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Project Title: 3-D Cubic Spline

Overview:
We present an approach to implement cubic spline interpolation for 3D cubic grid. Depending on what type of curve it is, such as linear, quadratic or cubic, we implemented different Bezier equations for each to get the next value.

Algorithms:
Implemented are linear, quadratic, and cubic Bézier algorithms. Currently, the default is cubic Bézier with fifty sample points between the beginning and ending points. For instance, the cubic Bézier does interpolation between four points, and then moves onto the next four points to interpolate until the end is reached. Each individual splines are then connected to create the final spline. To note, linear would require two points, and quadratic curves would require two points.

Code Organization:
Simply, the graphical user interface is contained in main.py, and the Bézier algorithms are in BezierCurve.py. In the beginning of BezierCurve.py, linear and quadratic options are also available for interpolation. The number of sampling points can also be chosen, with the default set to 50. The actual spline can also be observed by uncommenting plt.show() on line 203 in BézierCurve.py.

Inputs/Outputs:
The inputs to the program are simply the x, y, z control coordinates found in smooth_path.csv, and the size values in GCorridor.csv. The Bézier functions then run and create intermediary sample points between the control coordinates. These points are then plotted onto the graphical user interface.

Performance:
To test each different Bézier curve, Python's built in library "time" was used. We found that all of the functions doing the interpolation using Bézier's ran in linear time. If we increased the points sampled by a factor of 10, then the time it took also increased by a factor of around 10. Although they all increased linearly, linear Bézier ran the fastest, with quadratic Bézier next, and cubic Bézier being the slowest. There is little surprise in this because linear only requires calculations between two points while cubic Bézier uses four points.