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ALGORITHM VISUALIZATION

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ABSTRACT

As the need for virtual learning has increased, it has become a necessity in recent years. The way of teaching has changed, visual learning is given more importance than the traditional methods of teaching. Visualizing the concept being taught is one of the easiest ways to understand the concept. Also explaining the concept becomes much easier when visual aid is used to explain the concept. In computer science, algorithms play an important role. The need for creative problem solving, optimizing the existing solution, increasing the efficiency of creating new solutions, etc have increased in recent times, the basic requirements for these skills is a good understanding of algorithms. In this paper, the different types of algorithms explained via the use of visualization are path finding, sorting, dynamic and back tracking. The path finding algorithms can also be visualized with the help of a first person shooting game. For understanding the theory of the algorithms it provides a separate section which the user can access and navigate easily. A page dedicated to recent information about developments in computer science and algorithms can be accessed by the user. A detailed explanation has been provided in the modules of the proposed system.

Keywords: Algorithm, Visualization, Learning, Dynamic Visualization.

I. INTRODUCTION

Visual learning has been superior since one's childhood, as we know the first thing we learn as a kid is basically a scenario of a particular object or being. Similarly, know-how algorithms are vital to laptop technological know-how. Even though algorithms can be understood using flow charts, artificial codes and actual programming language, the exceptional manner to recognize the functionality of algorithms is to visualize. Visualizing the set of rules affords a way for human beings to recognize and consider the real functionality of the algorithms. Energetic visualization of the set of rules the use of the algorithm shows is the exceptional manner to recognize the set of rules. A powerful visualization of a set of rules display algorithm helps to better understand the algorithm of how the set of rules will work underneath distinctive situations consisting of enter quantity, complex set of rules used, and so on. In recent years, the want for eye touch has elevated. As online teaching has become a necessity inside the teaching enterprise these days, the field of laptop technology has a need for a set of rules instructors. As a result, a visible algorithm visualizer is needed for teaching and knowledge algorithms. It now not only enables the scholar to recognize the algorithms however additionally the instructor / expert in explaining the algorithms without problems and correctly.

II. LITERATURE SURVEY

According to Osztián Pálma Rozália[1], a generally accepted level of correlatability cannot be proved. In this paper, three interactivity levels were introduced: Viewing, Responding and Constructing, as no-interactivity, half interactivity and full interactivity. All of the levels have their benefits and detriments. While these results were formed from the fact that this study only used shell sort for this research, initial results proved a relation between level of interactivity and the development in understanding the algorithm.

In keeping with Šimoňáok Slavomír[2], the take a look at performed at considered of 2 companies of scholar studying statistics systems and algorithms, both organizations have been taught with the aid of the same professor the usage of conventional whiteboard approach, the handiest distinction being that best one organization became given access to visualization gear before giving the test. From the experiment it was concluded that the usage of visualization extended the knowledge of the algorithms. The organization that used visualization performed better within the test than the one that did no longer use visualization. distinctive tests had been performed, in the first test the institution that used visualization finished higher by means of a huge margin within the check score in comparison to the group that did now not, inside the 2d check , the institution that did no longer use visualization turned into given a visualization device to recognize the taught fabric and

the alternative institution become not given the visualization tool, presently the institution that used visualization carried out a bit better than the other group. At the same time as additional research is required to show the reliability of a set of rules visualization, this take a look at gives the indication that visualization helps in better informing the algorithms.

Together with Bo Wu[3], this document consists of a new set of policies used to visualize information in the best possible dimension. Records with the highest dimension are displayed on a two-dimensional plane, regardless of which statistic is rendered. In this article, we will use the renderer to visualize it. An algorithm that uses the right level of information and imposes a set of policies from scratch.

In step with Jonathan C. Roberts[4], this paper presents a framework for expertise algorithms. while the framework encompass six tiers thru which help pupil analyze the set of rules, the author emphasis on visualization of set of rules by the student, as by doing so the pupil gets a clear idea about the running of the algorithm and additionally each student has a completely unique way to visualize algorithm which inspire creative considering students, that's in demand ability inside the enterprise today.

According to Katarzyna Romanowska[5], the algorithm visualization tools available on the internet are of not much help due to lack of good design, Usefulness and ease-of access. The paper provides us a guide on how to create an effective algorithm visualizer which will help better understand & encourage user interaction for a good user experience. Increasing the ability to learn algorithms, memorize key points, usefulness through interaction, changing or giving output dynamically, will help user better understand the algorithm.

III. PROPOSED SYSTEM

This undertaking consists of diverse rendering-primarily categorized algorithms which include good judgment-based renders and element-based renders, Which take logic into account to discover paths and type facts that compare to each other.

Each rendering algorithm having numerous features of this platform:

1. 2D Visualization.
2. 3D Visualization (Virtual World).
3. Theoretic Information.
4. Manual mode (Visualize User's Input data).
5. Forum (Application in real world).

Aside from those, Judgment primarily based algorithms has extra characteristic i.e. "Compare" (Use to evaluate their algorithms primarily based on real-time pace of execution).

Current platform consists of following algorithm representation:

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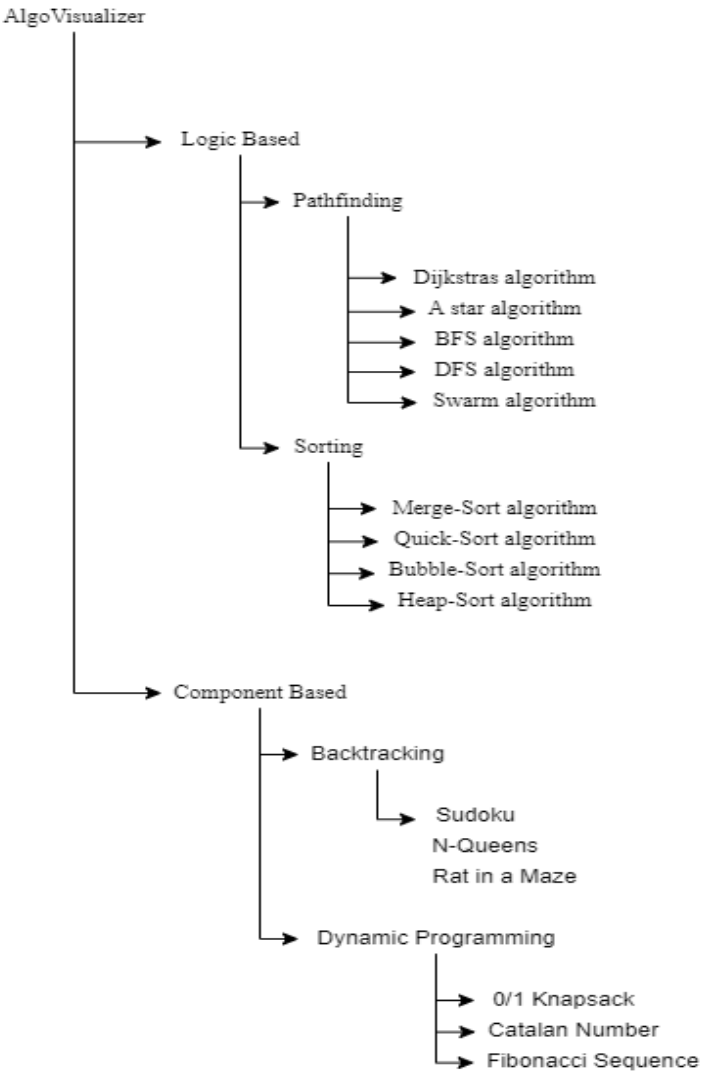

Fig 1: Platform Contents

Considering different categories; lets understand each of them separately.

Pathfinding:

A path-finding categorized algorithm is a term typically utilized with graphs and tree data-structure which is used to identify the shortest available route among nodes, which might be initially designed for travel maps and now used in inner gadget to break map information.

Computerized: Default mode in visualizer guides the user to understand the working for finding a path from source to the destination node with respect to obstacles generated on the way.

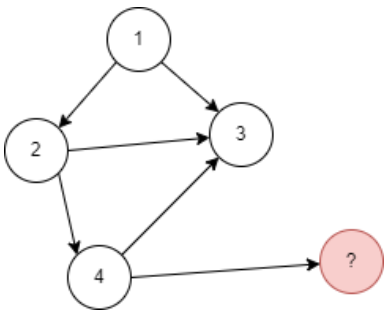

Fig 2.1: Path-finding (Default)

Manual: Manual mode contains various checkpoints initialized by a user in-order to get shortest possible route covering all the nodes

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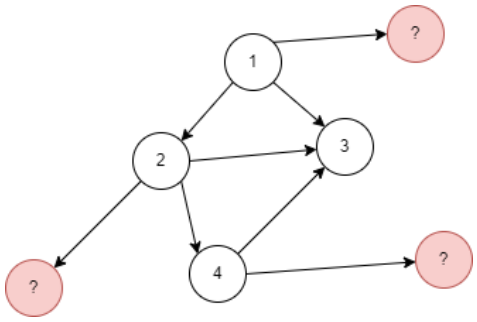

Fig. 2.2: Path-finding (Manual)

Sorting:

Data-sorting is an important task in this world, they need to be sorted as per generation, identification or other required sequence. However, sorting algorithms has been implemented by software engineers so that the system could provide better results in the shortest possible time these data are in terms of array queues, linked list or any other data-structure.

Computerized: Default mode on this visualizer will help a user to observe a work using a variety of algorithms and randomly generated data.

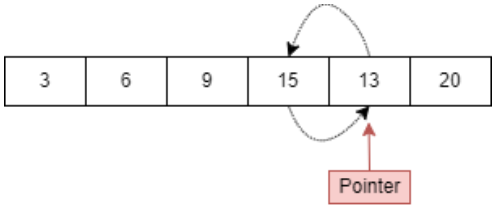

Fig 3.1: Sorting (Default)

Manual: Manual mode helps a user to see working by sorting their own input-data using any method available in the options.

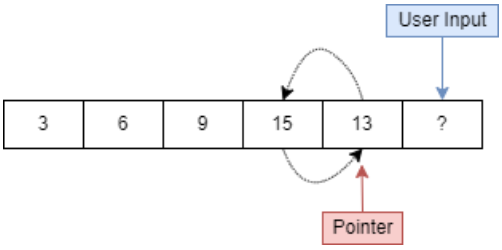

Fig 3.2: Sorting (Manual)

Backtracking:

The algorithms specifically built for solving the particular component. It determines the brute-force technique to answer a given problem-statement at almost every possible value for a component.

Computerized: Default mode of a platform will automatically generate a problem inside which the component randomly visualizes every possible value updating to get the final answer.

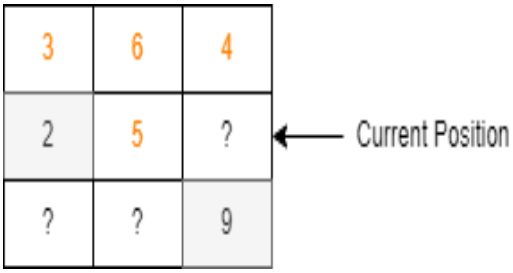

Fig 4.1: Back-tracking (Default)

Manual: The user can customize a given component while creating their own problem-statement and the visualizer will solve it without changing the user value.

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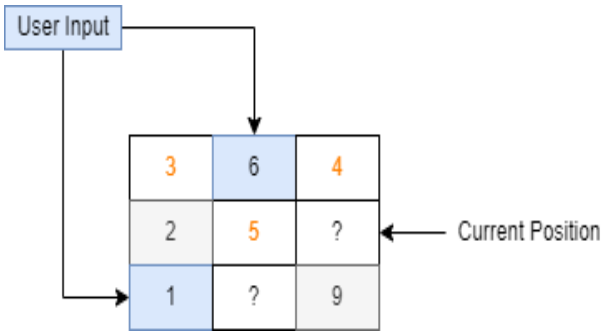

Fig 4.2: Back-tracking (Manual)

Dynamic Programming:

Introduced methods are the most optimal way to solve the problem-statement of an applied component. This method uses a previously generated solution to obtain a new solution and store it with some data-structure to reuse it in future.

Computerized: Default mode generates its own problem-statement for a component specified by the user and also visualizes the storing and reusing the data generated.

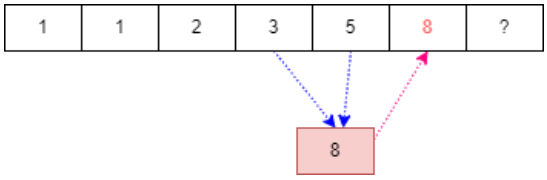

Fig 5.1: Dynamic Programming (Default)

Manual: Users may add their own data to observe and understand the working of the most optimal solution for their problem statement.

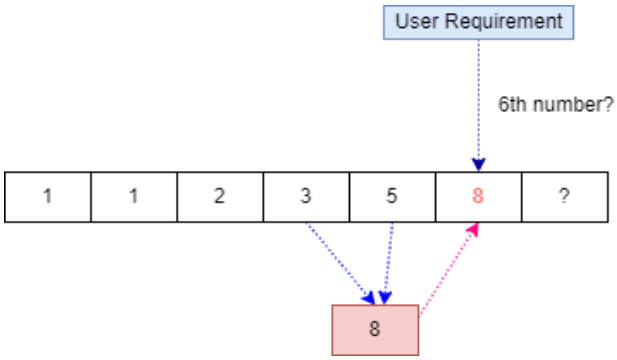

Fig 5.2: Dynamic Programming (Manual)

IV. RESULT

Visualization of every algorithm with the manipulative speed answers all questions of the learner and interaction with their own data will spoon-feed the user requirements. Platform built with ReactJS will boost the performance of an execution of the code in a most effective manner. Anyone is welcome and can be trusted by this platform as no authentication required while learning for good.

Example of Minimalistic User Interface of Platform:

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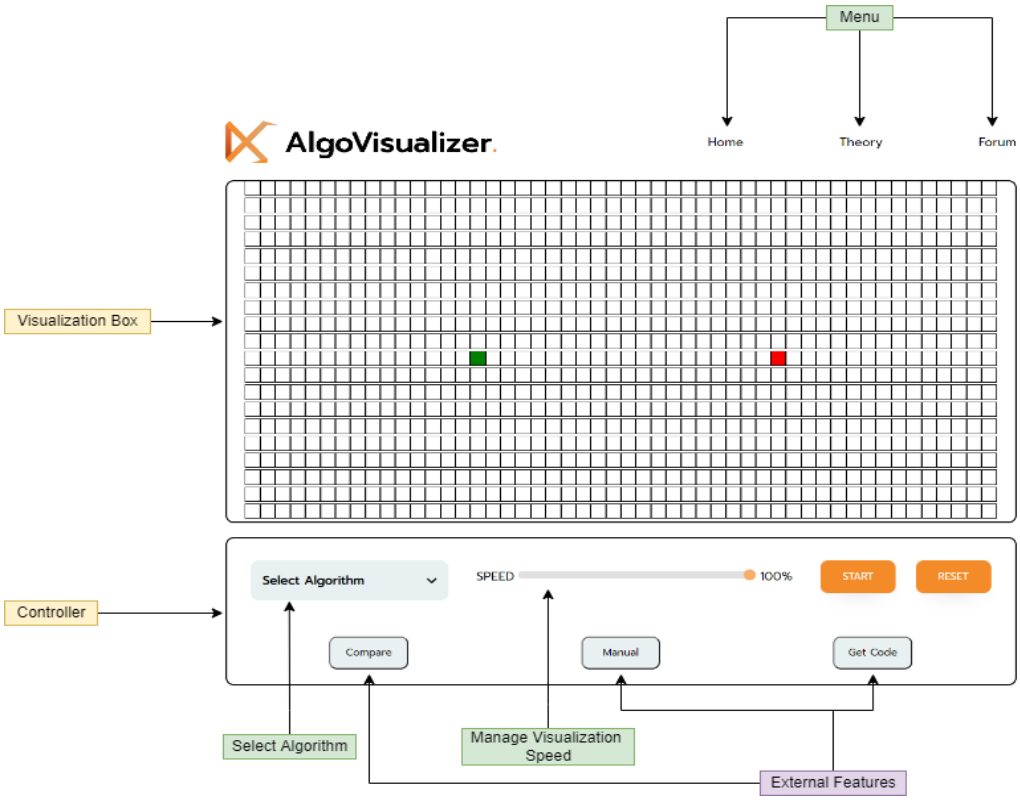

Fig 6: Minimalistic Visualizer

As occurred previously, Logic Based Visualizer contains Comparison between their algorithms for time complexity to get the real-time value of execution. As these algorithms are running on web, its also include network speed while running the algorithm.

Algorithm	Worst complexity	Real-time complexity
Dijkstra's Algorithm (Pathfinding)	O(V + E log V)	68.81884765625 ms
Merge-Sort Algorithm (Sorting)	O(n * Log n)	195.81005859375 ms

3D Visualization is a unique feature that "AlgoVisualizer" offers the user to understand the use of the particular algorithm in the Real/Virtual world. The world is built inside a unity game engine to deliver optimized with a better experience for users. Unity is known for its scalability on almost any of the processors for easy to access modes or game levels.

V. CONCLUSION

The methodology and analytics of learning algorithms on this platform has been outlined in this article. A platform where users can observe, engage, learn, understand, apply can be the medium to get better at any concept. Users can add their data for getting any solution through that particular algorithm. Apart from learning, this platform offers a whole resource of every part of the algorithm. Platform consists of theoretic and video Information with algorithms in top programming languages mostly used by the programmers. User data can be also visualized by this application, through which the user is actually modifying the problem statement. This method includes dynamic manipulation of the algorithm visualizer. The resultant values after visualization can be used by the user purposely.

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