

Design, Construction and Calibration of a Laser-based Fog Detector

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Abstract. How well do low powered lasers can transmit through fog? A transmission system works better than a reflective system because when the laser is reflective behind the fog some of the laser is reflected off the fog itself and the light from the target and the fog gets confused.

Keywords: Engineering, laser, fog, calibration

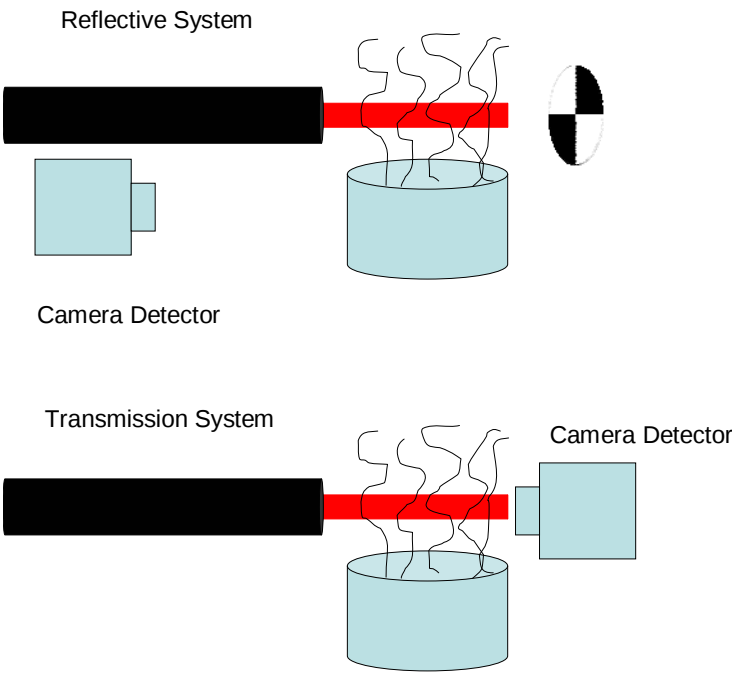
INTRODUCTION

Fog detection on bridges can help avoid large scale crashes. Also it can help on highways to warn drivers about fog that can hinder the sight of motorist. Typical systems rely on helicopters in the air. To detect fog I built and calibrated a laser-based fog detector.

METHODS

Fog was created by placing boiling water under an ice water bath to generate fog. Then a secchi disk was placed on the wall and the fog setup was placed in front of it. A camera was placed on a tripod so to make the same picture every time. A transmissive system was created by using the same setup, but instead of shooting the laser at a target I shot the laser directly at the camera through the fog.

RESULTS



The top is a Reflective system where a low powered laser is targeted through the fog at a secchi disk which shows the contrast of the laser. It is then reflected off the secchi disk and back through the fog at a camera acting as a detector. The bottom is a transmission system where instead of the laser being reflected of a secchi disk it is shot straight at the camera.

Pictures	Red Value	Blue Value	Green Value
Without Fog	212	57	29
			
With Fog	159	34	15
			

DISCUSSION

The reflective system is much simpler than a transmission system. However the laser may reflect off of objects in the environment. This would produce mixed results that are inaccurate. The transmission system is bigger and more complex but the results are more accurate. The laser is shot directly at the detector so nothing is distorted on the way back to the detector like in a reflective system.

CONCLUSIONS

It is possible to make an effective calibrated fog detector with a low-powered laser and a simple camera. A transmissive system works better than a reflective system for the detection of fog.

ACKNOWLEDGMENTS

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