ROBOTIC HVAC INVESTIGATION

A CHELSEA GROUP CASE STUDY

TAKE AWAY

Concept

- Robots are used for HVAC insight
- Speeds diagnostic process
- Reduces patient space intrusion

Features

- Advanced video
- Use in retrofit design
- Magnetic wheels

Benefits

- "Eyes on" as-built designs
- Visual proof for decision makers
- Unexpected energy cost savings

A COMING OF AGE STORY

A major metropolitan medical center comprising over two million square feet of occupied space faced a complex and serious problem: the exhaust system in patient rooms, toilets, and isolation wards had multiple points of failure. Central exhaust fans had been replaced. But the larger fans did not solve the existing problems, let alone allow for the expansion capacity desperately needed by the facility.

Design engineers involved with the fan upgrade had studied the problem and concluded that the design was correct. The failure was construction or operations. They washed their hands of it.

BRING IN THE ROBOTS

Chelsea Group was engaged by the medical center to find the problem and design and manage a solution. All that was known came from the hospital engineering staff observation of complaint areas and the fan balance report from the upgraded exhaust system.

Chelsea Group mapped the as-built exhaust system and produced a series of CAD based tools that allowed rapid field investigation and documentation of the "hot spot" areas set as a priority by the facilities team. Testing air flows at proximal (near the exhaust shaft) and distal (farthest reaches of the ducts) quickly yielded a pattern to the seemingly random complaints.

Details were taken from design drawings and field verified or corrected. The CAD maps absorbed the new data and showed turning vanes, airflow measurement stations, smoke and fire dampers, and existing access points. Color coding showed duct size categories and call outs identified degree of failure in the exhaust duct system section by section.

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The robots were unleashed once the plan of attack was settled based on the intelligence gathered through this process. The mapping provided a precise plan of where access could be taken, and where new access points would be required. Two robotics teams were deployed, accompanied by facilities personnel from the hospital and guided by the floor nurses.

TEAMWORK MEETS NEW TECHNOLOGY

The teams almost immediately discovered the first major problem in the exhaust duct structure: a massive rupture between arms of the exhaust plenum near the transition to the roof exhaust fans was drawing air from the entire ten story shaft, not the ducts. But the numbers from the preliminary investigation and mapping told that this was only one of many problems to hunt down.

Work progressed quickly from hot spot to hotspot. Soon a new set of challenges for the robots came to the fore. The accumulated dust in distal parts of the duct system made the paths slippery for the robotic wheels. The slightest slope and the robots became stranded. Collaborating with the robotics supplier, the Chelsea team worked out that magnetic wheels, still in prototype at the robotics manufacturing facility, would be necessary. The team worked into the night adapting the wheels to the robots on site.

Magnetic wheels enabled a new range of exploration. The robots were able to approach and video inaccessible portions of the duct system. Tracking all of these points on the CAD based mapping system enabled rapid translation into designs and specifications for needed repairs.

DOUBLE WIN OUTCOME

Providing adequate exhaust to each patient care area of a hospital is a basic necessity. The resulting project from the robotic investigation enables current state-of-the-art performance of the hospital exhaust system. This was the primary and only goal of the hospital in pursuing the project. Chelsea Group's application of new technology and proper investigative technique resulted in a complete solution.

The hospital benefited from a second, unintended win on this project as well: energy savings. The recommended program of corrective actions provides a reduction in electrical energy use in the exhaust fan system in excess of 50%. Controlled, rather than uncontrolled, exhaust from the building is likely to produce additional savings on HVAC costs. Improved quality of service at a reduced cost.

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