MIDIH
MANUFACTURING·INDUSTRY
DIGITAL·INNOVATION·HUBS

AWEAR

MANUFACTURING SME AND CHALLENGE

The **AWEAR (A Wearable Expert Augmented Reality System)** platform enables the creation of **3D maps** of complex industrial facilities with **low-cost mobile sensors**.

Based on the created offline models and current sensor data (RGB + IMU), the AWEAR platform is able to accurately **localize the worker** (position and orientation) without the need of further expensive sensing infrastructure and **provide assistance** in the form of augmented navigation guidance for e.g. maintenance workers or remote expert applications.

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SOLUTION: ARCHITECTURE AND COMPONENTS

The **AWEAR** solution consists of:

- **Point cloud generation** using depth cameras and RTAB-Map [La19]

- **Localization** of the user via the image feature-based ACG-Localizer [Sa11] and **tracking** via Google ARCore (visual inertial odometry)

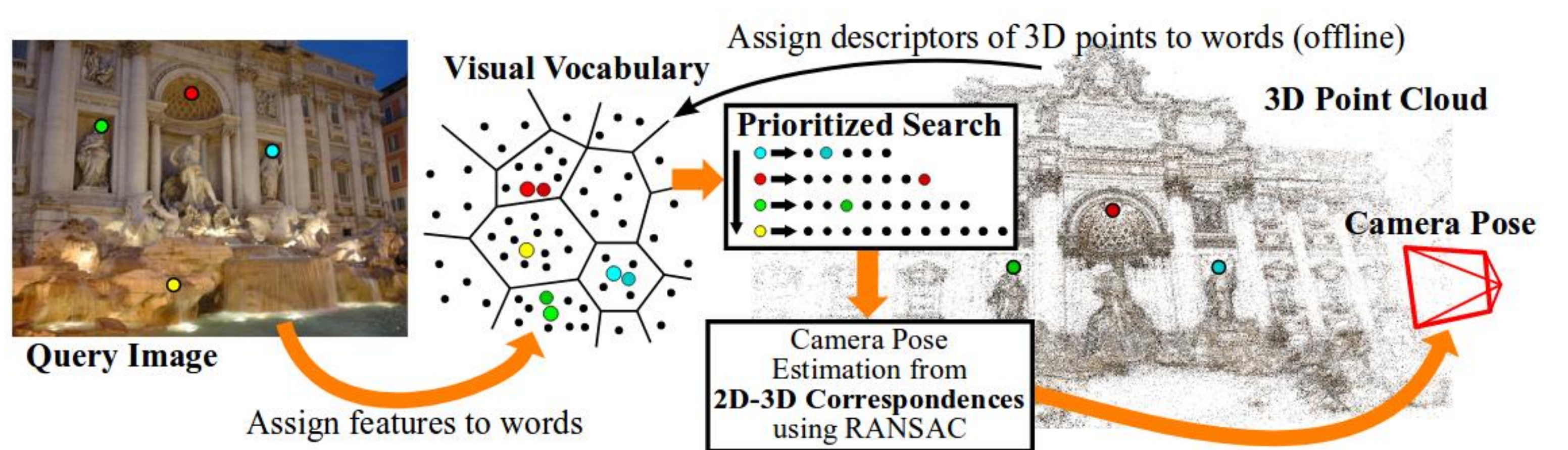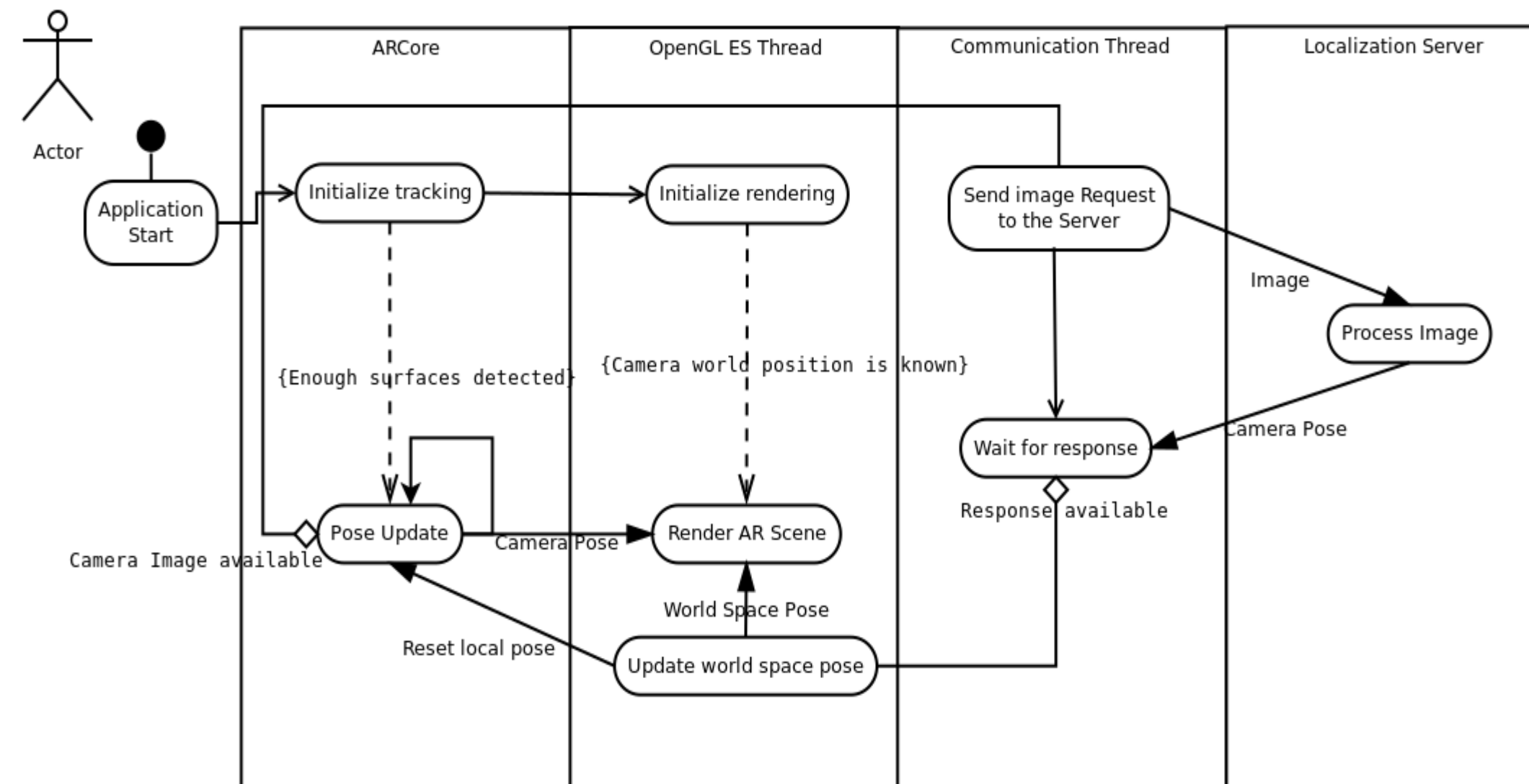- Display of **AR guidance markers** using the Unity engine

Illustration of localization based on 2D image features, from [Sa11]

[La19] Labbé, M., & Michaud, F. (2019). RTAB-Map as an open-source lidar and visual simultaneous localization and mapping library for large-scale and long-term online operation. Journal of Field Robotics, 36(2), 416-446.

[Sa11] Sattler, T., Leibe, B., & Kobbelt, L. (2011, November). Fast image-based localization using direct 2d-to-3d matching. In 2011 International Conference on Computer Vision (pp. 667-674). IEEE.

*Activity diagram of the implemented approach to fuse image-based localization with visual-inertial odometry*

Test setup: Lenovo Phab2 Pro smart phone, Lenovo ThinkPad notebook

BENEFITS AND LESSON LEARNT

Results from test at **training factory** at Politecnico di Milano:

- generated **3D point cloud** (right)
- **AR Navigation marker** displayed in localization on smart phone (bottom left)
- Overlay of **point cloud** and **AR marker** over camera image (bottom right)
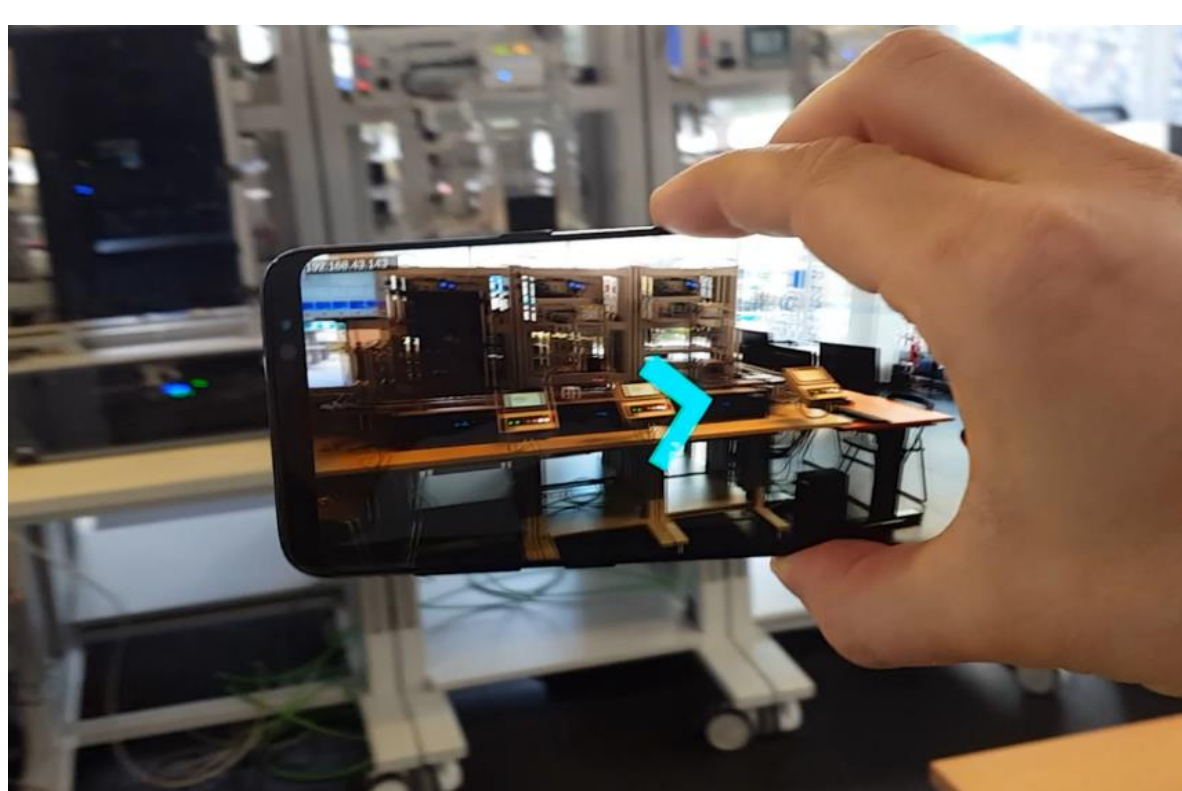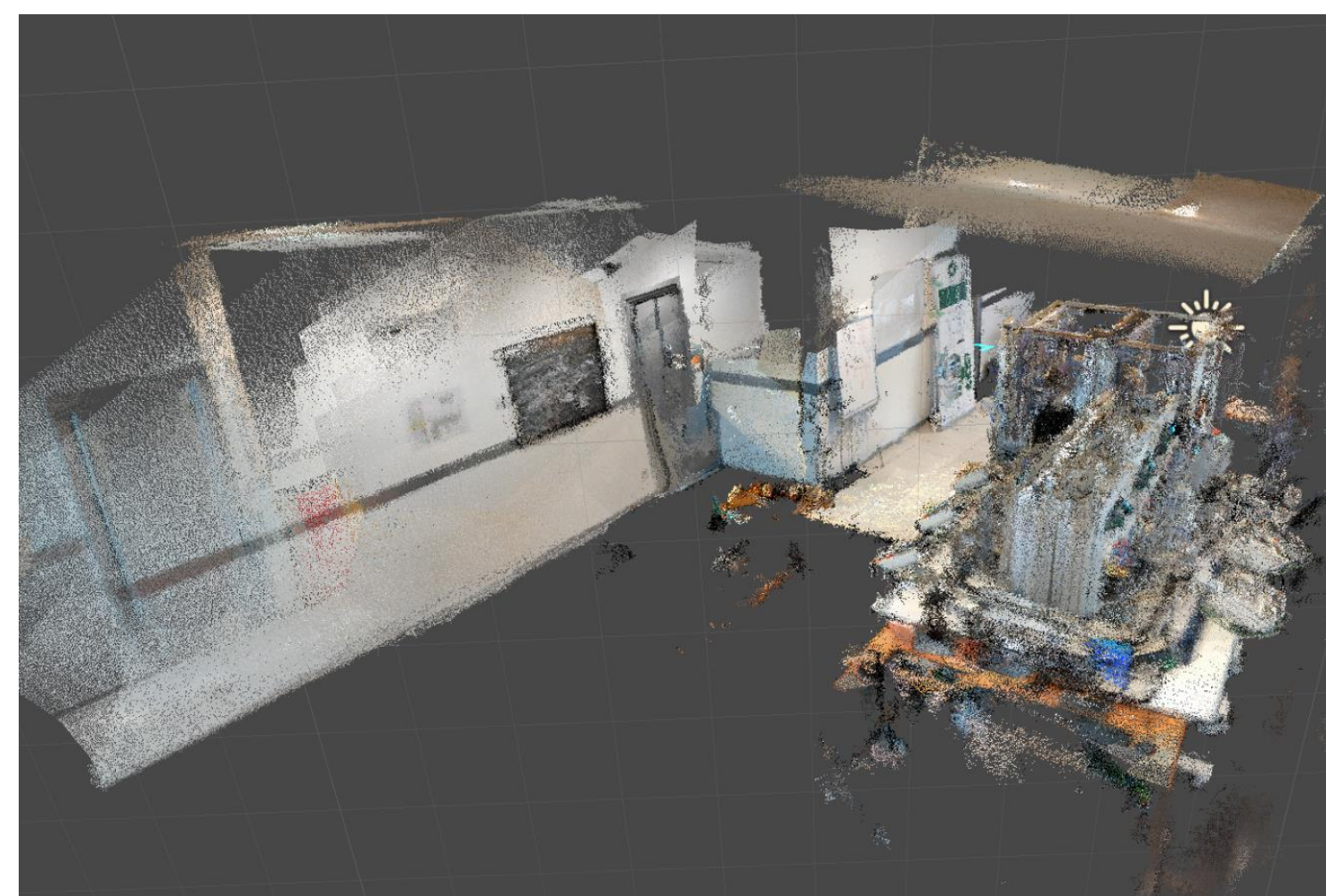
OUTLOOK

AWEAR platform successfully shown ability to
- **Generate a 3D model** of industrial space
- **Localize** user in mapped-out space
- **Guide** user to location using AR interface

Future exploitation plan in Augmented Maintenance Support:
I. **Pathfinding / Navigation** (current solution)
II. **Task Execution Support:** highlight parts, indicate work steps etc.
III. **Automated Documentation:** digital documentation of performed work steps using AR assistance systems

I4MS