The Vector Field Histogram – Fast Obstacle Avoidance for Mobile Robots

IEEE Transactions on Robotics and Automation, Vol. 7, No. 3, June, 1991.
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1. The author describes some other methods for doing obstacle avoidance, what kind of problems do they have that are solved in the Vector Field Histogram method?

2. The authors uses a very simple sensor model when they incorporate new sensor readings into the histogram grid – what are the arguments for using such a simple model? Does it make sense to you?

3. How does the Vector Force Field (VFF) method work? What drawbacks does it have? Explain this by making a small example of the VFF method. Why is it necessary to use a low-pass filter in the control loop when using the VFF method? What is gained and what is the price of the low-pass filter?

4. Describe the different step in the Vector Field Histogram method. How is the histogram grid updated? How is the polar histogram calculated? How are the steering signals calculated?

5. How is the steering angle determined, i.e. from the polar histogram – how is the steering angle calculated? Does the method allow the robot to approach an obstacle or is it always trying to avoid the obstacles?

6. The authors use a threshold value to determine candidate valleys – can you think of a way of adaptively set this threshold?

7. If an obstacle (e.g. a human being) turns up in the desired path of the vehicle, which means that the only sonar that detects the newly arrived obstacle is the sonar in the vehicle's target direction – will the VFH method avoid this obstacle, or will it simply run it over? Motivate your answer.

8. What is the main reason that the VFH method works much better than the edge-detection method?

9. The robot used in the experiment is a three-wheeled synchro drive vehicle – derive the kinematic model of this vehicle.