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ANALYSIS OF THE EXISTING ROBUST METHODS FOR OBSTACLE DETECTION IN THE UNSTRUCTURED ENVIRONMENTS

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In the current global environment, autonomous mobile robotic systems, such as unmanned aerial vehicles (UAV) or ground robots, have gained immense popularity worldwide and play an invaluable role in almost all spheres of human lives [1, 2]. One of the indefeasible components in the software part of any autonomous system of the above type are obstacle detection and subsequent trajectory planning problems [3]. Accordingly, the effectiveness of obstacle detection and subsequent trajectory planning in the software directly determines the identical characteristics of the entire autonomous system. Therefore, taking into account that the given factor designates the critical need to consider al solution in this area, this research is aimed to provide it.

Obstacle Detection Algorithm – unified definition for a set of approaches designed to identify and classify objects in surrounding space (two-dimensional or three-dimensional) through the mathematical transformation of graphical or audio raw datasets [4].

The first method [5] that will be considered is obstacle detection using depth Images. The core idea of the proposed method is to use a stereo depth camera and the following property of its output data: the density of the U-depth map elements increases as the autonomous system's camera approaches the obstacle closer. Accordingly, an obstacle can be considered as the area of interest that has a signature that exceeds the previously determined threshold value, which is defined by the formula

$$S_{OI} = f \cdot \frac{S_P}{d},$$

where f is the focal length, S_P is a predefined threshold value for the area of interest that allows it to be considered as an obstacle in surrounding space, and d is the current value of the image depth parameter from the camera output. Using this classification algorithm, areas of interest can be grouped up and inserted into either three-dimensional bounding boxes or two-dimensional bounding frames for further analysis.

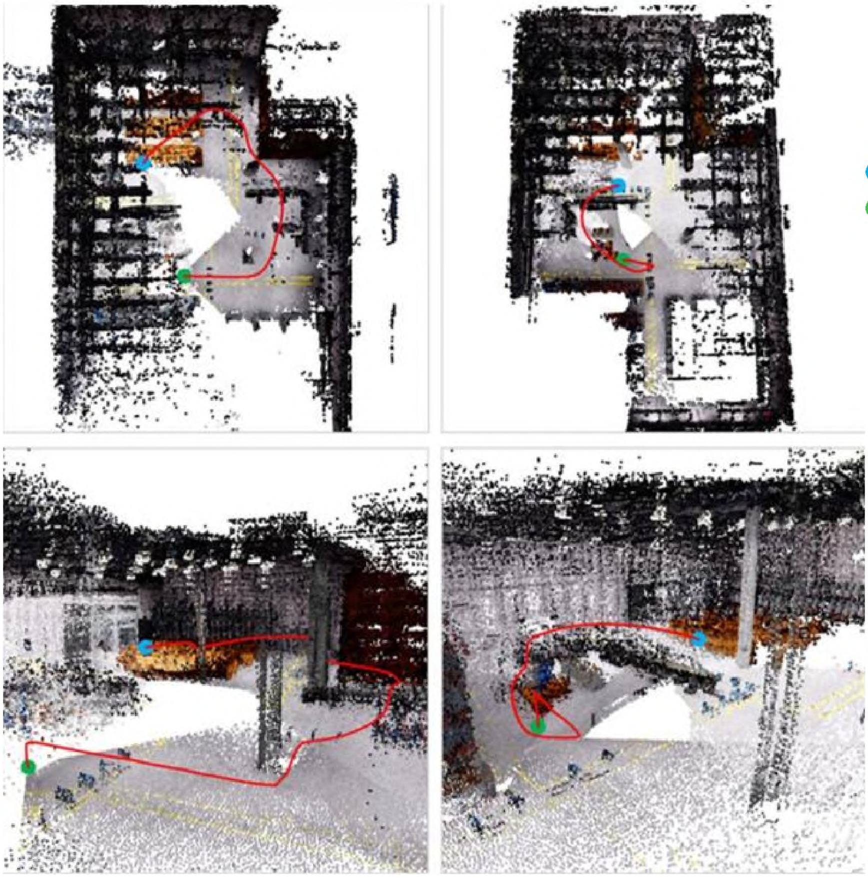
It goes without saying that an identical approach can also be used to identify objects that determine the surrounding space – "walls".

The second method involves 3 stages. In the first stage, input data is gathered from either Lidar or a depth camera. Consequently, it acquires the form of a point cloud and the segmentation is used to identify walls, floors and ceilings (see Figure). In the second stage, the Euclidean Clustering method is used to group the points together if they fall into a group with a threshold distance. At last, the third stage involves placing a bounding box around the individual clusters formed by the clustering algorithm [6].

In this paper, we shall conclude our presentation on that point as further, more detailed, information will be provided in the main article text.

Therefore, we shall move to the graphical part in which we will introduce trajectory planning algorithm point clouds from the simulated environment (see Figure).

Simulation 1 Simulation 2



Simulated environment scanning results conducted by using the proposed algorithm

From the simulation results, we can conclude that the analyzed methods fulfil the estimated needs for further development and practical application.

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