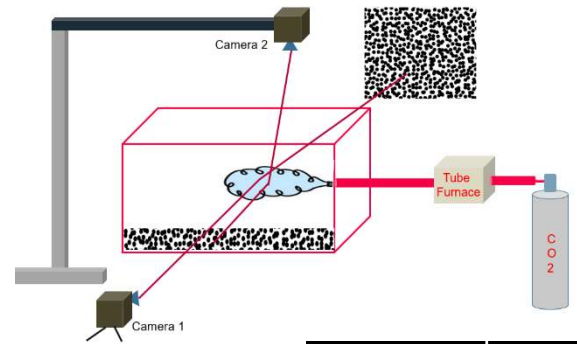


Development of 3-D Gas Schlieren Imaging Sensor (GSIS) System for Vehicle Exhaust Imaging – Master Thesis (30 ECTS)

Thesis Description

Background Oriented Schlieren (BOS) is a well-known method of visualizing a flow using the variations in its refractive index. Changes in temperature, pressure, concentration, composition or humidity cause variations in the refractive index. A 2D Gas Schlieren Imaging Sensor (GSIS) system has already been developed at the Institute. The GSIS system setup consists of a system control PC, a device control unit (Raspberry Pi 4B), digital cameras (Raspberry Pi HQ camera), a pattern board and a GPU (GeForce RTX 3080) for fast image processing and object detection using convolutional neural networks (CNN). The system can be used for both qualitative and quantitative analysis of gases and vehicle exhaust. In this thesis, the 2D GSIS system will be extended to a 3D GSIS system using multiple cameras.



Objectives

The thesis comprises

- Literature research: Background Oriented Schlieren (BOS), 3-D BOS, 3-D reconstruction from 2D, BOS – Tomography and Advanced image processing techniques
- Design and Development of 3-D BOS setup (Raspberry Pi 4B, HQ digital cameras)
- Construction of 3-D images of gases using 3-D BOS setup (Python, OpenCV)
- Post processing of images (Python, OpenCV)
- Object detection using Deep Learning (Training and Testing images with GPU and CNN) (optional)

Organizational Matters

Field of Study: Electrical Engineering, Information and Communication Engineering, Digital Engineering or similar with experience in Python

Duration: from now/6 months

Workplace: EMS, Inffeldgasse 33/I

Employment: up to 20 h/week

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