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## Concept for open-path gas measurements between a drone and a base station

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We present a platform for open-path tunable diode laser absorption spectroscopy between a drone and a base station. This is a step towards an open-path measurement between two collaborating drones, which to our knowledge has not yet been achieved. Such a system enables mapping of remote (permafrost tundra, e.g.) or hazardous areas (landfills, e.g.) and localization of emissions. We use a commercially available quad-copter drone that carries a reflector and a LED for being tracked. The base station consists of a self-made pan-tilt unit that carries a camera to track the drone, and the optical measurement system. The base station is controlled through a field-programmable gate array. We decided to build the base station ourselves to ensure a fast response, enabling tracking of the drone. To demonstrate the concept, our tunable diode laser absorption setup is tailored towards the detection of ammonia (NH<sub>3</sub>) because of its fairly strong absorption, and thus comparatively easy detectability. The distributed feedback laser operates at a centre wavelength of 1512 nm, with a bandwidth of approximately 2 nm (full width at half maximum), and a typical output power of 10 mW. We characterize the stability of the drone, the reflector, and the laser system. We aim to further develop this concept such that it (a) can be implemented on two collaborating drones, without the need for a base station, and (b) to measure other greenhouse gases or pollutants, such as methane or hydrogen sulphide.