

2021 Hilti smart construction challenge

Leveraging IoT and reality capture to unleash productivity in construction sites

Construction is vital to both society and the economy by creating exceptional buildings and infrastructure. This is achieved despite numerous challenges, such as high interdependencies, lack of skilled labor, high price pressure, lack of automation and more. While many other industries have adapted themselves to the fast-changing world, the construction industry lags somewhat behind. Just imagine the scope of potential for making an impact on the industry through the development and design of advanced technology solutions.

Go with us on an exciting journey

Let us take you on a construction site on a typical day for a minute. You are now at the center of a highly dynamic environment where numerous pieces are constantly moving around. A workforce of multiple trades is moving between different floors, tools and materials are placed and moved to enable the completion of various tasks, and heavy equipment is operated everywhere. It is hard to track which task is performed and where, what the task's progression status is, and which partners and sub-contractors are involved in every phase. To a large extent, this environment is still mainly managed manually. With a pad in hand, project managers move around to manage multiple tasks. Safety managers track hazardous situations and incidents manually. Daily planning, task logs and attendance logs are all managed manually, and a large amount of highly valuable data is unutilized and going to waste.

There is a large gap to fill, and a strong need to move forward.

Therefore, we would like to give you a true challenge: develop a concept/solution, in which new technologies, such as IoT, reality capture, computer vision and robots are able to capture and contextualize relevant data in the field to improve productivity and simplify the complex construction site environment.

Example Use Cases:

- **Jobsite visualization**- creating a constantly updating digital twin by remotely leveraging 360 visual data, reality capture and sensor data to avoid unnecessary and repeat field visits.
- **Progress management**- enhance the current, mainly manual process with data input to track task completion status in real time and address obstacles the moment they appear. Enable smooth and efficient operation and generate optimization recommendations for the future.
Tasks such as measuring, pouring, drilling, cutting, sawing and more require mm accuracy and specific protocols of tool and material usage in order to ensure safe and reliable construction. Building and locating elements must follow the construction plan carefully.
These tasks can be monitored, for example, by tracking location, time, trade and completion status as well as by tracking tool performance and ambient metrics.
- **Enable field collaboration** to ensure smooth communication between the different stakeholders. Enable managers to assign tasks to teams, involve external partners and experts and link between highly interdependent tasks.

- **Ensure solid construction for safe and long-lasting results.** Correct installation and construction are critical for the safety of the building and its future residents. To minimize faults along a building's lifetime, it is crucial to ensure correct installation and operation during the construction phase. Try to imagine building the elevator pit of an 80-story skyscraper. There is no room for mistakes, and each of the infrastructure elements must be in its own very specific place. Data collection, monitoring and real-time reporting, to ensure elements are installed and to enable immediate intervention if something is built wrong, ensures both the safety of the building and operational quality and productivity.
In addition, tracking the installed elements over time is highly desirable. Making "analog" construction elements "smarter" by enabling constant monitoring of critical elements, and allowing for immediate notification when changes happen over time, is highly important (i.e. enable alerts on loosening, corrosion, cracks, leakages, etc.).
- **Increase safety and protect lives** by utilizing sensor and visual data, processed by machine learning and AI, to analyze high-risk factors, provide notice of hazardous situations in advance and prevent injuries and fatalities. Common high-risk factors include working at height, physical condition (fatigue, inattention, stress, etc.), avoiding safety equipment usage, entering restricted areas and more.
- **Facilitate the data flow of different application within the Hilti Enterprise Architecture-** set up a shared ecosystem across different systems and user communities both externally and internally. Enable seamless exchange and processing of data for various subsequent and adjacent systems, multiple data sources (i.e. robots, portable/ fixed sensors, etc.) including mappings and conversions.
- **Utilize machine learning to turn data into insights** by crossing multiple data sources (of products, robotics and workforce, as well as transactional data from ERP/CRM systems of computing trends and behavioral patterns). Trigger learnings and actions to improve tool usage and maintenance, and optimize work efficiency.
- **Improve employee compensation and project costing** by seamlessly capturing and analyzing information about workforce attendance, work duration, task completion and performance.
- **Leverage jobsite progression information to trigger/ pause/ define marketing communication.**
- **Deliver personalized how-to messages to secure safe installation.**

Typical jobsite challenges:

- Need for high robustness.
- Unstructured environment.
- Limited power supply.
- Limited computation power and memory on edge devices.
- Multiple users of the same device.
- Limited mobile connectivity whilst on the construction site (later connectivity access can be assumed).
- High exposure to environmental elements (extreme temperatures [low and high], precipitation, air pollution, etc.).
- Variety of personas (construction workforce, back office managers, etc.).
- And many more...