Augmented Reality supporting the planning processes in PV plants

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Today the costs of planning and administration to setup a PV roof in Switzerland are much higher than the costs of PV inverter, for instance. Augmented reality has the potential to reduce these costs by supporting the planning process incl. further installation, operation & maintenance (O&M) tasks like:

- Measuring and collecting the data of the roof top size (Fig 5) including 3D objects on the roof relevant for causing partial shading of PV generators during the first site inspection of the roof
- Automatically transfer of the real up-to-date 3D roof top data into a PV planning tool to arrange semi-automatically the PV module layout in the plant design processes
- Visualize the placement of all PV modules including, related power electronics by augmented reality displays while site inspection of the roof for the first time (Fig 4 and Fig 6)
- Presenting the appearance of different types of black, blue or special colored PV modules by the augmented tool to the potential customer to check how it looks from different perspectives like from the street for example
- Automatic generation of an accurate cost estimation of bill of materials of the plant, with a few feedback loops for the planner to be able to hand out a convincing offer to the potential customer during the first meeting
- Installation task: augmented reality can assist the installer to locate a single component like module power electronic equipment on the roof and link it with the bar-code ID. Visualize a checklist in the AR-display for regular acceptance tests of a PV installation during first feed and automatically create the minutes of the final document.
- O&M tasks: optical module defect, growing plants – partial shading status; visualize checklist in AR-display for service tasks, like exchange a PV module, or PV inverter.

In a joint project the industrial know-how of one of the project partners to implement AR in optimizing measurement tasks[1] into a fully digitalized sales process to improve efficiency and the customer experience[2] will be transferred to the specific needs of the PV sector. First results of the comparison of existing measurement processes of the solar roof sizing, like automatic measurement using a drone at an uncertainty of a few centimeter[3] are in comparison with the newest generation of the Microsoft HoloLens 2.

First algorithms are in operation to make an automatic layout of the PV modules on the roof (Fig 4 and Fig 6) and instantaneously visualized on the AR display in the field. First estimation of the proposed energy yield of the PV plant are shown on request in the AR display (Fig 4).

Next steps are the implementation of the bill of materials and a first rough estimate of an offer. Additionally, the planning process is further on optimized to link it to commercial PV planning tools and make it ready to be used on the AR display and link it to a notebook for further data processing.

[1] https://kem.industrie.de/allgemein/microsoft-hololens-messgeraet-zuehlke-thyssenkrupp/

References:

[2] https://www.zuehlke.com/ch/de/success-stories/hololinc-digitaler-salesprocess/ and https://www.zuehlke.com/de/de/ueber-uns/presse-zuehlke/presse-news/treppenlift-trifft-augmented-reality-hololens/

[3] Philippe Staiger, «PV planning by Quadro copter», Project Work of MSE Master Thesis Studies at ZHAW, Oct. 2019

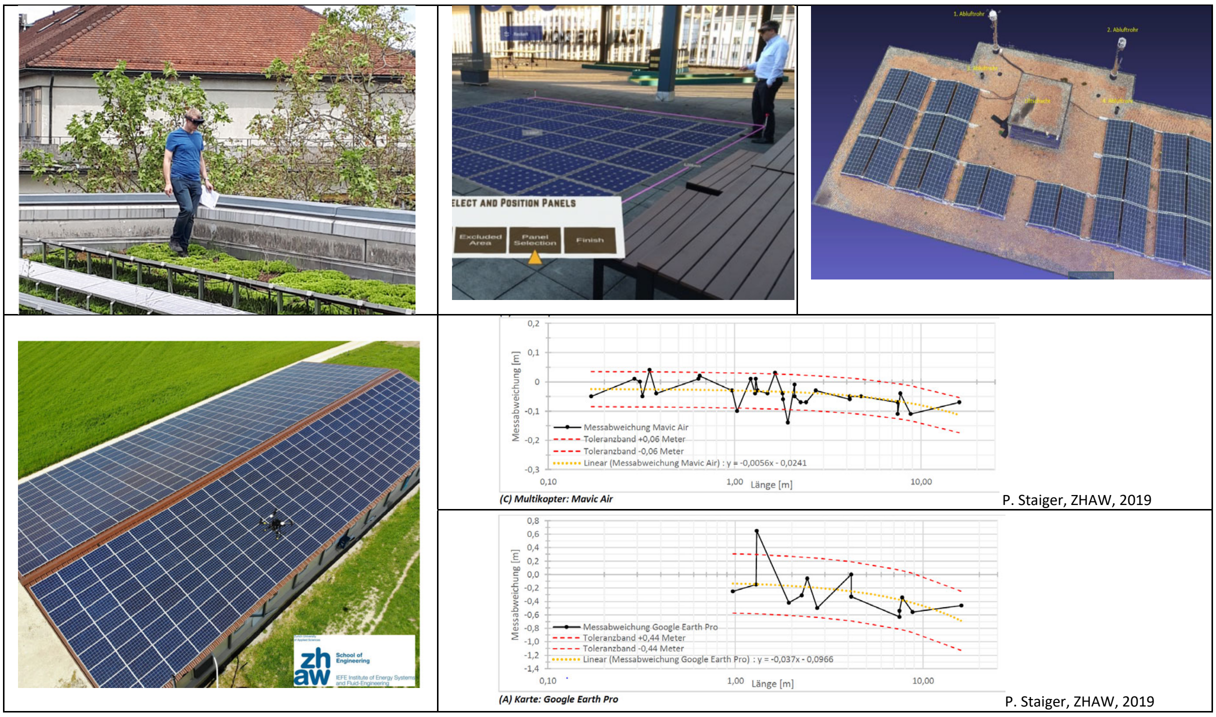

Fig. 1 The two pictures on the top show the use of headset AR tools to measure the size of a PV roof. Top right gives the model of a PV installation to simulate performance of the plant. Below a multicopter is scanning the PV roof as a reference standard measurement tool. In the right corner below the comparison of uncertainty of web-based Google Earth «metering» is compared to optical drone measurement which is typically in the few centimeter range depending on the size of the object.

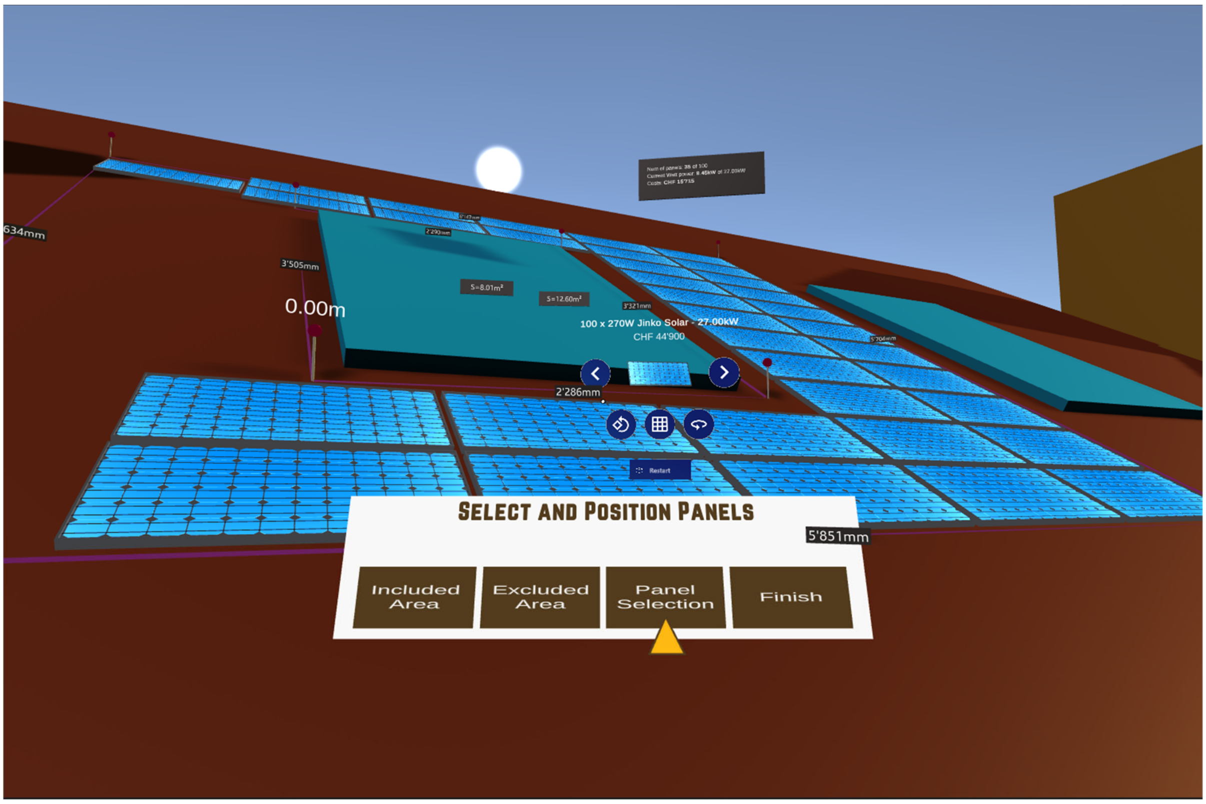

Fig. 4 Testing the planning tool with a virtual sample rooftop showing holograms with the measured space, the solar panel layout and a first result of our power estimation algorithm

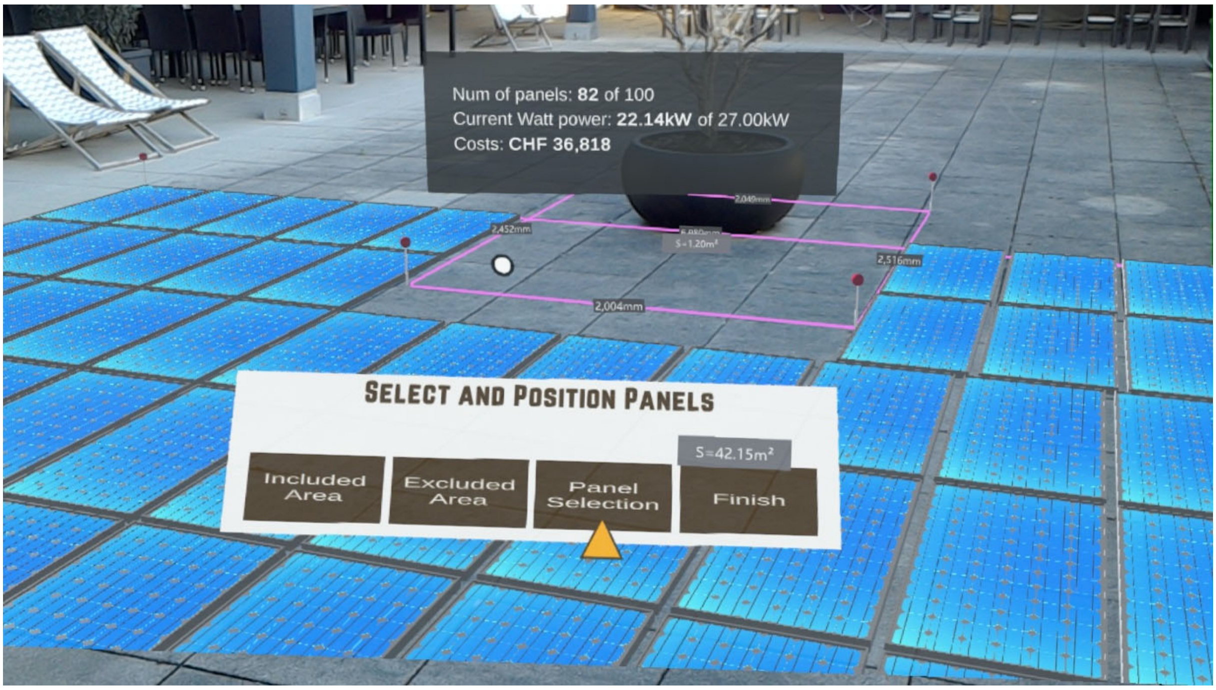

Fig. 5 Holographic visualization of a roof top measurement of a panel layout with excluded area

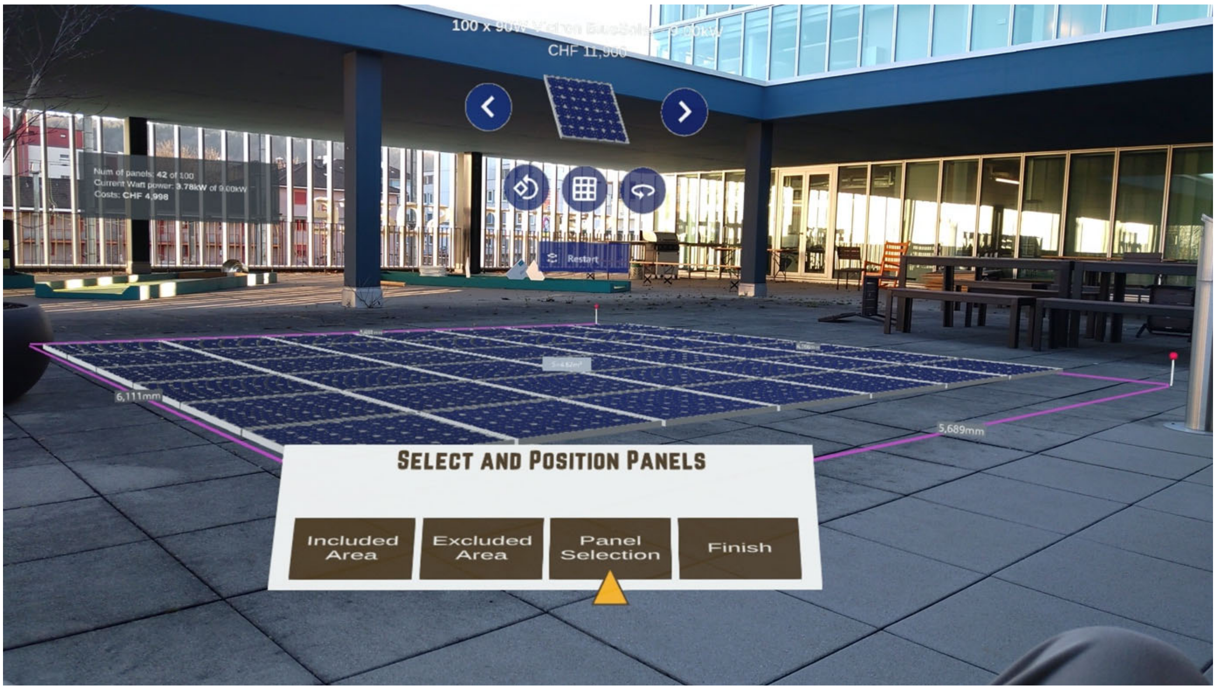

Fig. 6 Panel layout visualization on the HoloLens 2 after a measurement

Fig. 7 Holographic measurement visualization of a roof top measurement

Fig. 8 Measuring on a flat rooftop with the HoloLens 2