Technology in ENGINEERING

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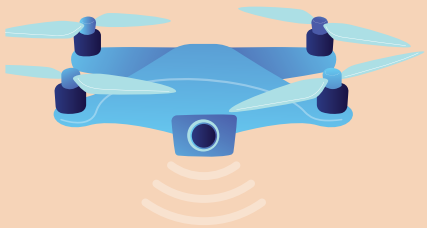

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We have some ideas of when it started. Early engineers had the first simple machines to build the monuments of antiquity. They included the inclined plane, lever, roller, and basic mathematics for constructing the Great Pyramids of Giza. Engineers have relied on technology ever since to create the built environment, explore the galaxy, and improve the health and safety of everyone. Let's look at a few technologies that homeowners in condominiums might see in their communities. Ones that board members should know about can be applied to understand and take care of properties.

Many will be surprised that an early drone was developed in World War I by the French. The Voisin 8 bi-plane was tested in 1917 for use in reconnaissance. That's a far cry from today's quadcopters. Drones are officially known as unmanned aircraft systems (UAS). They have reached the level of technology with 360° camera gimbal systems, 4K video, and intelligent piloting modes.

With the current level of sophistication, they have become an essential tool for engineers. One important assignment is building exterior inspections. Many cities' façade inspection ordinances require regular inspections for deterioration and potential detachment. The use of drones can detect possible defects and direct an engineer to where hands-on closer inspection is needed. Steeply pitched roofs are another inspection target where access and safety are concerns.

Inaccessible terrain and locations mapping are other venues where their remote capability is an asset. With the technology, dams, communication towers, windmills, and power lines can all be accessed quickly.

Be careful in embarking on a drone project. The FAA Operations Over People rule became effective on April 21, 2021. Drone pilots operating under Rule 107 may fly at night, over people, and moving vehicles without a waiver as long as they meet the requirement of the rule. The rule applies to flying a drone under 55 pounds. For work or business, flying the 107 guidelines stipulate an FAA certified drone pilot certificate and drone registration.

Drones are developing rapidly, and their potential for increased use will only be improved by better battery life,

smart object guidance, and payload capacity. Engineers can't wait.

Infrared (IR) is a segment of the electromagnetic spectrum invisible to the human eye. Like visible light, it is a wave that carries energy. While we cannot see it, we feel it as heat. You probably use an IR device every day to remotely control your TV.

Because IR detects heat, it helps detect changes in temperatures of the exterior of a building. It can find locations of air infiltration and the movement or warmth of cold air through cracks, missing or damaged caulk, and construction defects. When building materials are wet, they remain colder or warmer than their surrounding dry components for some time. By capturing their thermal

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image during the periods of transition in temperature, it can detect wet materials in a location. It is a handy tool in finding defects in siding or low slope roofs. Not limited to buildings, an IR scan can locate electrical hot spots like overcurrent in wiring, distribution panels, or transformers.

The beauty of the inspection is that it is non-invasive. No test cuts, penetrations, or disruption to regular operations are needed. What is required is a trained, certified thermographer. With the falling prices of IR cameras, many amateurs have them. ASTM has developed standards and guidelines for infrared thermography. Inspectors who operate the cameras and interpret images should be certified by the Infraspection Institute. It should come as no surprise that drones can now be equipped with IR cameras for an impressive marriage of technologies.

Regarding the electromagnetic spectrum, let's return to the visible part of the spectrum, light we can see, this time from a laser. "Lidar" is the acronym for Light Detection and Ranging. It is a remote sensing method that uses a pulsed laser beam to measure distances. Combined with a special GPS receiver, it can measure exact distances. Like an IR scan it is non contacting, noninvasive and non-disruptive to building occupants. Furthermore, it can operate in darkness as it generates its light.

Care is necessary when employing the technology. Some lidar units emit light at the wavelength of 905 nanometers. That's a frequency that can damage eyes and cameras. Fortunately, at that wavelength, governments have limited the power emitted.

Initially developed in the 1960s, lidar was extensively used on aircraft for terrestrial measurements. Now, it is frequently used to create 3D representations of terrain for the construction of roads, bridges and buildings – all the purview of civil engineers.

One newer application of lidar scanning is in the interior measurements of buildings. With the lidar scan, a point cloud can be created. A point cloud is a set of data representing a 3D object in space. Because

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the cloud represents so many closely spaced points, a very accurate picture of its shape and its dimensions can be determined. Imagine the savings in time in using this tool to measure the inside of a complex building. For example, an open industrial setting can describe the structural members, mechanical and electrical components, piping, and ducts. In design and renovation, the information is priceless to engineers and architects.

These few examples of progress in using technology as engineers help us investigate, design, and build better.

One last no surprise. Lidar-equipped drones are available at an online store near you. ■