# Rubik’s Cube with 3D Visualization

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## Description:

This project aims to implement an efficient Rubik's Cube solver using the A\* algorithm, allowing users to find optimal solutions for any given cube state. The project will include a 3D graphical user interface (GUI) to provide a visual representation of the cube and its solving process.

Implementation Details:

1. **State Representation:**

* Represent the Rubik's Cube state as a 3D array or an appropriate data structure that allows for easy manipulation of cube rotations.

1. **Search Algorithm:**

* The A\* algorithm to find optimal solutions. A\* considers both the cost to reach a state and an estimate of the remaining cost, making it suitable for the Rubik's Cube problem.

1. **Heuristics:**

* Develop heuristics that efficiently guide the A\* algorithm toward the goal state. These heuristics will estimate how close a given cube state is to the solved state.

1. **Python Implementation:**

* Implement the solver algorithm in Python, leveraging libraries like NumPy for efficient array manipulation.

1. **3D GUI:**

* Create a 3D GUI to visualize the Rubik's Cube and the solving process. Libraries like Pygame or PyOpenGL will be considered for the graphical interface,
* Implement user-friendly controls in the 3D GUI, allowing users to input custom cube states, scramble the cube, and observe the solving process.

1. **Timeline:**

* Day 1: In-depth research and finalize state representation; commence A\* algorithm and fundamental heuristics implementation.
* Day 2: Develop the 3D GUI using state-of-the-art libraries like Pygame or PyOpenGL; seamlessly integrate the solver algorithm with the visually immersive interface.
* Day 3: Optimize the solver for performance; implement user interaction features for an intuitive user experience.
* Day 4: Conduct comprehensive testing on diverse cube states; prepare thorough project documentation.

**Links:**

[**https://towardsdatascience.com/rubiks-cube-solver-96fa6c56fbe4**](https://towardsdatascience.com/rubiks-cube-solver-96fa6c56fbe4)

[**https://jakevdp.github.io/blog/2012/11/26/3d-interactive-rubiks-cube-in-python/**](https://jakevdp.github.io/blog/2012/11/26/3d-interactive-rubiks-cube-in-python/)

[**https://github.com/bellerb/RubiksCube\_Solver**](https://github.com/bellerb/RubiksCube_Solver)