



WEB BASED APPLICATION VISUALIZATION FOR COMPREHENSIVE DATA STRUCTURES

IHAB AHMED NAJM ⁽¹⁾⁽³⁾, NAYIF MOHAMMED HAMMASH⁽¹⁾, MAHAMOD ISMAIL⁽³⁾,
POLLA FATAH ⁽²⁾.

⁽¹⁾ Computer Department , College of Computer science and mathematics Tikrit university ,
Salah Eldin, Iraq

⁽²⁾ the university of Nottingham ,UK

⁽³⁾ Faculty of Engineering and Built Environment

Universiti Kebangsaan Malaysia, 43600 UKM, Bangi, Selangor, Malaysia

ihab@tu.edu.iq , nayif81_mh@yahoo.com, mahamod@eng.ukm.my, psxpf1@nottingham.ac.uk

ABSTRACT

The Web Based Application Visualization for Comprehensive Data Structures (WVCDS) project includes a Web based to support the teaching of introductory computer-science statistics courses. The web application provides easy access to interface, watch sorting process dramatically when barter between each value regarding user need with ascending or descending by offer control speed of showing the process events, and it includes a Fibo function augment with Rand function, which is the focus of the current paper, is designed to capitalize on special capabilities offered by the open source Web based. The easy linkage between Web pages provides support for a highly interactive tutorial, which uses “switching-based” learning and immediate feedback. Students rated the tutorial as easy to use and indicated that it would have improved their initial statistics course.

Keywords: *Sorting, Fibo, Web-Based System, GUI, Data Structure.*

1. INTRODUCTION

The Web Based Application Visualization for Comprehensive Data structures is an Open source Web-based application featuring comprehensive sorting to sets of elements visually for the learning and teaching of Data structures as well as a prototype of interactive tutorials designed for use in undergraduate computer-science or any informatics courses.

The current paper focuses on the tracing that can be supported by new Web technology. The WVCDS application,

which will continue to evolve . WVCDS was created to assist professors and students with difficulties associated with education in data structure. The required introductory data structures course for computer- science majors is often met with trepidation lack of understanding. Many students approach computer schools with great anxiety, perceiving the course as a painful rite of passage, sorting is a classic subject in computer science ,there are three important reason to studding it

First ,sorting algorithms illustrate many creative approaches to problem solving and these approaches cab be applied to solve other problems is pregnancy. Second, sorting algorithms are good

for practicing fundamental programming techniques using selection statements, loops, methods, and arrays.

Third, sorting algorithm are excellent examples to demonstrate algorithms performance. The data to be sorted might be integers ,doubles ,characters ,or objects.

Within WVCDS presented three algorithms, Bubble, sequential and selection sorting for simplicity ,this

Will assumes:

Data to be sorted are Integers , Data to be sorted in array , and Data to be sorted in ascending or descending (Liang,2008). Placing the data into some particular order, such as ascending is one of most important computing applications, An important item to understand about sorting is that the end result- the sorted-array-will be the same no matter which algorithm you use to sort array.

The choice of algorithm affect only the run time and memory use the program .However, In recognition of these negative initial perceptions of data structures , it is especially important to make the topic en- gaging and challenging for students enrolled in the class. data structures educators must be alert to new and interesting ways to make the topic stimulating and relevant. The use of



multimedia technological supplements, such as graphic user interface - assisted instruction, is one way to address these issues and to accomplish the goal of engaging students in data structures education[1].

Traditionally, the teaching of computer schools emphasizes working through, what, how, why... what a problem design, how to implement, why did we select that focusing on only input output interface make students and lecturers still confused. Student still deal or treat with it as ambiguous issue, lectures with students to make reality level or process actually try to tracing out of each algorithms individually by write each step iteration finally to combining all output of each step to imagine sorting algorithm how hold on, it just collect set of fragmentations to able know how sorting algorithms working, by programming each algorithm even lecturers when like to show it will resort display part of code for each different kinds of sorting algorithm, teaching And understanding by assemble all pieces of code seem hard bit for beginner's and need long time of instructor's regarding that WVCDS offer many ability, most important part provide Three algorithm of sorting by GUI notation with that make this more interaction between students or user side with proffers or instructor's while depends on GUI, same code application but one without GUI just depend on CLI Command Line interface user use it each time by enter value from peripherals same without put or final result heading to CLI, compare that with GUI for same code, after that same user or student will be more interactive with same code rather than CLI, this very important concept with in software engineering try to directed almost work to be visualizes, by this first impression got it will me more affect, reduce time for explain, tracing time restricted, expanding level of knowledge by exceed combining parts of each steps output by display details of process. reality with clarify why it happen, Student's with WVCDS able to see how values of 15 integers in set will sorting according three algorithm, Bubble, Selection, Sequential.

WVCDS also introduce more effect show for both students and lecturers, supplying controllers on this show to increased level of interactive between WVCDS and end user this most important concept with Information Technology how to make end user at most interactive level with system or application,

Controlling managements consist of ascending and descending option in show with popup menu by this end user will able to select and start sorting regarding his demand, there are another

opportunities like review, preview and many parts will see in Design and development[2].

Tutorials on the sorting in data structures can meet many educational goals; they should include the following:

- (1) Thought-provoking questions to be asked of students to stimulate interest and a deep processing of information;
- (2) representation of each process that been related with behavior of algorithm;
- (3) the opportunity to learn in a highly flexibility move from process to previous or next show items;
- (4) the opportunity to calculate time needing for each algorithm which it fast and robust
- (5) topics presented in multiple ways, providing the student with more than one representation of complex concepts.

In contrast to traditional instruction in which students complete work and are given feedback at a later date,

WVCDS could be on-line tutorials open source can give immediate feedback that is contingent upon the students' responses, thus assisting the students in overcoming misconceptions quickly. This type of teaching allows the student the opportunity to learning by show. "show-based" learning, when combined, is an extremely powerful, show-based learning allows students to make comparison smoothly and review or preview each steps tail realized what different between each algorithm, sorting type, speed of show, learn why they have made switching between values, and correct representing values according to restriction of system in their understanding immediately and without negative consequence. In this model, students are not penalized for mistakes; instead, errors are viewed as opportunities to learn[3]. By providing a multitude of ways in which to understand data structures sorting concepts, application can create a cognitively complex manner of understanding in which students learn a variety of ways in which to grasp data structures and to be more specific sorting concepts. Thought-provoking questions can require students to respond to criticism of their answers and to evaluate a series of sorting in data structures analyses that are flawed. To be successful in this portion of a teaching, the student must take on a understand role, thereby further promoting the goal of developing a multifaceted understanding of a concept[2, 4].

Using graphic user interface with java language and a amount of applet scripting, a prototypical teaching was created



to supplement classroom presentation of the t test for independent means. The teaching places the student in the role of data analyst, promoting a “learning-by-doing” approach. Special focus is paid to “visualization sorting” areas where students are likely to need assistance. The Web interface uses hardware and software that are readily available and that require little special training for student use.

this augmented with three algorithms beside wealthy controlling show theater[5, 6]. Several professors who regularly teach introductory data structures identified topics that are perpetually difficult for students to understand. The teaching addresses these issues, including the importance of examining data distributions sorting prior to performing sorting with data structures tests, constructing and stating hypotheses, choosing appropriate algorithm or what needed to change from one to another tests, and interpreting inferential sorting be dissuasion values[4, 7-9]. The Web pages utilize a data structure where in the student more accessible , after deciding what step to take, under which criteria would like to start the show is asked to perform a variety of tasks (e.g., state a hypothesis, select the appropriate algorithm test, choose a critical value). Each choice leads to a new visual output , containing specific feedback regarding the choice and an explanation for each steps with in swapping of why the choice is correct or incorrect. Each choice worked synchronization with another WVCDS where the student kind of algorithm and sorting type and speed or may be need to enter values by own , when supplier this possibility should to know there is some human error by e.g. error input , how to manage that will found in design and develop answer more questions, with each event swapping to yet another swapping.

2. DESIGN AND DEVELOPMENT

In terms of information to be teaching sorting and data structures might more understandable

to students , the system was ready to develop. This study has intention to discuss about the requirement in detail, and to focus more on its design and development.

WVCDS main factor as a place the student in the role of a data analyst and represented who is presented with a specific research context and asked to make sense of relevant data. This approach contrasts with traditional textbook and

classroom presentation. In the classroom, students typically begin with a description of a sorting representation each level or at each step procedure (e.g., trace, analysis of variance) and what it can do,

they are shown some formulas, and then they are given data for calculations.

In this respect, a WVCDS tutorial is much closer to the actual processes or it level of reality in which researchers engage when dealing with research data structures of sorting . begin by stating the sorting test to be used, thus providing the student little opportunity to learn how to choose the correct value in range or restriction for test[10].

The WVCDS tutorials, like actual research applications, begin with a problem. The student must decide what guidance for analysis is provided by previous literature, how to deal with data , and what sorting data structures analyses to perform, how move on from step to previous or next will evaluated .

The module designed to supplement the teaching of t tests begins with a Web page that presents a brief attractive interface[11-13].

Although based on real data, the following description should be viewed as hypothetical, with an inferences regarding the input GUI, which will be try to be smooth easy but strongly robust with meaning full label ,for guide student how each step represented[10, 11] .

this manuscript aims to encourage researchers produced more supplementing of teaching aids, likewise, aspire to make students get understandable, accessible and available matrailes of data structure curriculum.

Both design and development of the system are discussed in the following subsections.

2.1 Design

WVCDS depends on GUI features in Java This beside mean motivation is Applet representation for demand GUI.

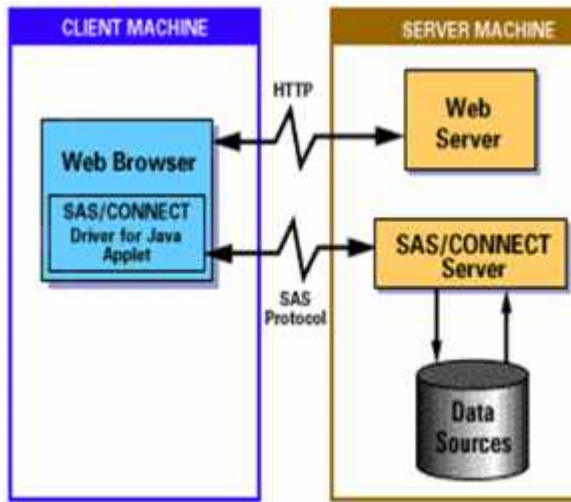


Figure 1. WVCDS architecture.

Figure 1 clarify end user how interact with WVCDS

By may be user initiation enter set of integers values to get sorting, deserves to be noted that there is a portability and default values already in WVCDS save with in array , with input GUI under user demand could generate Fibro series,A series of whole numbers in which each number is the sum of the two preceding numbers. Beginning with 0 and 1, the sequence of Fibonacci numbers would be 0,1,1, 2, 3, 5, 8, 13, 21, 34, etc. using the formula $n = n(-1) + n(-2)$, where the $n(-1)$ means "the last number before n in the series" and $n(-2)$ refers to "the second last one before n in the series."

In computer programming, Fibonacci numbers give a model for designing recursive programming algorithms where the time for any routine is the time within the routine itself, plus the time for the recursive calls.

The Fibonacci numbers were originally defined by the Italian mathematician Fibonacci, also known as Leonardo da Pisa,

in the 13th century to model the growth of rabbit populations.

Also may need to use `rand()` function , to generate series of random numbers. Both of Fibro and Rand functions have rights to get sorted with algorithms available within WVCDS also controllible by triggers bottoms in Web-based application work bench, later on user will have opportunities to selected algorithms ,sort type ,and another controlling management .



Figure 2. input values to WVCDS .

Figure 2 illustrate GUI that interact with user , to enter his values or Generating Fibro,Rand functions.

After passing the desired values will get sorting each step of sorting events will take effect visually front user on workbench of WVCDS .

2.2 Development

Mainly algorithms of sorting available with any reference of language, within any reference of data structures .

main purpose of WVCDS exceed level of imagining the process of sorting to hold on visually in reality, granting ability to comparison between various algorithms which it available with WVCDS ,regarding time, resource consuming,problem was even teaching methods need to treat by software engineering students and lecturers both need flexible, interactive, creative, effect behavior to explain main concepts of any topic to be accomplished to the fullest take benefit of most part interaction of multimedia programing focus on GUI parts most success factors with end user, especially when implementation depends on Applet or any web based application[12, 13], what enhanced or adapt some key points in WVCDS, manage sorting algorithm with greatest performances output for each algorithms , by another meaning even if source code of algorithms available with any reference WVCDS try to reduce as much as could less numbers of loops, calling procedures ,establish temporary variables[8, 9], applied effect of GUI and focus on it with each steps of process of sorting in WVCDS , give a chance of controlling management on theater of sorting process to make WVCDS more familiar with end user , by e.g. just to mention , with process of sorting for any algorithms that available in WVCDS each swapping will highlighting for value of it or representation of this value .

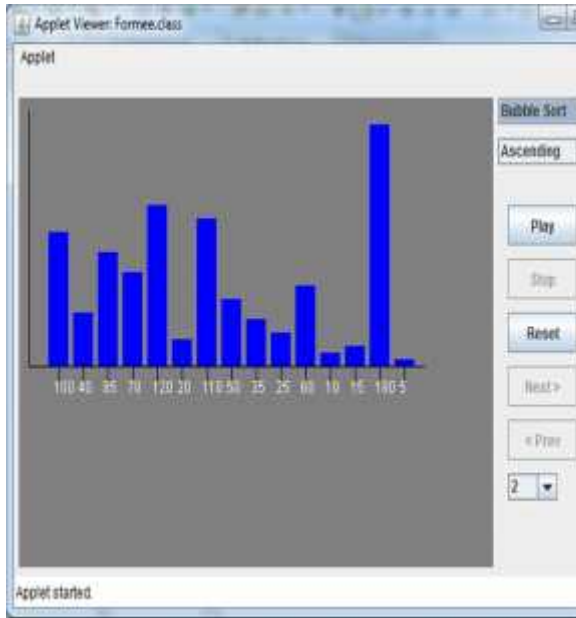


Figure 3 main work-bench or WVCDS

A values stored already with an array by default unless user did not want to enter or test values , figure 3 shows using an applet accros WVCDS, also, illustrate kind of algorithm, type of sroting Ascending or descending order.

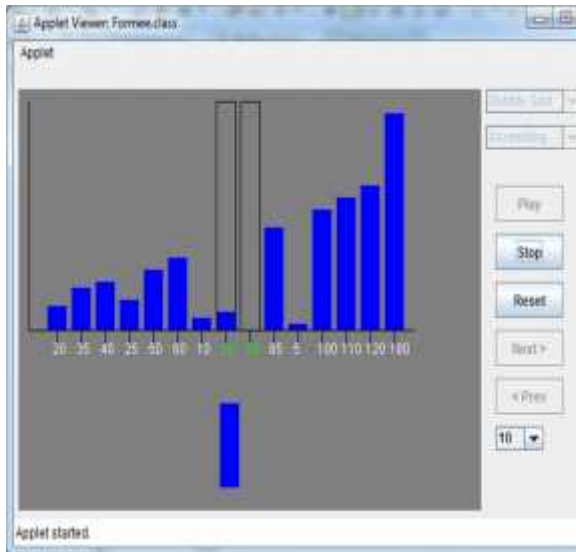


Figure 4. actual process of sorting within WVCDS

Figure 4 explain how effect take it placed inside theater of WVCDS.

Very clear activity of controlling management of show, Intended by this description right side of figure 4 . students /lecturers can test integers values as mention

both possibility entered values or generating values . by subordinate to kind of algorithm ,sorting type , at any step able to stop, review ,preview show finally speeding show also has selected to present steps to take time to understand and coverage hole side of sorting regarding algorithms selected.

Capitalize effect of each value “text of value” and “representing of value ” make end user know very well action part where is it reaching ,

Due that now students /lectures could with this ability clarify different between each algorithms by follow each algorithm signature’s .

3. IMPLEMENTATION

The WVCDS has been tested on the web-based. It was found that the system work as intended properly and smoothly . All main purpose functions were made working certainly. The implementation of WVCDS was also intended to make sure that all functions work correctly. In short, the implementation was intended to check:

- 1-accept user input through GUI ,ability to generate Fibonacci /Random number
- 2- passing entered values /Generated values to been sorted ,regarding design restriction and also manage errors while occurs with run time "Exception concepts" sorting may be ascending or descending .
- 3- representing passing values by GUI bars rectangles by pain them on work-bench ,repaint swapping rectangles with in each process of sorting .
- 4- ability to controlling management by stop, replay ,reset ,review ,preview each steps of show , increased or decreased speeding display show ,finally this start by select kind of algorithm regarding by name reference for each available algorithms. During the implementation, this study found that all tested aspects were in good conditions. Then, the WVCDS were presented to potential users, and asked for their feedback.

4. EVALUATION AND DISCUSSION

The initial evaluation of WVCDS was carried out to determination whether potential users "students/lecturers" find the system will help them. First, they were briefed about the sorting with GUI multimedia technology, in which algorithms that been selected to display how elements arranged and display each events visually in interaction show visually to clarify



behaviors of each algorithms , main reason of different from one to another algorithms , comparison between each output for them with in same set of values can know performance of sorting, which algorithm is best.

This study is necessary for computer science students in order help them to understand sorting topic in data structure subject, however, using web-based application concepts across subjects as a teaching aids very significant in order to increase students understanding.

with GUI multimedia representing take major important concern of developers a round world to create WVCDS not for specific target of students or lecturers it open source application created on web-based application "Applet" available for all ,all can update ,increased in it features ,open source community always try to make resources free ,recently updated, available for No target slice it for all ,any feedback mostly welcome to share develop WVCDS .make much most numbers of end-users get benefit of WVCDS wish after that expand them knowledge with data structures and try to increased them understanding sorting , and not stop with in this limitation just exceed to reach and coverage most topics of data structures .

4.1 Assumptions and Limitations

With WVCDS depends on set of factors by depending on Java ability , however, this article lays on some of strengths.

- Throwing exception with meaning full messages when error occurs,
- Implements interfaces to make WVCDS more interaction with end-user .
- Reduced no of interfaces that end-user treat it
- Try coverage concepts of sorting in data structure to make general idea understood.
- Select web-based "applet" and open source make it more reachable and increased chance of accessible.

On the other hand, the limitation of this article is only a visual sorting tracing included not whole data structures topics.

4. CONCLUSION

Day by day, the web-based apps offer exciting new technologies that can be used effectively to supplement teaching aids. To increase students understanding we used web-based application notations as a WVCDS, this prototype of tutorial can take advantage of this technology by providing self-paced instruction and tracing with multiple representations of concepts and

immediate. Through the WVCDS easily detect which algorithm is better based on time duration of each algorithm, specifically, each algorithm can be sorting a same sample of values. It is to be noted the using web-based application of WVCDS will act as online classroom, however, since WVCDS is an applet, therefore the rate of availability and accessibility will increase. This research presented adding effects to WVCDS at a time of execution by the student/lecturer in order to increased level of interaction between end-user and web app of WVCDS. Familiarized end-user "students/lecturers" by providing an applet of open source WVCDS to create a media of knowledge with specific field of data structures that be reached through various platforms. In future work, we will apply more topics inside WVCDS and a presenting analysis of algorithms performance.

REFERENCE

- [1] Mohammadyari, S., and Singh, H.: 'Understanding the effect of e-learning on individual performance: The role of digital literacy', *Computers & Education*, 2015, 82, (0), pp. 11-25
- [2] Chen, C.-M., and Lin, S.-T.: 'Assessing effects of information architecture of digital libraries on supporting E-learning: A case study on the Digital Library of Nature & Culture', *Computers & Education*, 2014, 75, (0), pp. 92-102
- [3] Ching, C.C., and Hursh, A.W.: 'Peer modeling and innovation adoption among teachers in online professional development', *Computers & Education*, 2014, 73, (0), pp. 72-82
- [4] Garcia-Cabot, A., de-Marcos, L., and Garcia-Lopez, E.: 'An empirical study on m-learning adaptation: learning performance and learning contexts', *Computers & Education*, (0)
- [5] Favier, T.T., and van der Schee, J.A.: 'The effects of geography lessons with geospatial technologies on the development of high school students' relational thinking', *Computers & Education*, 2014, 76, (0), pp. 225-236
- [6] Ibáñez, M.B., Di Serio, Á., Villarán, D., and Delgado Kloos, C.: 'Experimenting with electromagnetism using augmented reality: Impact on flow student experience and educational effectiveness', *Computers & Education*, 2014, 71, (0), pp. 1-13
- [7] Lysenko, L.V., and Abrami, P.C.: 'Promoting reading comprehension with the use of technology', *Computers & Education*, 2014, 75, (0), pp. 162-172
- [8] Liu, Y., and Liu, Y.: 'A Study of Selection Strategy in Web Service', *Information Technology Journal*, 2013, 12, (24)
- [9] Wang, J.: 'Factors Influencing Social Networking Website Loyalty', *Information Technology Journal*, 2013, 12, (3)
- [10] Okita, S.Y.: 'Learning from the folly of others: Learning to self-correct by monitoring the reasoning of virtual characters in a computer-



- supported mathematics learning environment', Computers & Education, 2014, 71, (0), pp. 257-278
- [11] Sommerauer, P., and Müller, O.: 'Augmented reality in informal learning environments: A field experiment in a mathematics exhibition', Computers & Education, 2014, 79, (0), pp. 59-68
- [12] Chen, X.: 'Research and Realization of E-commerce Monitor System Based on Focused Web Crawler', Information Technology Journal, 2013, 12, (17), pp. 4033-4039
- [13] Fang, H., and Li, X.: 'Web 2.0 application in subject services of high school libraries', Information Technology Journal, 2013, 2, (3), pp. 458-461