Adaptive Student Arrangement System for Enhanced Learning

המכללה האקדמית להנדסה בראודה בכרמיאל

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Enhancing Learning through Algorithmic Optimization and Teacher Input

PROBLEM

Why Classroom Optimization Matters:
Efficiently managing diverse classrooms, requiring adaptive solutions for seating, student engagement, and performance tracking to enhance learning outcomes and streamline teacher workflows.

SOLUTION

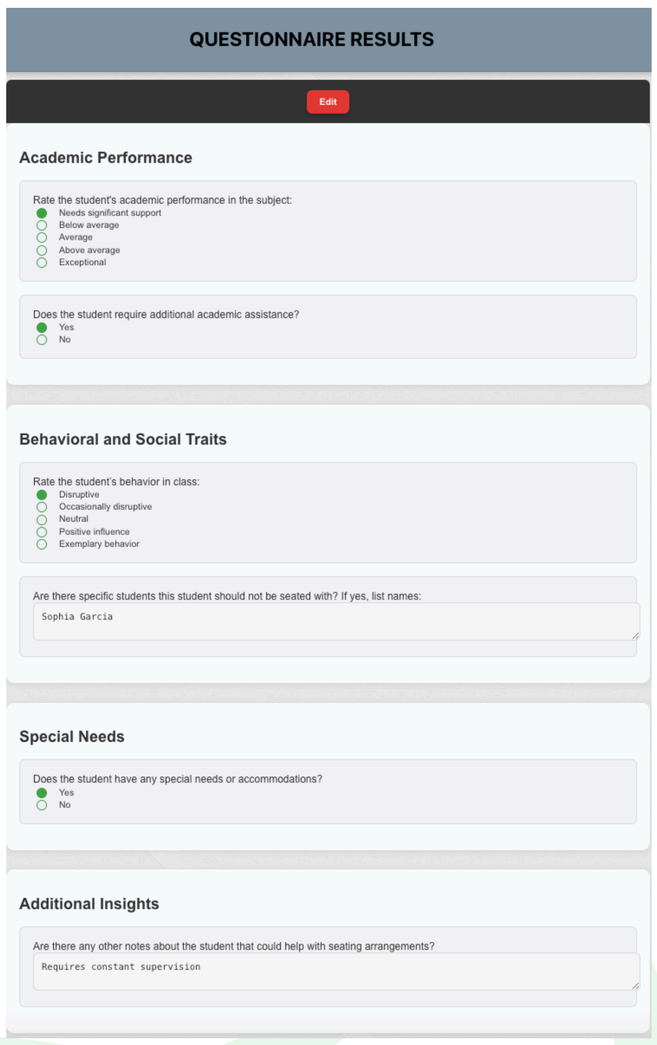
CSP (Constraint Satisfaction Problems) algorithm with student data and teacher-defined constraints to optimize seating arrangements, refining the system with real-time teacher feedback for adaptability and efficiency.

METHOD

We collected classroom layout and student data. Using weighted scoring, students were prioritized and assigned seats through a CSP algorithm, ensuring balanced arrangements. Teacher feedback allowed real-time adjustments for continuous optimization.

WORKFLOW

1	2	3	4	5
Input Data	**Weighting System**	**Apply CSP**	**Output Seating Arrangement**	**Feedback Loop**
• Gather classroom layout, student details (academic, behavior, special needs) and teacher defined constraints.	• Assign priority scores to students based on academic performance, behavior, requires assistance and special needs using weighted formula.	• Use the CSP algorithm to generate a seating arrangement that satisfies all constrains.	• Produce an optimized seating grid balancing behavior, academic diversity and special needs.	• Collect teacher feedback to adjust constraints and refine the arrangement dynamically



ALGORITHM

Inputs:
Classroom layout, student data (behavior, academic level, special needs, teacher notes).

Preprocessing:
Group students by response data.
Calculate priority scores using:
Priority Score = -Academic + Behavior + Assistance + Adjustments.
Special Needs: Scores are multiplied by 1.5.

Weighted Scoring:
Academic Level: 1–5 (higher = better).
Behavior: 1–5 (lower = better).
Requires assistance: If true: 2 else 0.
Adjustments: Derived from teacher notes (GPT API).

Seating Arrangement:
High-priority students placed in front rows.
Avoid conflicts (e.g., Based on questionnaire).
Ensure academic diversity.

Regeneration:
Adjust arrangements dynamically using teacher feedback.

TESTS

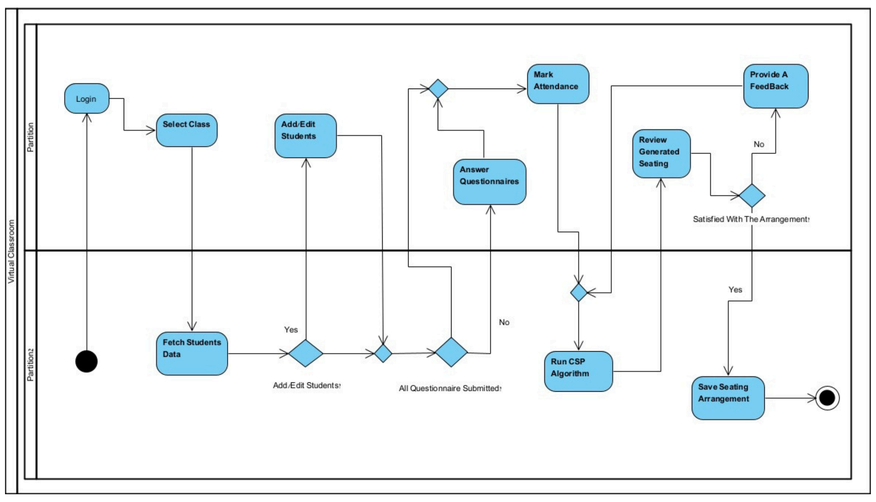
Functional Tests:
- Seating arrangements accurately aligned with academic performance and behavior traits.

Non-Functional Tests:
- The CSP algorithm remained stable and effective under high constraint loads.

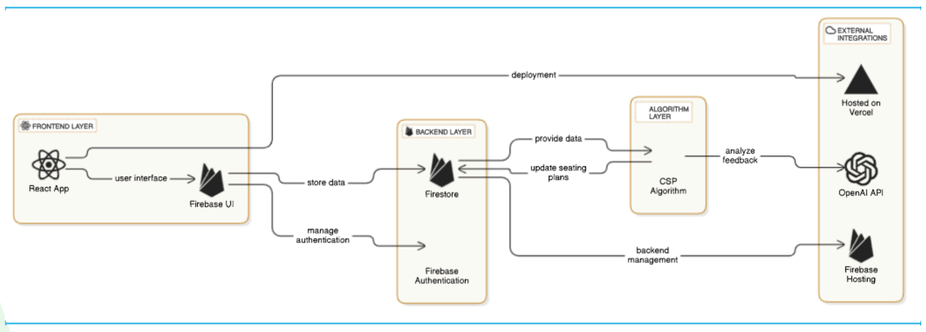
Usability Tests:
- Educators found the seating arrangement intuitive and easy to use.

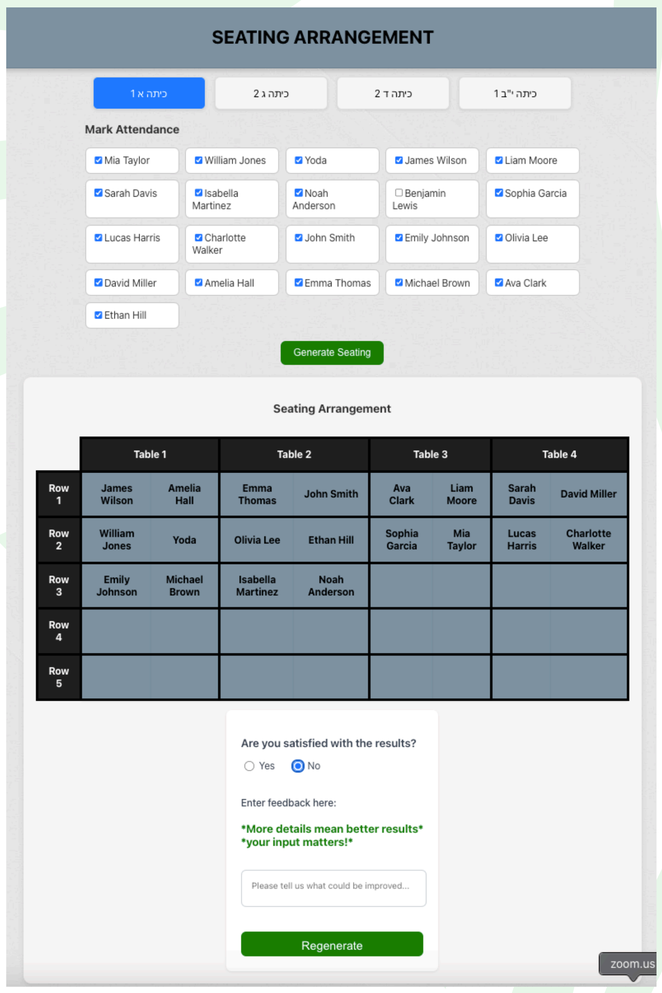
Accessibility Tests:
- 10 usera reported that the algorithm's outputs were clear and simple to interpret.

ACTIVITY DIAGRAM



ARCHITECTURE DIAGRAM





RESULTS

- Optimized seating arrangements using a CSP algorithm to balance academic, behavioral, and special needs.
- Real-time teacher feedback ensures adaptability and practical adjustments.
- Future plans include AI-driven analytics and scaling for multi-class environments.

CONCLUSION

- Optimized Seating: Generated seating arrangements successfully balanced behavior and academic performance while meeting all teacher-defined constraints.
- Behavior Balancing: Rows were optimized to ensure an even distribution of challenging behavior profiles.
- Efficiency: The CSP algorithm completed arrangements within seconds, even with complex constraints.