



Brick Builder

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Challenge

- The Goal: Fix input pixel models to look like the target output files
- Using a custom “drone” with a strict set of constraints on movement
- Minimize the amount of work/time needed to construct the structure

Against the Grain

One of the main focuses of our team was how we can develop a solution that not only optimized time, but that also works in untraditional ways. Rather than using a very standard algorithm of moving block sorting stack by stack, we created a process that is much more versatile and that can be built off and applied to other projects.

With the ECL, one of the main things that resonated with our team was deliberating values. We decided to enforce values of sustainability, creativity, and effects on future development rather than strictly usability for specific examples.

We believe our work meets many of the principles outlined by the ECL, especially:

- Take responsibility
- Expand

Engineering Design Process

Step 1

Defined the problem and sought clarification about problem constraints. Brainstormed rough algorithm ideas.

Step 2

Implemented our design using Python, working through technical problems as a team.

Step 3

Troubleshooting + improvements to our algorithm after seeing the practical results of the system.
Documenting our ideas and designs.

Our Solution

Optimizing both ours and
our clients' time





Solution - Environment Design

States:

- Current State of the system
- Desired State of the system

Can:

- Determine when the states match (drone is finished)
- Add blocks from the drone
- Remove blocks and give them to the drone
- Give the drone the information it is allowed to receive
- Ensure the drone cannot break the rules



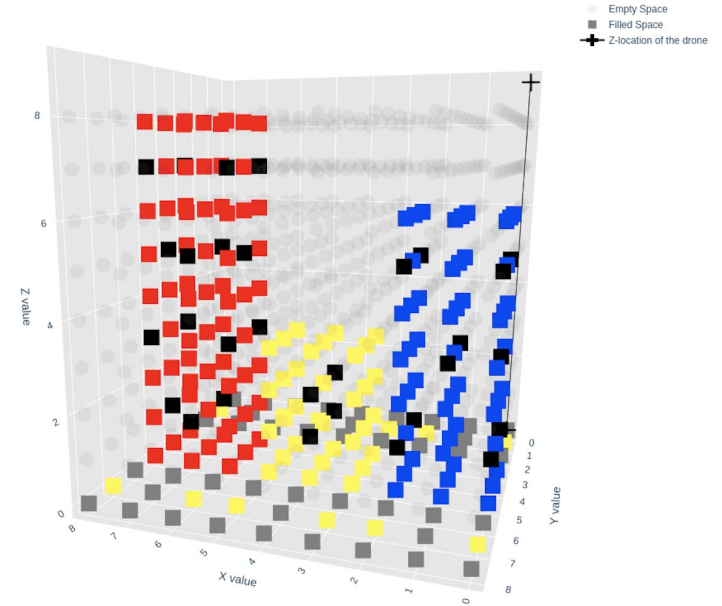
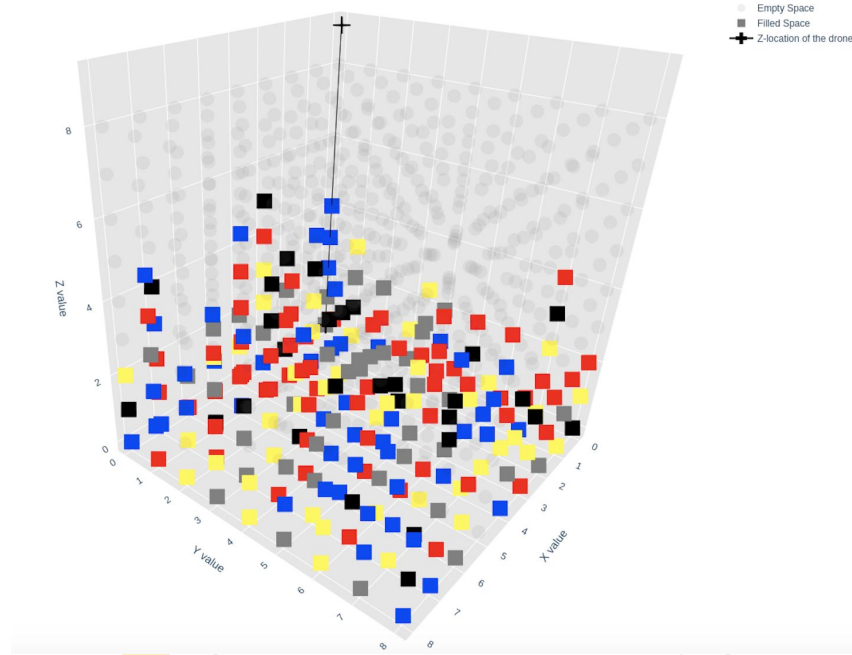
Solution - Algorithm Design

- Iterative design
- Two Stages:
 - Building stacks of similar blocks
 - Constructing the solution from the stacks
- Optimization
 - Use of shortest path algorithms
 - Pillars built to minimize inaccessible blocks

Algorithm Demo



Algorithm Visualization



Relation to Engineering Change Lab (ECL)

- ❖ Seek purpose: the better the algorithm, the more positive affect our company has on its stakeholders.
- ❖ Take responsibility: we are proud of our model and can comfortably explain our design choices.
- ❖ Expand involvement: our design made us work outside of our comfort zone with .
- ❖ Widen approaches: The drone is a novel approach to this type of problem, which might be solved using more traditional engineering techniques.
- ❖ Advance understanding: our solution allows for others to develop solutions in similar ways.
- ❖ Realize diversity: The solution mostly focuses on the client. We are missing the effects on other stakeholders.
- ❖ Deliberate values: sustainability was a big part of this project. Making the code manageable for the future



Next Steps

- ❖ Look into different methods of optimization
- ❖ Consider alternative solutions
- ❖ 3D visualization with camera as opposed to single 2D image
- ❖ Evaluate effects of solution on stakeholders
- ❖ Coordinate with other Engineers outside the team to incorporate a diverse set of ideas

Questions?