



A Novel Triangular-Based Estimation Technique for Bezier Curve Control Points Generation on Autonomous Vehicle Path Planning at the Roundabout Intersection

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Abstract

Path planning plays a major role in autonomous vehicle navigation. Among different kinds of intersections, roundabouts are far more difficult to plot a course than other intersections due to their special design. Different curve fitting methods such as circles, clothoid curves, Bezier curves are utilized for path planning inside a roundabout. Among those Bezier curves are widely used as they can generate a possible number of paths. However, the major drawback when adopting a Bezier curve is locating its control points. Control points need to be placed correctly for the path to generate. Roundabouts have varying shapes and sizes, there is no one-size-fits-all strategy for locating the control points in a roundabout. Moreover, the circulating path of a roundabout is generally formed based on the radius of the circular path, but this method cannot be applied in all roundabouts since the roundabout can have variable shapes depending on the available space. Therefore, this paper introduces a new method called the triangular-based point selection approach for locating the control points for a Bezier curve traversing a path. The triangular-based point selection approach is used to find points on the road to calculate the control points of a Bezier curve passing through these points. The circular path is likewise created using Bezier curve allowing the path to follow the contour of the roundabout. The proposed method is demonstrated in an oval-shaped roundabout and tested using a vehicle model also the proposed path generation algorithm is compared with other path planning methods.

Keywords Autonomous vehicles · Bezier curve · Control points · Path planning · Roundabouts

1 Background and Introduction

In the last decade, several improvements have happened in the field of vehicles. Different kinds of driving and safety assistance have been added to vehicles to enhance their autonomous capabilities. The Advanced Driver Assistance System (ADAS) helps reduce accidents caused by human errors. These helps assist drivers in various situations for controlling vehicle. Many researches have been going on

to develop a fully autonomous vehicle that is able to travel through different kinds of situations and obstacles [1].

Driving a vehicle requires an expertise of a driver. There are many situations such as different road types, different kinds of intersections, and different rules drivers must follow while driving [2]. Different kinds of driving controls such as emergency braking, adaptive cruise control have been introduced in vehicles to make driving on a highway easy. These help in longitudinal control of the vehicle. But vehicles must overcome different intersections when it comes to the urban environment. There are different situations such as roundabouts, U-turns that vehicles must travel without causing any traffic. Researches are going on to develop a system that can overcome all kinds of intersections and road types without causing any kinds of traffic congestion.

Among different types of intersections, roundabout is a type of intersection where path generation is difficult when compared to other intersections. It is due to the shape and traffic rules to be followed depending on the exit [3]. The

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