Abstract

With the project PLOTBOT/CRAWLER of the research platform BAU KUNST ERFINDEN at the University of Kassel, an innovative, web-based and sensor-guided motion machine was developed for the application and renewal of complex layer systems for the functionalisation of building surfaces. By means of a consistently interlocked tool-software logic, surfaces of components of any geometry are controlled instantaneously or coated according to a previously digitally created processing system. The development of the plotbot/crawler contains four interdependent parts. A machine component "All-In-One" with effectors, sensors and mobile base, a software component with systematized and flexible control, a hardware-software interface for hardware related information input and processing, as well as a web interface for technical support and user dialogue. With the application and renewal of the organic photovoltaic system DysCrete, the research project has a concrete application as its task. DysCrete is a dye-sensitized energy-producing concrete in which the power-producing coating is renewed at regular intervals. The focus of the development was the combination of processes of automated coating application and coating renewal in one machine, as well as the automation of the design reading process. The system meets the requirements for robotic systems resulting from the analysis of the Industry 4.0 strategy. The projected system is comparatively compact and mobile. It uses spraying and printing techniques in a new way, which are of growing importance for materials research and the building industry due to their efficiency and diverse application potentials. Thus, a modification of the plotbot/crawler can enable the integration of further specific functional systems for in-situ use, such as the detection and sealing of cracks or defects, maintenance and cleaning of facades, maintenance and care of vertical facade greening. Solutions were sought which on the one hand exploit these potentials and at the same time consider the special requirements of the building industry. The research project offers an independent and at the same time exemplary approach in this respect. The combination and clear interface definition of the combination of "high-tech" (plotbot/crawler) and "low-tech" (facade element) is new and advantageous. Up until now, the development of such systems for the construction industry has not progressed very far. However, it is of interest because, for example, regarding the requirements of a sustainable and economic restructuring of the building fabric, it offers a conceptual as well as action-oriented approach to develop the potential of technology-oriented and flexible production for this sector.