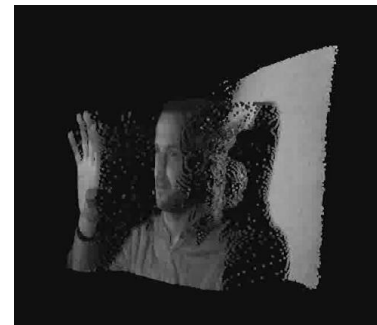


# Master-Thesis

## Optical Simulation of a Lens System Applied to Very High-Resolution Time-of-Flight imaging

Unlike traditional RGB cameras, which capture only color and intensity information to produce 2D images, ToF sensors offer an approach to depth perception. Amplitude Modulated Continuous Wave (AMCW) ToF sensors are a specialized type of ToF sensor that utilize continuous wave modulation to measure distances. Instead of emitting discrete light pulses, AMCW ToF sensors emit a modulated continuous wave of near-infrared light. By calculating the phase shift of the reflected light, these sensors are able to retrieve the distance to objects with exceptional accuracy. ToF imaging is used in a wide range of applications, from industrial automation and robotics to consumer electronics like smartphones and gaming consoles. However, the resolution of ToF sensors is much lower compared to 2D cameras.



Range image of a human face captured with a time-of-flight camera (artist's depiction). © Wikimedia.

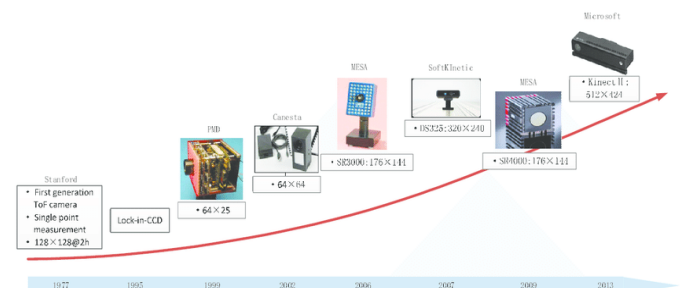
To bridge the gap between ToF sensor resolution and traditional camera resolution, a spatially-multiplexed demodulation will be used to attain high-resolution ToF imaging. The simulation results of the optical system (consisting of a set of lenses) are crucial. Different combinations of optical components will provide multiple options for constructing very high-resolution ToF imaging systems. Lens selection, performance simulation, and the analysis of performance differences between various combinations are fundamental tasks within this project.

### Requirements:

- Experience with ZEMAX or similar optical simulation tools
- Familiar with the composition and working principles of cameras (ToF)
- Good English

### After completing this work, there are good career prospects in the following fields:

- Optical Simulation
- 3D imaging
- Signal Processing



Evolution of the resolution of ToF cameras. © He, Ying & Liang, Bin & Zou, Yu & He, Jin & Yang, Jun. (2017).

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