A novel Bezier curve control point search algorithm for autonomous navigation using N-order polynomial search with boundary conditions

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ABSTRACT
The study on path planning at intersections such as roundabouts has become a crucial aspect for autonomous vehicle development. This is due to the nature of the intersections, which can vary depending on the level of complexity. Path generation for an autonomous vehicle in a roundabout cornering is done using different curve fitting methods such as clothoid curves, Bezier curves, etc. However, the Bezier curve is the most widely used in the curve fitting algorithm for vehicle path planning as it can generate a possible number of path maneuvers. However, the main challenge when using the Bezier curve fitting algorithm is finding its control points. The control points are a crucial part of Bezier curve generation as it determines the curvature and shape of the curve. Therefore, a new technique for finding the control points of a Bezier curve is presented in this paper. The process starts with random points selection along the path. Specific random points will be selected through which the curve should pass through. The algorithm then expands the generalized Bezier curve equations to solve the mathematical problem and eventually, the simultaneous equation will be formed for the control point generation. The generated control points will be able to generate a proper Bezier curve that passes through all the selected points along the path. The generated equations are further validated in a test case study to show the effectiveness of the proposed method. This method is able to generate the desired Bezier curve through the selected points. This will open possibilities to generate a smoother predictive motion output using the Bezier curve fitting technique.

KEYWORDS
Bezier curve; Control points; Curve fitting; Path planning

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