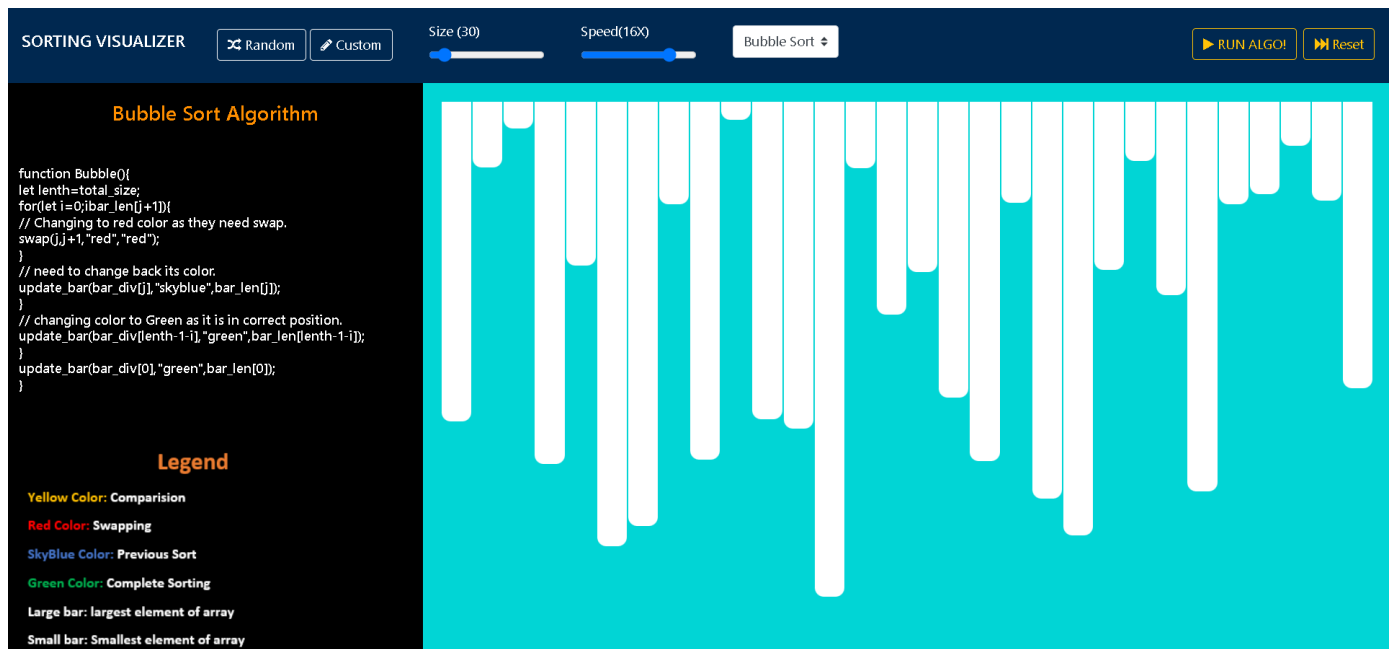


Fig 8.2.1 Bubble Sort

## 8.2.2 Enter Elements of Array:

**Input the Desired Array**

Size of Array:  
  
 \* Size Should be in Range (5 - 300)

Elements of Array:  
  
 \* Enter space separated integers.Total of above size.  
 \* For better Visibility each integer is of range (1 - 550).

Close Save changes

Fig 8.2.2 Enter Bubble Sort Elements

## 8.2.3 Generated Bars:

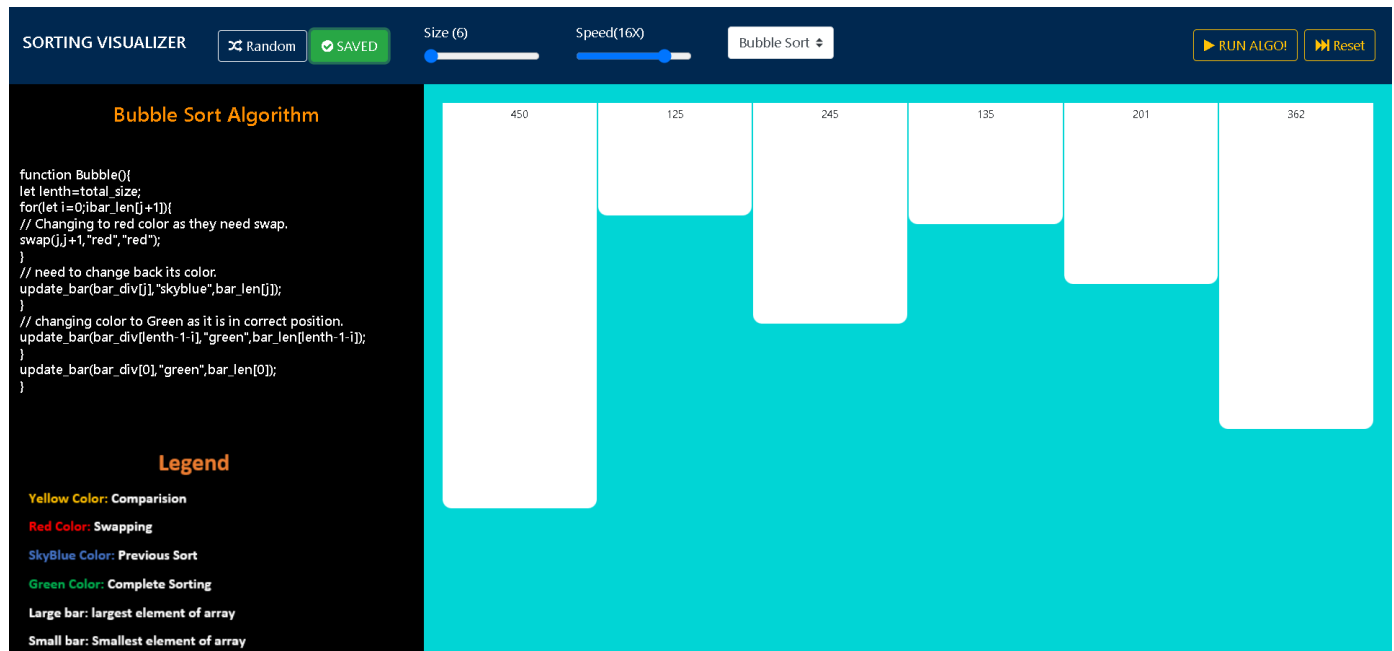


Fig 8.2.3 Generated Bars

## Output

## 8.2.4 Comparison Between Elements:

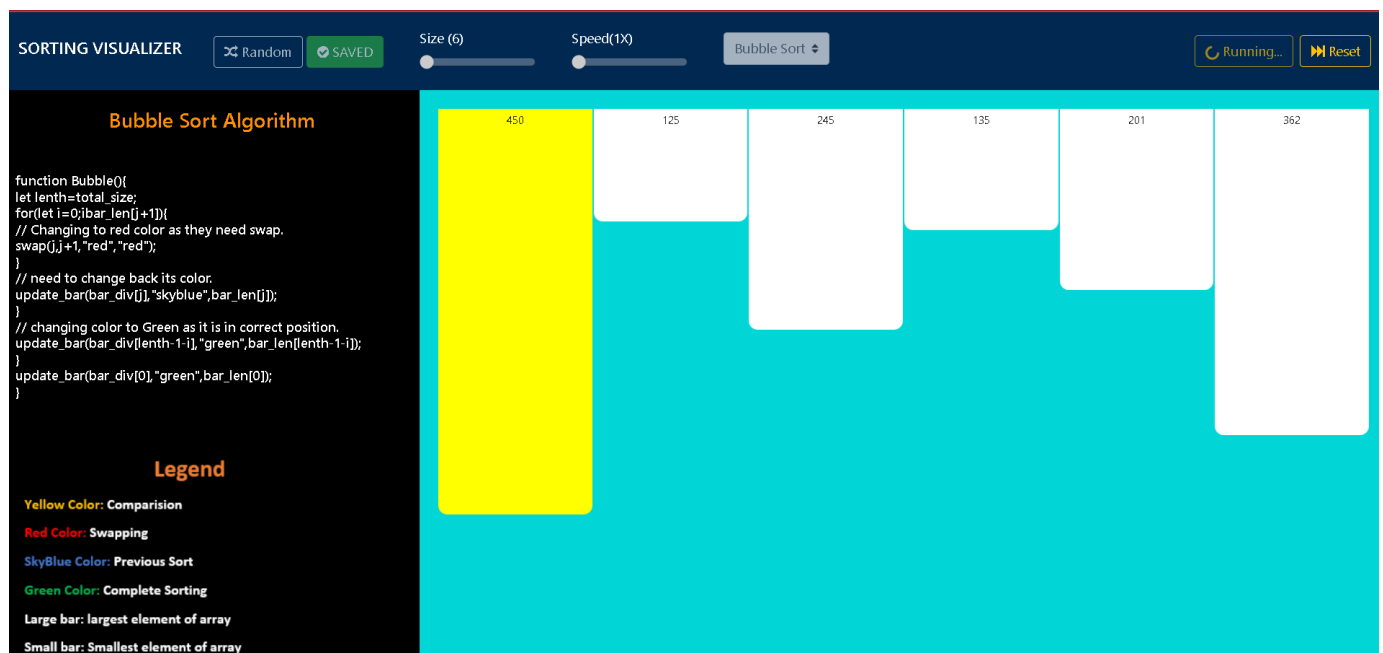


Fig 8.2.4 Comparison Between Elements



## 8.2.5 Swapping Between Elements:

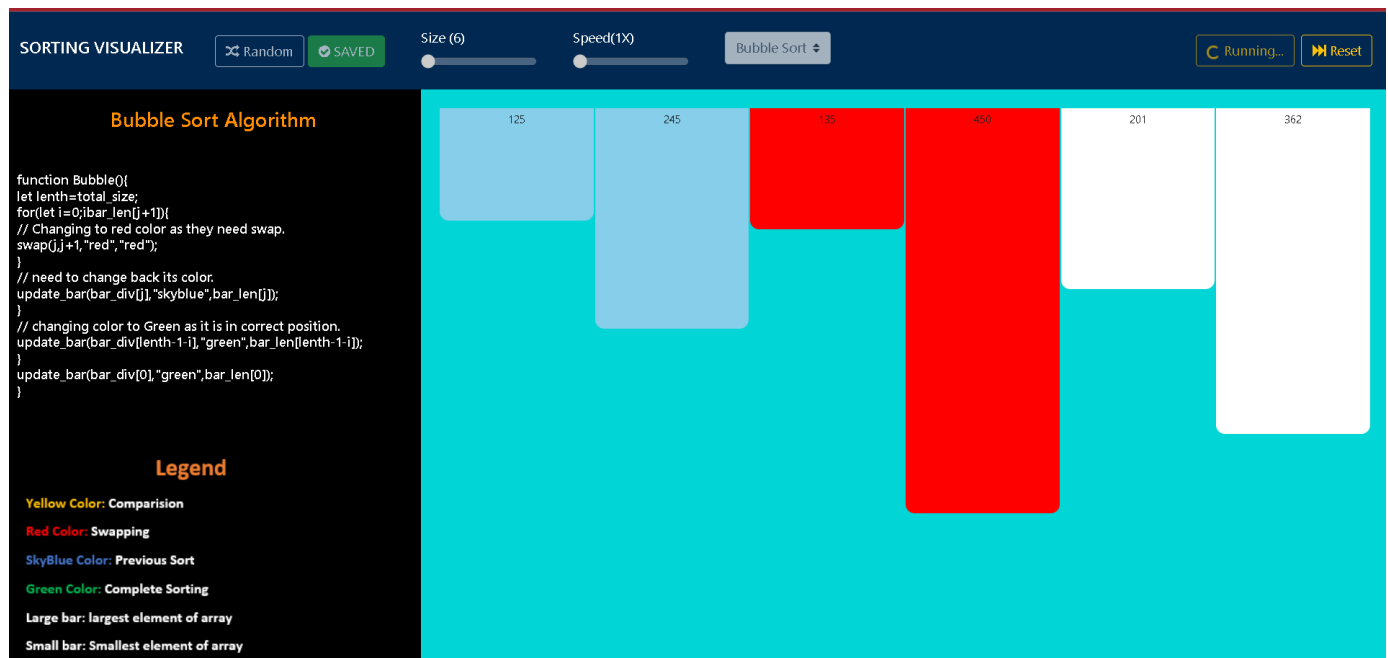


Fig 8.2.5 Swapping Between Elements

## 8.2.6 Previous Sort:

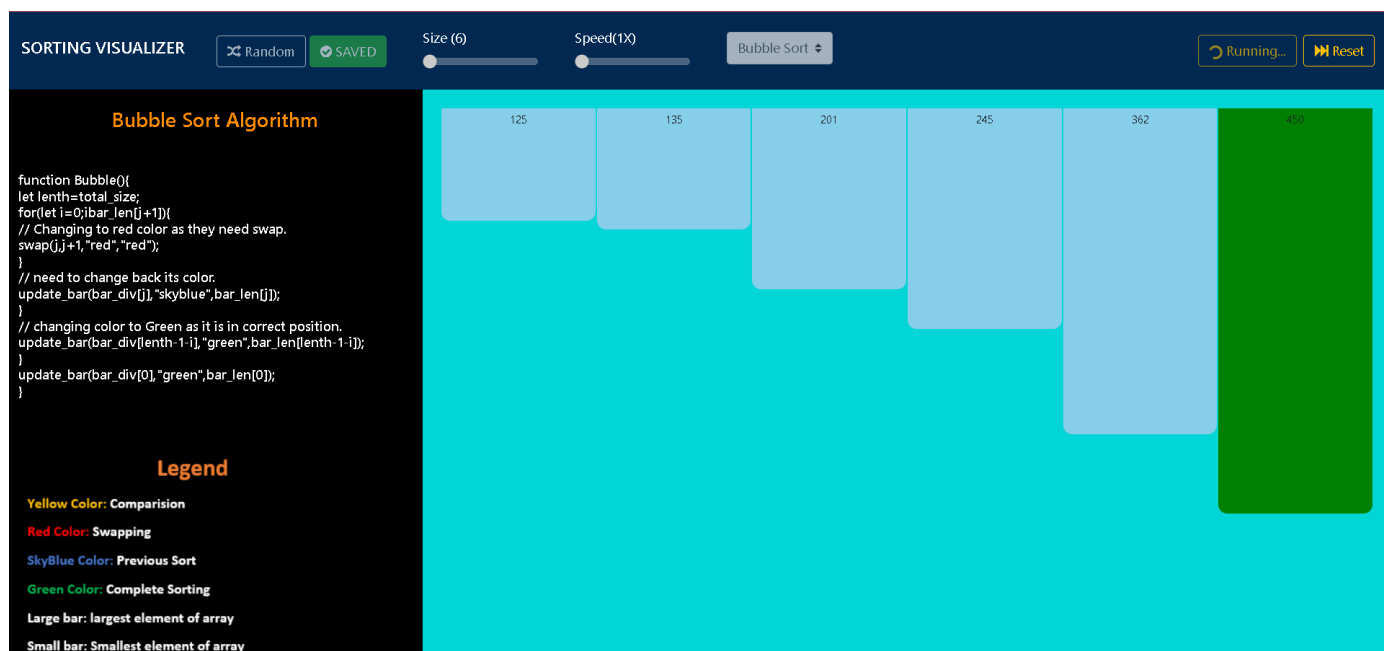


Fig 8.2.6 Previous Sort

## 8.2.7 Successfully Sorted:

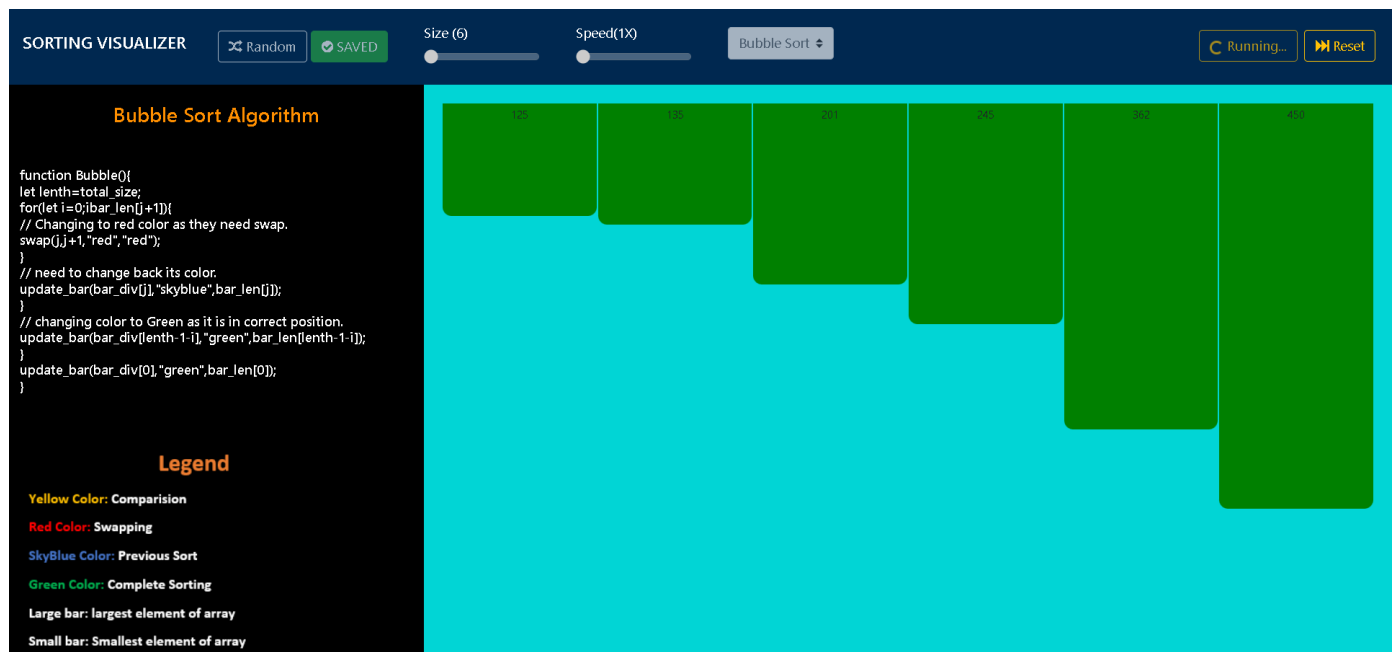


Fig 8.2.7 Successfully Sorted

## 8.3 Insertion Sort

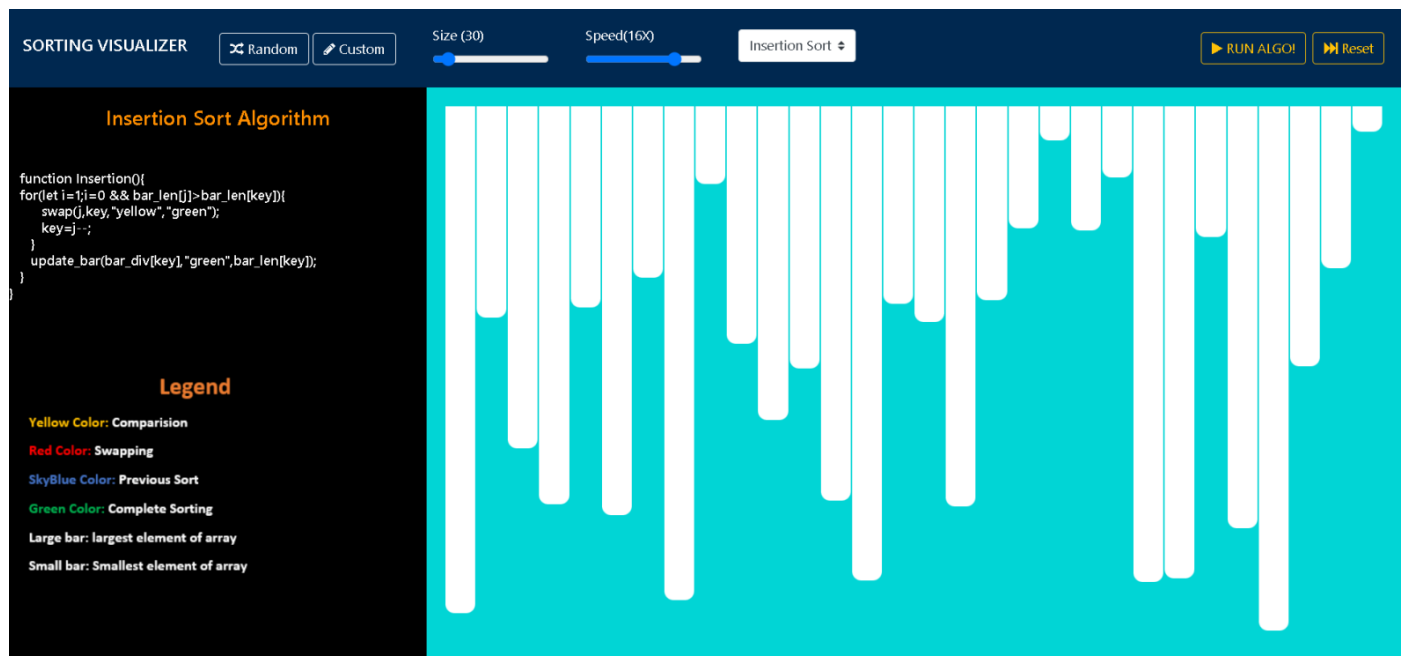


Fig 8.3 Insertion Sort

## 8.4 Selection Sort

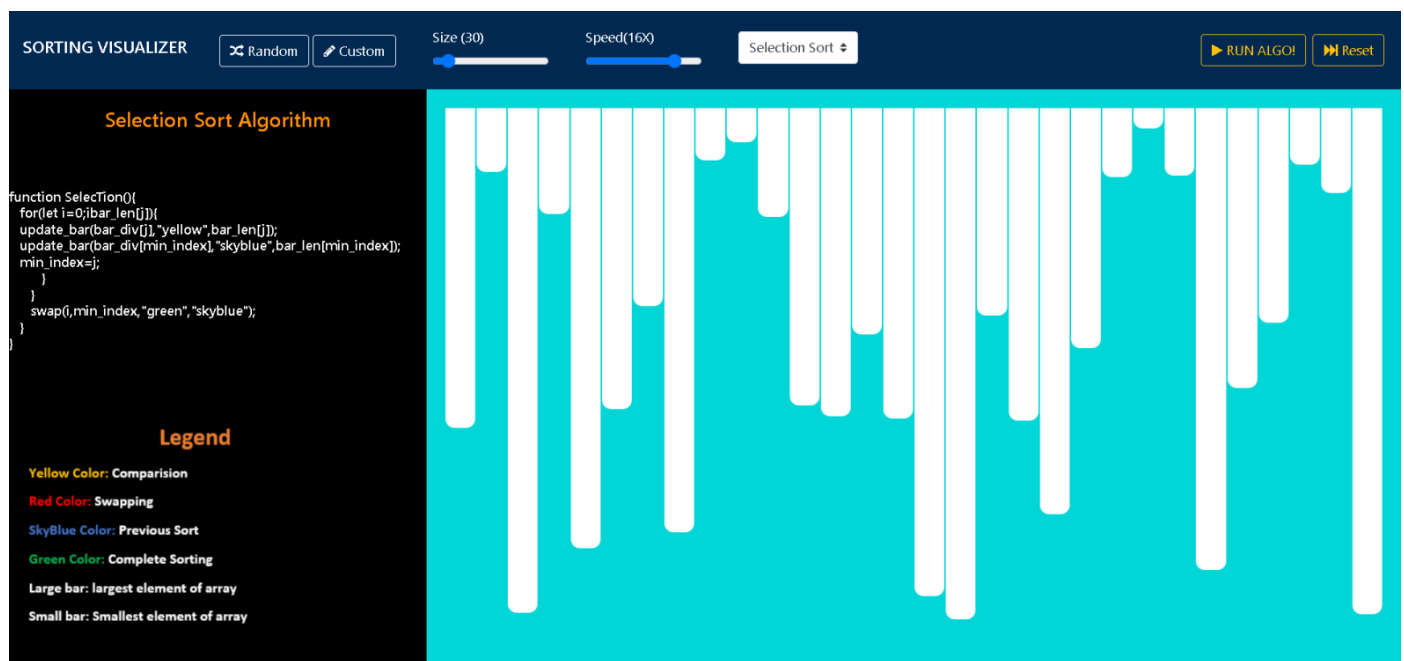


Fig 8.4 Selection Sort

## 8.5 Quick Sort

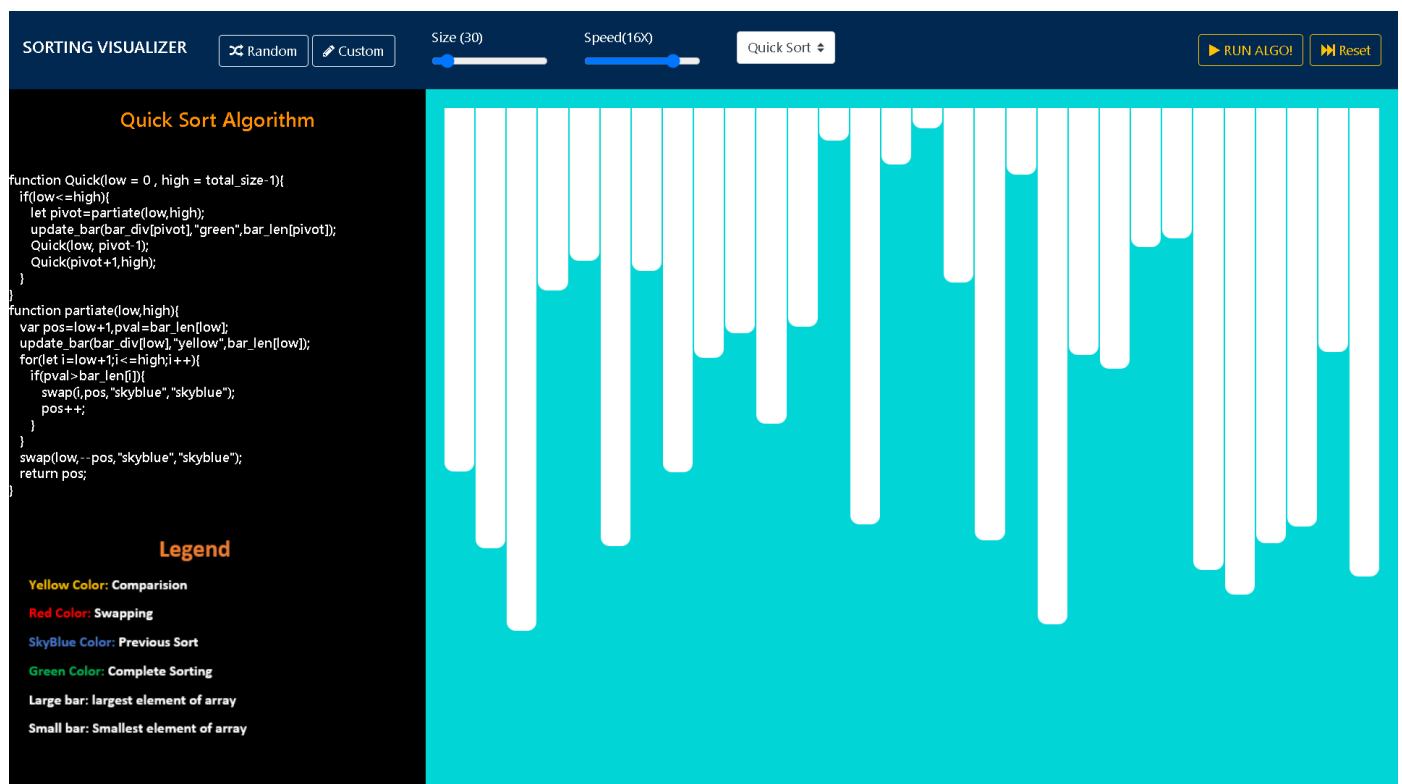


Fig 8.5 Quick Sort

## 8.6 Merge Sort



Fig 8.6 Merge Sort

# **CHAPTER 9**

# **CONCLUSION**

## 9. CONCLUSION

It is teaching support application which visualizes the most known sorting algorithms. User run sorting algorithm by giving custom array. During the demonstration run, the application visualizes pseudo code and current information about comparison of elements, swapping of elements, previous sorting elements and completion of sorting elements with different colors such as yellow, red, sky-blue, green which assure easy understanding of sorting algorithm.

We tried to create high-quality software with a user-friendly and easy-to-use interface, which could be used by lecturers, tutors, and students. Possible next improvement of the applications is extension it by AI application or Machine Learning algorithms.

# **CHAPTER 10**

# **BIBLIOGRAPHY**

## 10. BIBLIOGRAPHY

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# **CHAPTER 11**

# **PUBLICATIONS OF PAPER**

## 11.PUBLICATIONS OF PAPER









