DESIGNING AND IMPLEMENTATION OF

ALGORITHM VISUALIZER

WEBAPP

PROJECT GUIDE

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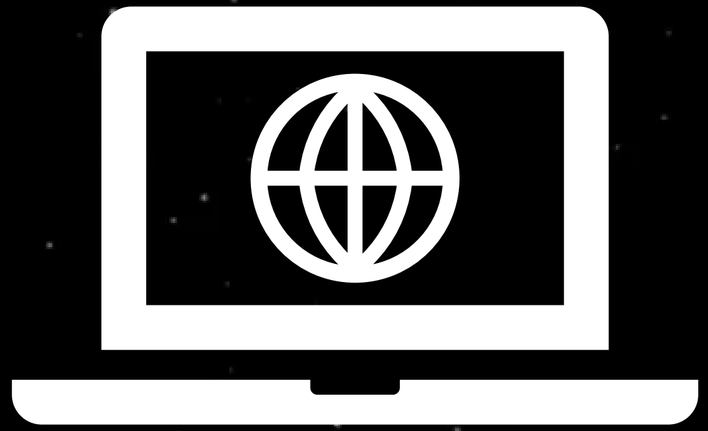
Team Members	Role
Venkatesh A	Design & Documentation
Barathraj B	Scripts & Logics
Chithukati Balaji	Styling & Documentation
Mohamed Akram	Frontend Implementation

OBJECTIVES

- To enhance understanding of complex algorithms through interactive visualizations.
- To bridge the gap between theoretical learning and practical execution.To develop an intuitive web-based tool for step-by-step algorithm execution.
- To increase student engagement and retention with dynamic, user-controlled animations.
- To utilize modern web technologies (HTML, CSS, JavaScript, ReactJS) for a responsive design.Objectives

APPLICATION

- Serves as an **educational tool** for students and developers.
- Acts as a **supplementary teaching aid** in classrooms and supports self-paced learning.
- **Enhances conceptual clarity** by visually demonstrating algorithm execution in real time.
- Bridges theory with hands-on experimentation through interactive animations.



INTRODUCTION

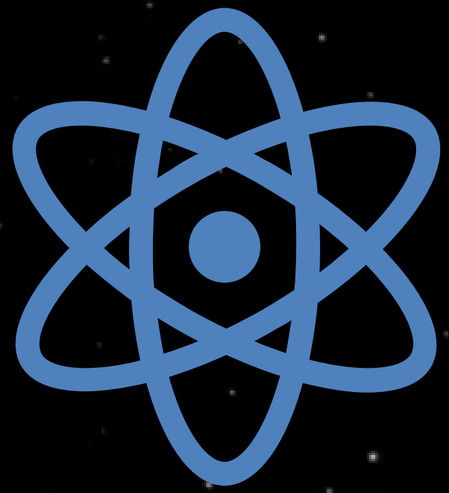
OVERVIEW

- Transforms abstract concepts into **dynamic visual** experiences.
- Enables **step-by-step observation** for deeper understanding and retention.
- **Overcomes the limitations** of static textbooks and lectures.
- Leverages **Framer Motion** in a React webapp to simplify complex algorithms.

INTRODUCTION

MOTIVATION & PROBLEM STATEMENT

- Many struggle to grasp complex algorithms with static examples.
- Traditional methods lack interactivity and dynamic feedback.
- An interactive, controllable approach is needed for thorough exploration.
- This React webapp visualizes **sorting** (and soon other algorithms) using engaging **bar animations** and full controls.



Literature 1

Title

“Algorithm Visualization: A Report on the State of the Field”

Verification Link

Summary

- Identifies **key challenges** faced by researchers in this domain.
- Traces the **evolution** of algorithm visualization over time.
- Highlights the potential of visual tools to enhance algorithm **education**.

Published Date

AUG
2010

Authors

Clifford A. Shaffer
Matthew Cooper
Stephen H. Edwards

Literature 2

Title

“Effective Features of Algorithm Visualizations”

Verification Link

Summary

- Evaluates interactive features.
- Emphasizes the value of integrating pseudocode.
- Offers design recommendations for creating more effective visualizations.

Published Date

JUL
2002

Author

Purvi Saraiya

Literature 3

Title

“A Literature Review On Algorithm Visualizers”

Verification Link

Summary

- Surveys a broad range of existing algorithm visualization tools.
- Discusses strengths in enhancing user engagement and clarity.
- Points out limitations and gaps in current visualization designs.

Published

AUG
2022

Authors

Sweeta Bansal
Karan Kohli
Krishna Kumar

Literature 4

Title

“Review of Algorithm Visualization Methodologies”

Verification Link

Summary

- Compares various innovative, interactive visualization approaches.
- Emphasizes the advantages of web-based visualization solutions.
- Highlights the central role of user interactivity in learning enhancement.

Published

APR
2022

Author

Jay Talekar
Jugal Suthar
Sanket Joshi

Literature 5

Title

“Designing Educationally Effective Algorithm Visualizations”

Verification Link

Summary

- Introduces the HalVis framework for context-rich, interactive algorithm animations.
- Demonstrates how synchronized pseudocode and visual feedback boost comprehension.
- Validates the importance of interactivity in transforming traditional algorithm teaching.

Published

MAR
1998

Authors

N. H. Narayanan
M. Hegarty
S. R. Hansen

Literature 6

Title

On the Role of Animated Analogies in Algorithm Visualizations

Verification Link

Summary

- Extended version of HalVis framework
- Presents interactivity feature and learning modules of HalVis
- Highlights the central role of user interactivity in learning enhancement.

Published

APR
2000

Author

S. R. Hansen
N. H. Narayanan

Literature 7

Title

Integrating algorithm animation into a learning environment

Verification Link

Summary

- Better empirical study than the previous mixed results
- Reports significant gains in student performance and engagement.
- Highlights design considerations for effective in-class and self-paced use.

Published

MAR
1997

Authors

C. Kann
R. W. Lindeman
R. Heller

Literature 8

Title

A Web-Based Algorithm Animation System for an Electronic Classroom

Verification Link

Summary

- Explores web-based interactive textbooks integrating algorithm animations.
- Discusses synchronous collaboration features for group learning.
- Emphasizes user control over animation speed and data inputs.

Published

APR
2000

Author

Marc H. Brown
Marc A. Najork

Literature 9

Title

Testing Effectiveness of Algorithm Visualization

Verification Link

Summary

- Presents an empirical framework for evaluating learning gains from visual tools.
- Addresses the challenge of quantifying “effectiveness” in controlled experiments.
- Proposes guidelines for designing user studies and analyzing engagement metrics.

Published

JUN
1998

Authors

J. S. Gurka
W. Citrin

Literature 10

Title

Smooth animation of algorithms in a declarative framework

Verification Link

Summary

- Introduces a declarative model for generating algorithm animations.
- Focuses on rendering smooth transitions to maintain user context.
- Offers a scalable framework suitable for both simple and complex algorithm visualizers.

Published

SEP
1999

Author

C. Demetrescu
I. Finocchi

BASE PAPER ANALYSIS

OBJECTIVES

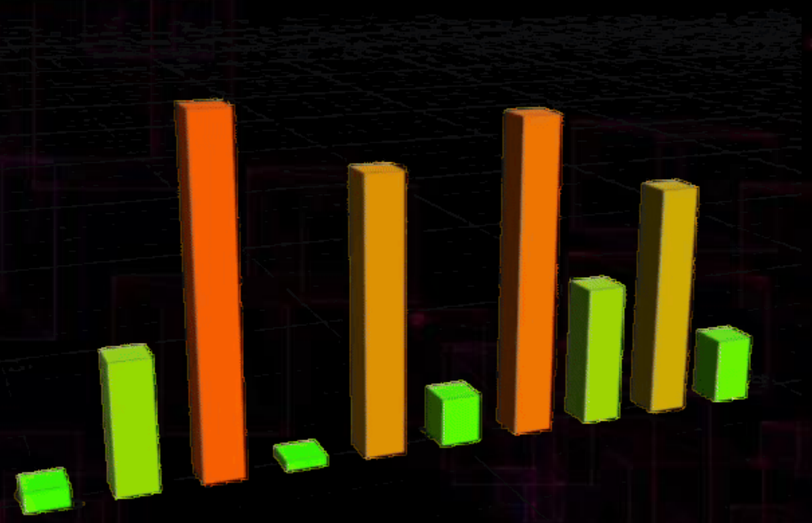
Paper

“Designing Educationally Effective Algorithm Visualizations”

by N. H. Narayanan & M. Hegarty

Objectives

- To develop the HalVis framework.
- To show that a context-rich animation improves conceptual and procedural learning.
- To compare interactive visualizations with traditional teaching methods.

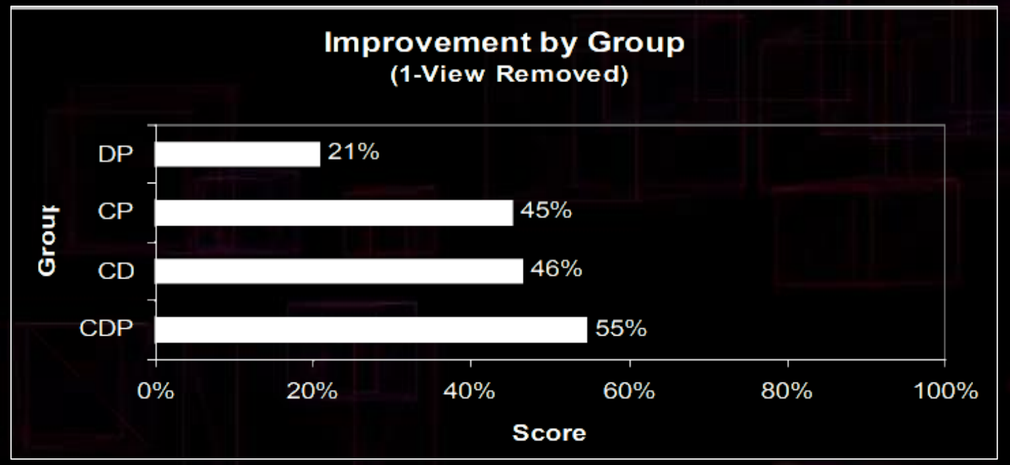


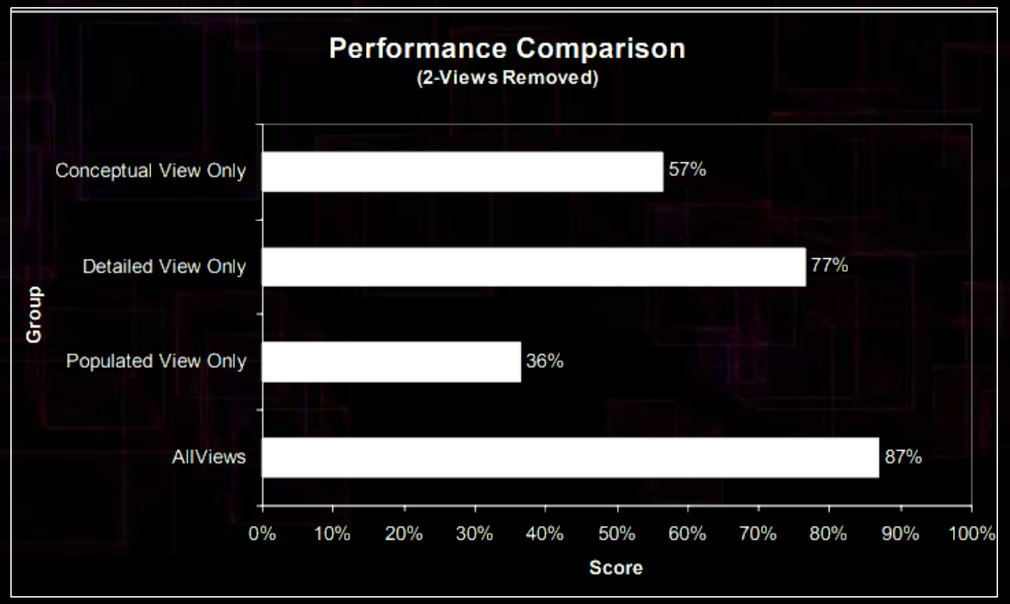
BASE PAPER ANALYSIS

DATASETS

Datasets

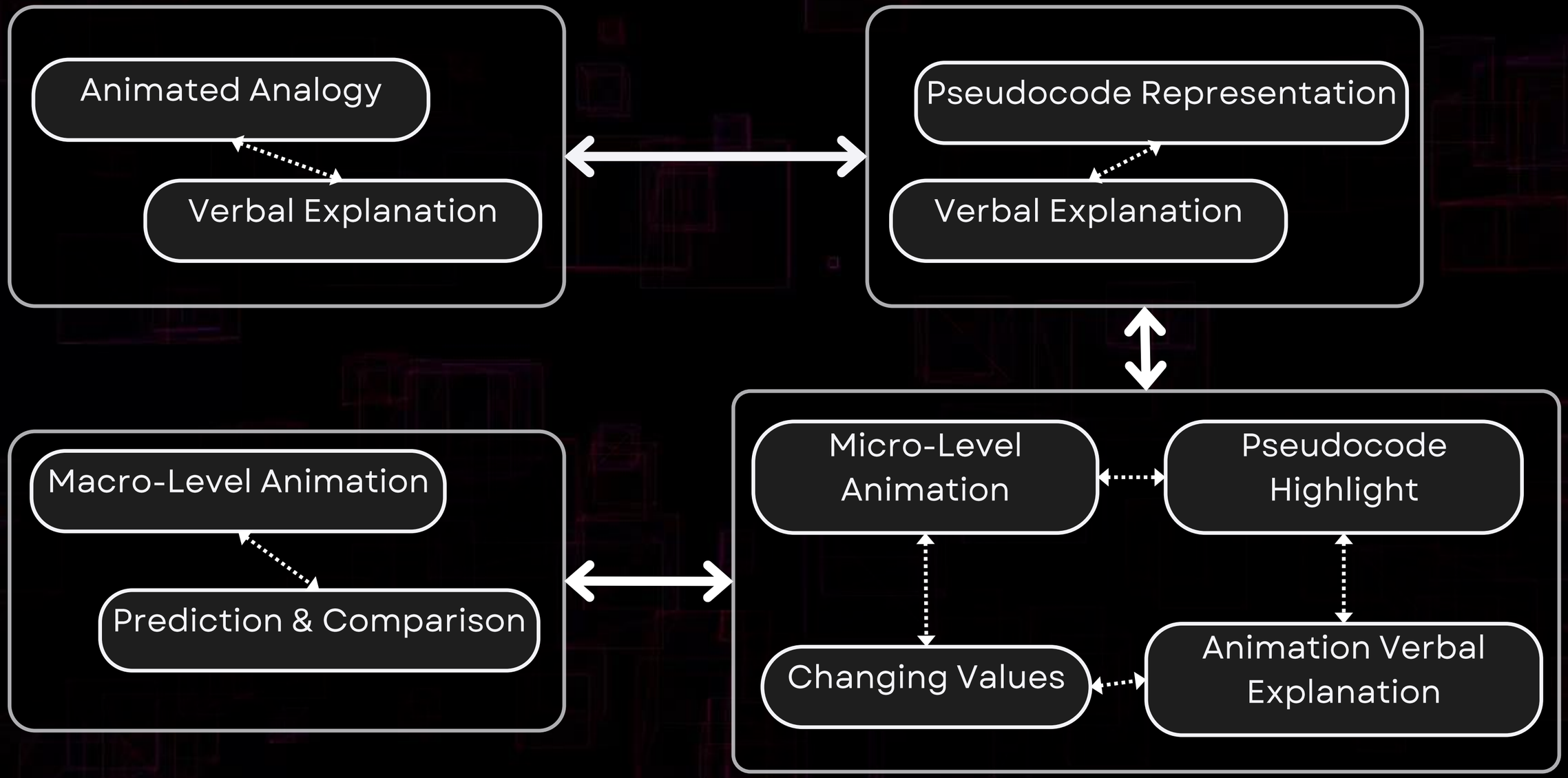
- Empirical experiments with computer science students.
- Pre-test/post-test scores measured conceptual and procedural skills (e.g., MergeSort, QuickSort).
- Engagement metrics such as interaction time and reflective responses were recorded.





BASE PAPER ANALYSIS

BLOCK DIAGRAM



BASE PAPER ANALYSIS

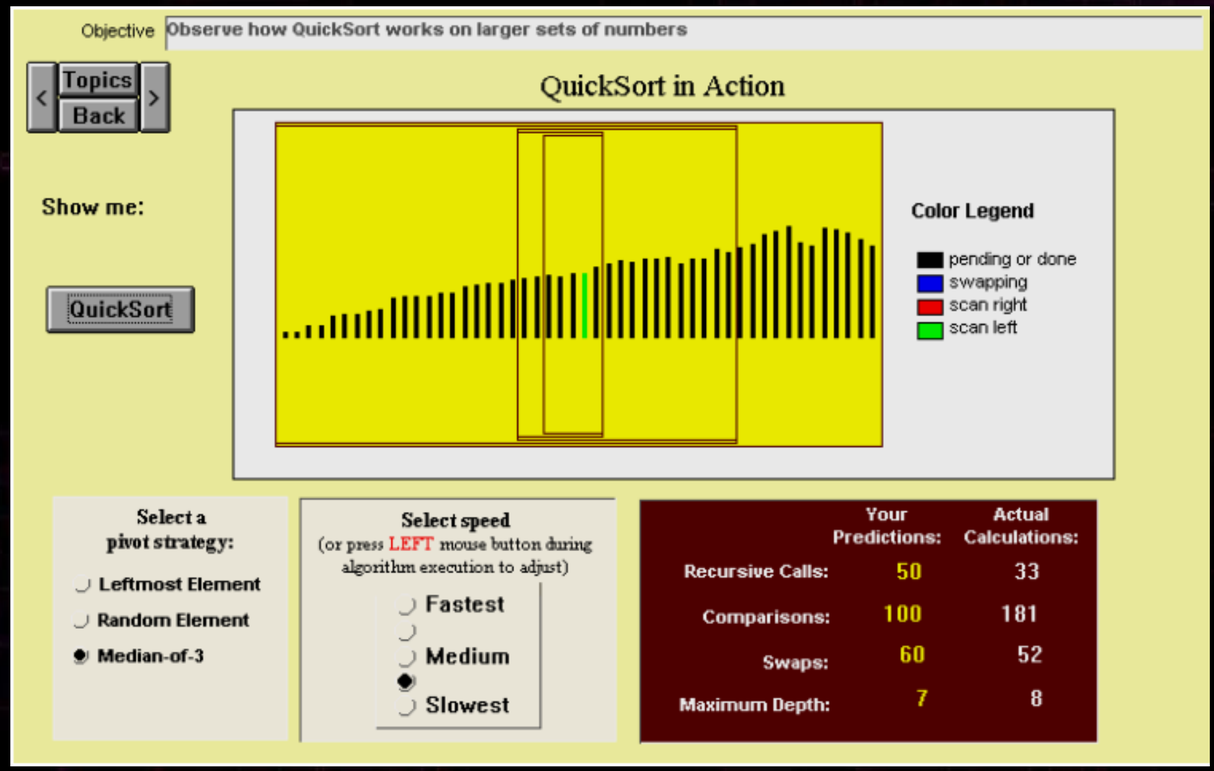
RESULTS & DESCRIPTION

Results

- Students using HalVis scored significantly higher on post-tests.
- Interactive features (speed control, synchronized pseudocode) boosted learning.

Description

- The study confirms that embedding animations in a rich context improves learning.
- These findings support our React webapp design with Framer Motion animations.



CONCLUSION

- Interactive animations significantly enhance algorithm comprehension.
- User-controlled features boost engagement and learning efficiency.
- Context-rich, synchronized visualizations bridge theory and practical execution.
- Empirical results validate the effectiveness of our design approach.

THANK YOU