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Line Follower Algorithm for a Flying Quadcopter

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Line Follower Algorithm for a Flying Quadcopter

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As interest in aerial drones and autonomous systems grows, so does the need for optimal solutions that can be run on minimalistic hardware. This paper describes an autonomous, vision-based algorithm designed for participation in the MathWorks Minidrone Competition. The algorithm was developed within competition' s specification [1] and the authors won the 3rd place in the nationwide MathWorks Minidrone Competition Poland 2025 [2]. The work done included research on publicly available, already existing solutions [3] as well as on tools that could be applied to the task at hand [4], [5]. As a result a custom vision algorithm was developed to balance fidelity and speed and to minimise the computing power required. The drone software, written entirely in Matlab is capable of controlling a Parrot Mambo mini drone tasked with traversing a course made of red straight lines joined at different angles. The programme is designed around a built-in low-resolution camera pointing downwards. The work focuses on the design and development of an image processing algorithm as well as path planner and flight control programs that transform a low resolution image into a list of instructions for the drone.

Full version with pictures can be found attached below.

References
[1] Contest rules: https://www.mathworks.com/content/dam/mathworks/mathworks-dot-com/academia/student-competitions/minidrone-competition/mathworks-minidrone-competition-guidelines.pdf
[2] Contest results: https://ont.com.pl/wydarzenia/minidrone-poland-25
[3] Projects reviewed: https://github.com/Rutwik1000/Parrot-Minidrone-Competition/tree/f176186176548ac9ab66335d6225048e436e043c; https://github.com/mar4945/Vision-Based-Pure-Pursuing-Algorithm
[4] Min-max algorithm: https://arxiv.org/abs/2011.14035
[5] Imfindcircles function: https://www.mathworks.com/help/images/ref/imfindcircles.html

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