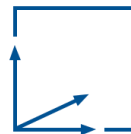


Optimizing Pens for Use as 3D Ray Casting Interactables with Monocular 6-DoF Object Tracking

Min-Shan Luong

09.01.2020



Kickoff: Bachelor Informatics: Games Engineering

Supervisor: Prof. Gudrun Klinker, Ph.D.

Advisor: Linda Rudolph

Introduction / Motivation

- Use in the industry
- Workers already have many tools
- Input via hand may have low precision



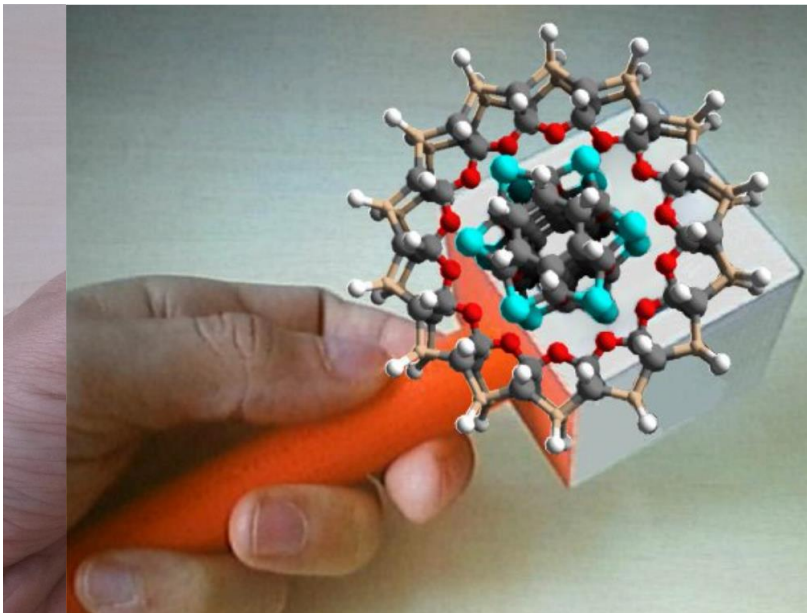
[Figure 1] Work Environment in the Industry

Problem Description: Issues

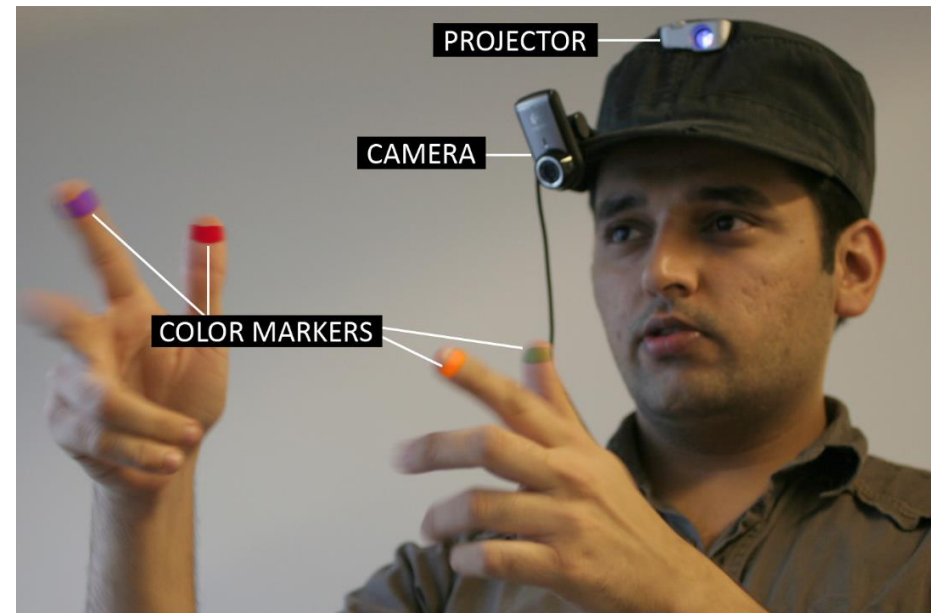
- Multiple stationary cameras not desired:
 - lack of space
 - Employee monitoring
 - one mobile camera attached to user
- Stable Tracking
 - Jittering through lack of accuracy
 - Occlusion of feature points
 - Find suitable object
 - Find appropriate algorithm

Existing Solutions / Related Work

- Cube Markers -> Augmented Chemical Reactions (Maier)
- WUW - Wear Ur World - A wearable gestural interface



[Figure 2 & 3] Cube marker used for augmented chemical reactions



[Figure 4] Prototype of Wear Ur World

Goals of this Thesis

- Object detection (& 6DoF tracking) for one stationary camera
- Find approach to increase accuracy in object detection / tracking
- Find optimal object/shape for tracking and detection

Proposed Work / Approach

Implementation:

C++
OpenCV
PnP + RANSAC

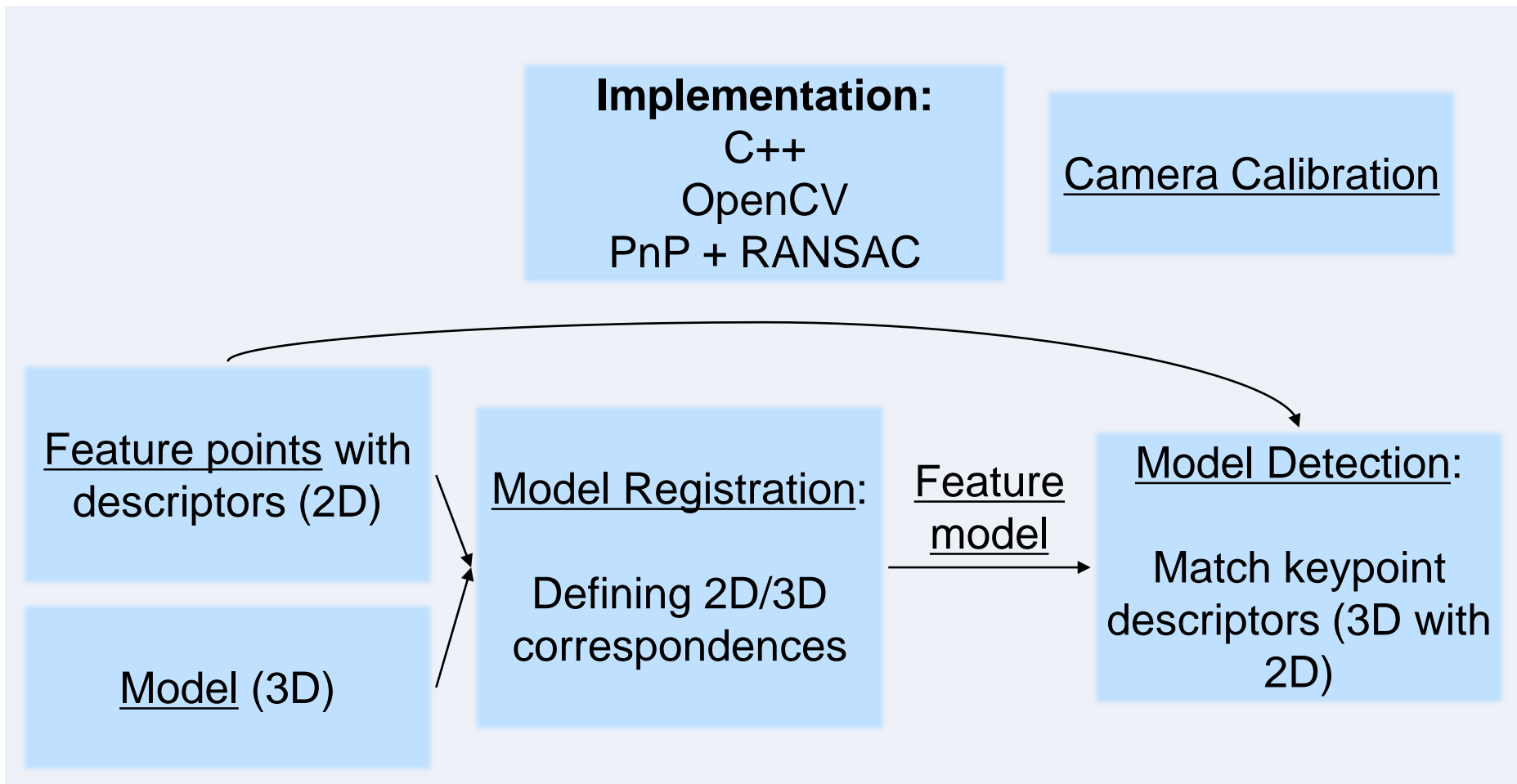
Design:

Blender
3D printer
Paint/stickers(?)

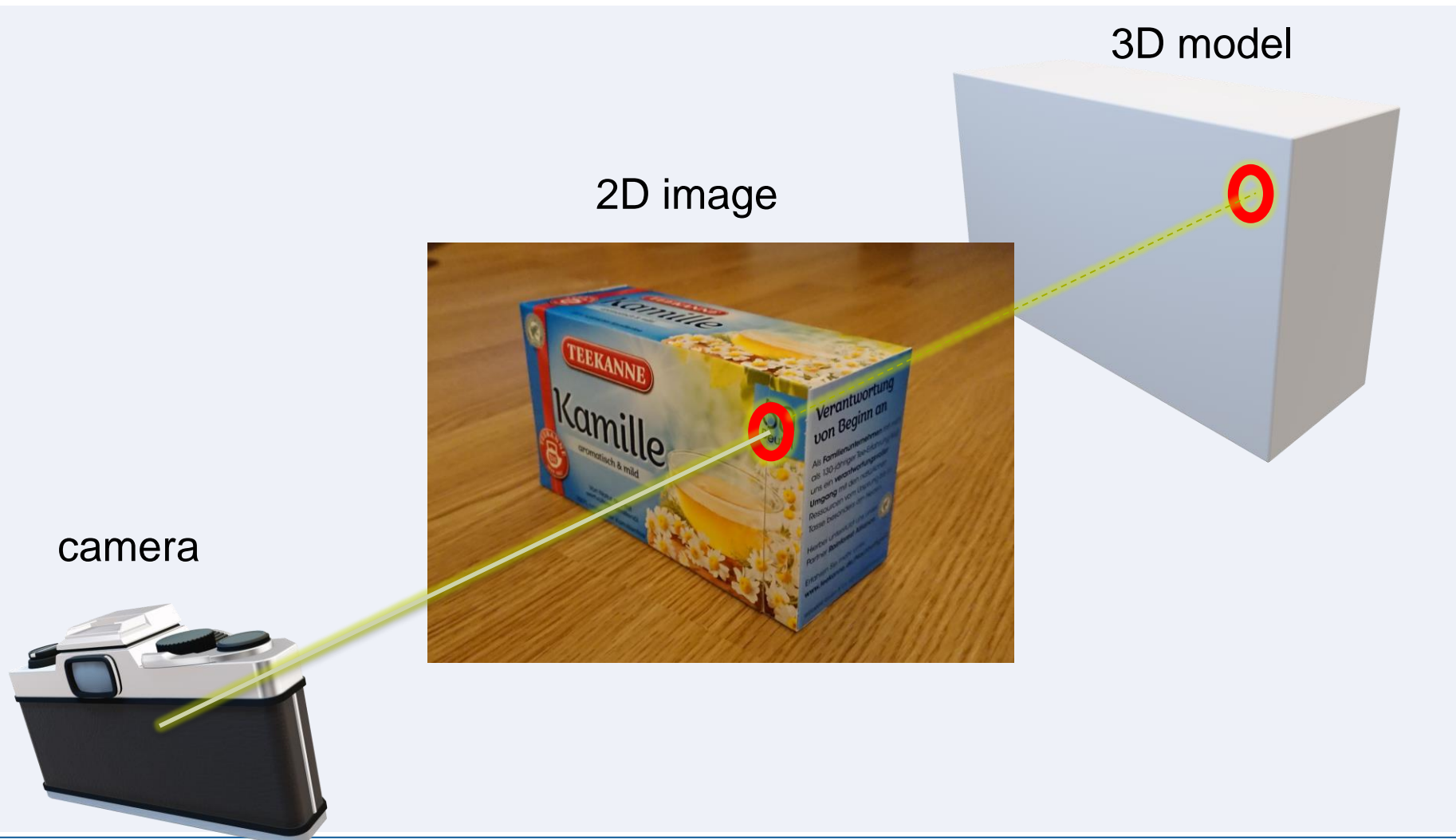
Evaluation:

Tracking quality
Slider & Turntable
Runtime measurements

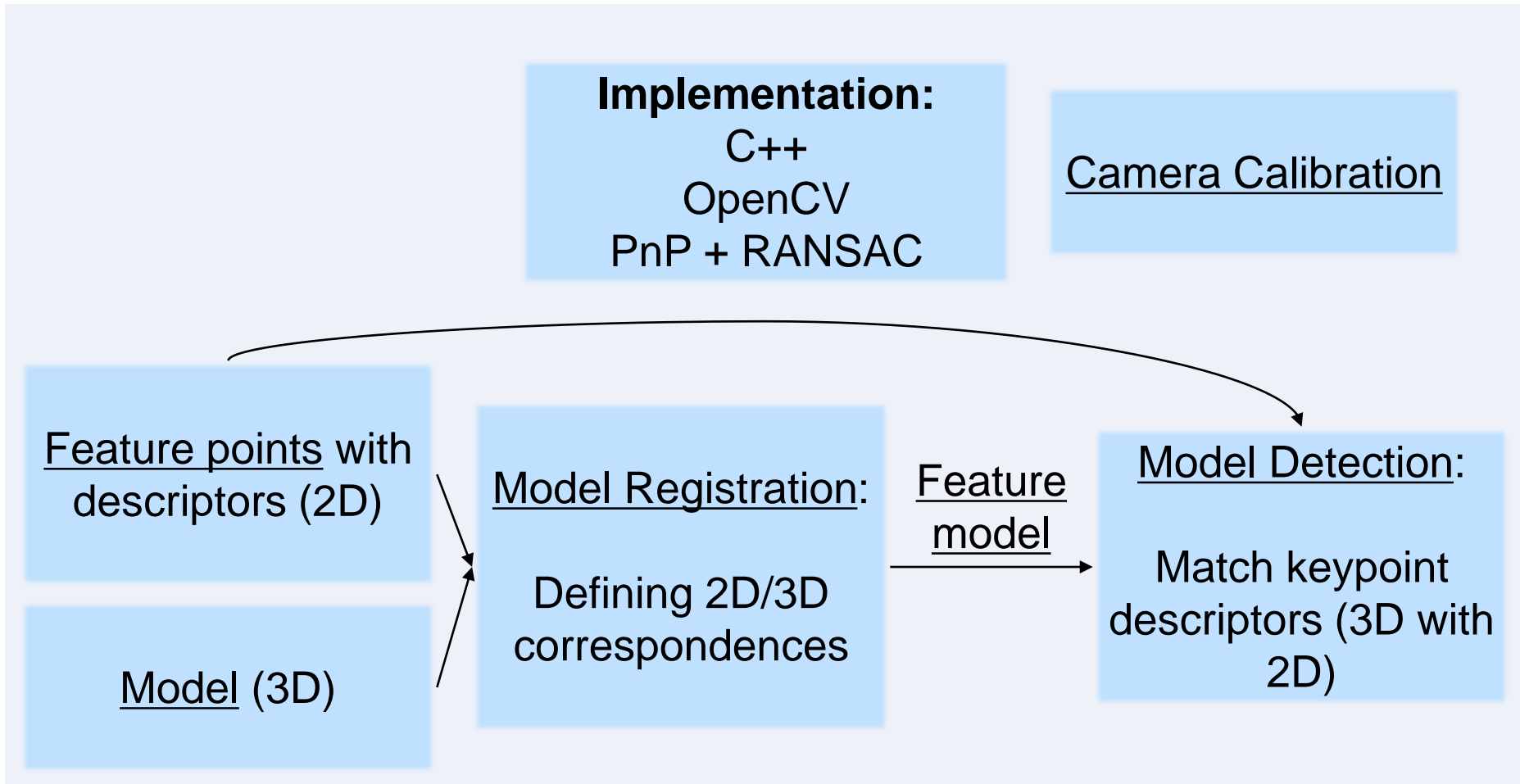
Proposed Work / Approach



Proposed Work / Approach



Proposed Work / Approach



Proposed Work / Approach

Implementation:

C++
OpenCV
PnP + RANSAC

Design:

Blender
3D printer
Paint/stickers(?)

Evaluation:

Tracking quality
Slider & Turntable
Runtime measurements

Discussion of Potential Issues

- Illumination (unbalanced or poor light condition)
- Motion blurring through fast movement
- Anatomic occlusion



[Figure 5] Motion blurring through fast movement seen by means of dices



Anatomic occlusion of the object marker

List of References

- [1] Image from Nataliya Hora, downloaded from <https://www.it-production.com/produktionsmanagement/synchrone-prozesse-in-der-produktion/> in December 2019
- [2], [3] Images from Patrick Maier, *Augmented Chemical Reactions - Research on 3D Selection and Confirmation Methods* (Munich, 2014)
- [4] Image from P. Mistry, P. Maes, L. Chan, *WUW - Wear Ur World - A Wearable Gestural Interface* (Boston, 2009)
- [5] Image downloaded from <https://www.fvfx.net/how-to-use-motion-blur-in-maya/> in December 2019