Masterproef industriële ingenieurswetenschappen

Flash photography vision system for inkjet drop formation

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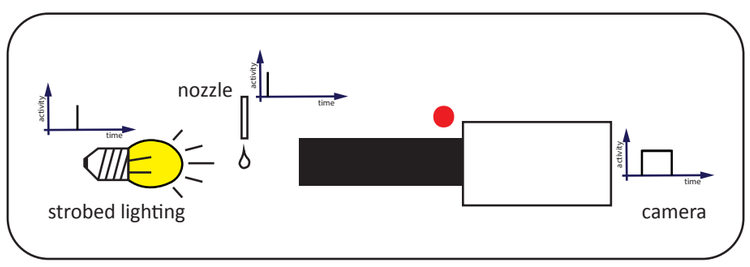
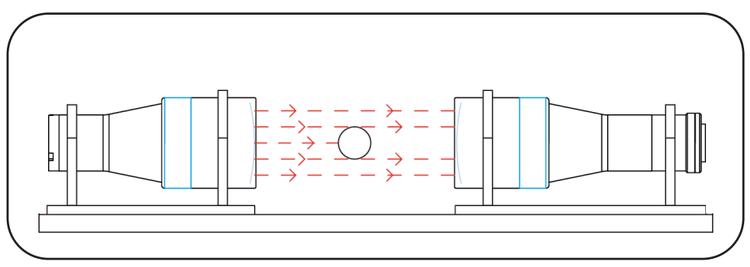
Introduction

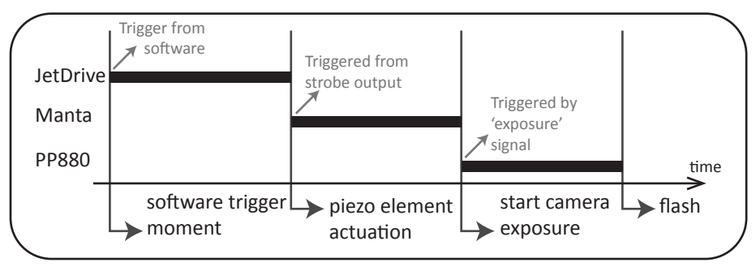
Functional printing holds the promise of, among others, foldable light emitting or absorbing devices (OLED/OPV) and intelligent clothing. As a printing technique, drop-on-demand (DoD) inkjet printing is able to picolitre volumes of material solutions with high precision in a non-contact manner and go from design to production with little or no start-up overhead. Inks with certain properties (e.g. conductivity) are hereby used but can only be DoD ink jet printed within very strict boundaries if the ink's exact material behavior is known. Optical inspection of the droplets can be used as a fast and reliable way of characterizing a new ink before printing. On this poster, a machine vision system is therefore be presented which is capable of inspecting ink jet droplets along their entire path from printhead to substrate.

Methods and materials

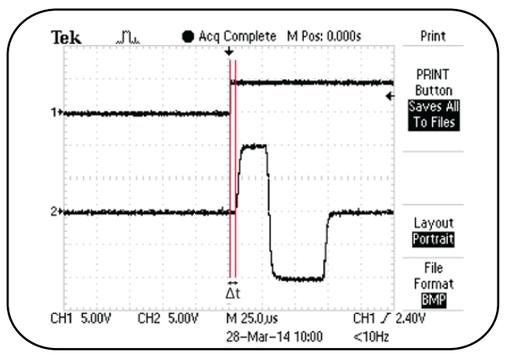
To image falling droplets very precisely, flash photography was designated as the method of choice. Not the mechanical shutter speed of the camera, but instead the effective lighting time of the strobed light source is thereby decisive for the effective exposure time of the droplet. The usage of bi-telecentric lenses furthermore ensures sharper and more accurate images by reducing side-effects and aberrations. A time critical hardware circuit moreover guarantees reliably timed capturing of images for further processing in LabView.

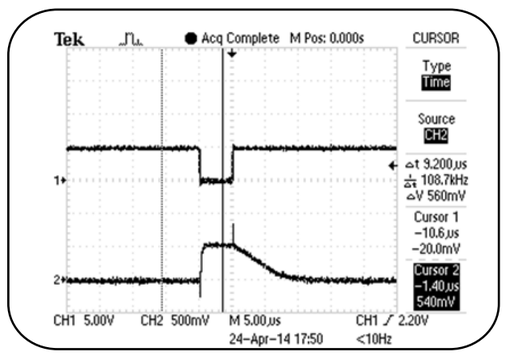






Experiments

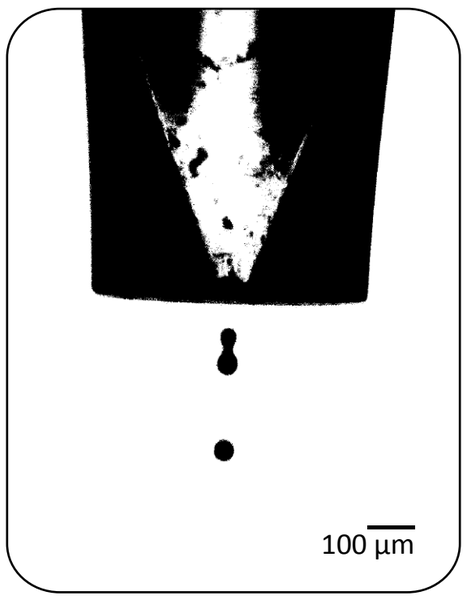




The intrinsic delay of each component in the time critical hardware circuit was determined by a series of oscilloscope measurements (top).

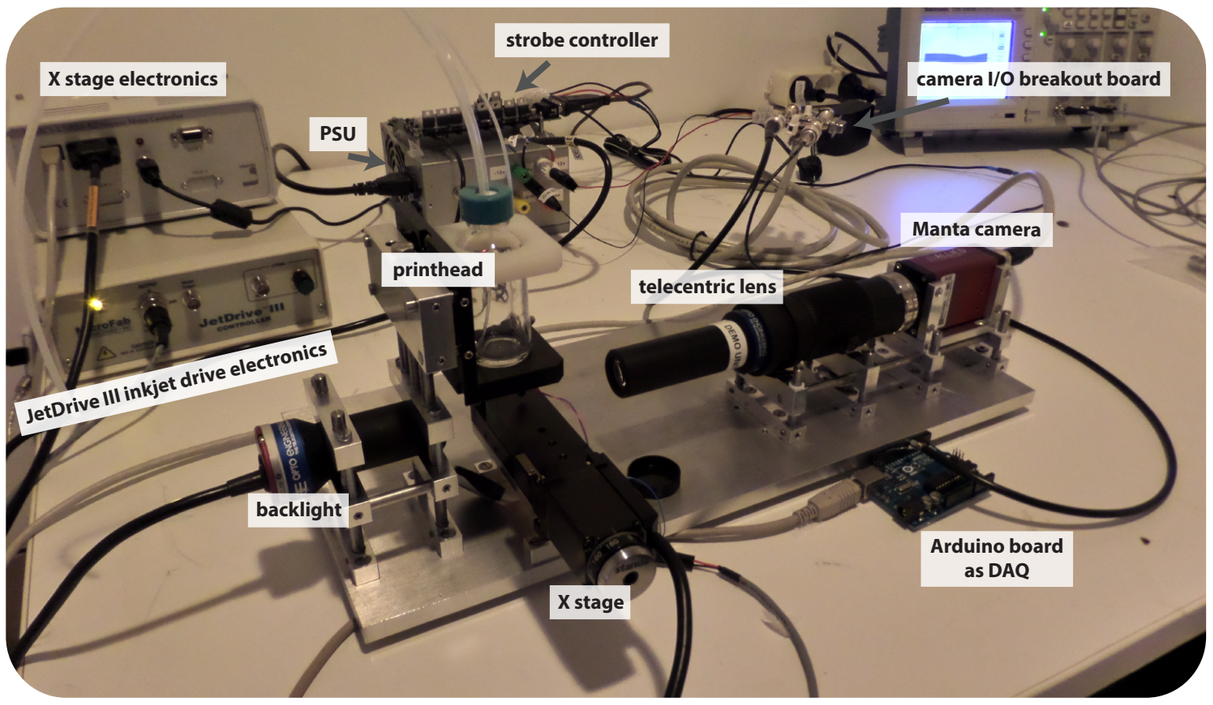
Following this, a verification was performed on the presence and timing of the optical light pulse (top right).

Finally, a drop formation process was succesfully captured in a sequence of images. (right)



Discussion/Conclusions

The result of this thesis is twofold. On one hand a carefully composed vision system is made which is able to observe droplets and of which the accuracy is determined. On the other hand, measurements have been taken from resulting camera images for one fixed printhead configuration. Properties of the main drop were then ultimately deduced from these measurements and found to include a 24µm radius, 1.08m/s average speed and 62 picolitres estimated volume.



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