OPEN ACCESS Freely available online

ISSN: 2469-4134

Journal of Remote Sensing & GIS

Editorial

Lidar Remote Sensing applications in recent years

Dr. Arthur B. Weglein*

Professor, Department of Physics, University of Houston, USA.

EDITORIAL

Aerosols, In Lidar (/ˈlaɪdɑːr/, also LIDAR, or LiDAR; sometimes LADAR) is a method for determining ranges (variable distance) by targeting an object with a laser and measuring the time for the reflected light to return to the receiver. Lidar can also be used to make digital 3-D representations of areas on the earth's surface and ocean bottom, due to differences in laser return times, and by varying laser wavelengths. It has terrestrial, airborne, and mobile applications.

Intimate Lidar is an acronym of "light detection and ranging" or "laser imaging, detection, and ranging". Lidar sometimes is called 3-D laser scanning, a special combination of a 3-D scanning and laser scanning. Lidar is commonly used to make high-resolution maps, with applications in surveying, geodesy, geomatics, archaeology, geography, geology, geomorphology, seismology, forestry, atmospheric physics,laser guidance, airborne laser swath mapping (ALSM), and laser altimetry. The technology is also used in control and navigation for some autonomous cars. Lidar uses ultraviolet, visible, or near infrared light to image objects. It can target a wide range of materials, including non-metallic objects, rocks, rain, chemical compounds, aerosols, clouds and even single molecules.A narrow laser beam can map physical features with very high resolutions; for example, an aircraft can map terrain at 30-centimetre (12 in) resolution or better.

The two kinds of lidar detection schemes are "incoherent" or direct energy detection (which principally measures amplitude changes of the reflected light) and coherent detection (best for measuring Doppler shifts, or changes in the phase of the reflected light). Coherent systems generally use optical heterodyne detection.This is more sensitive than direct detection and allows them to operate at much lower power, but requires more complex transceivers.

Both types employ pulse models: either micropulse or high energy. Micropulse systems utilize intermittent bursts of energy. They developed as a result of ever-increasing computer power, combined with advances in laser technology. They use considerably less energy in the laser, typically on the order of one microjoule, and are often "eye-safe", meaning they can be used without safety precautions. High-power systems are common in atmospheric research, where they are widely used for measuring atmospheric parameters: the height, layering and densities of clouds, cloud particle properties (extinction coefficient, backscatter coefficient, depolarization), temperature, pressure, wind, humidity, and trace gas concentration (ozone, methane, nitrous oxide, etc.).

LiDAR is a useful technology for a number of industries, from forestry to autonomous vehicles. One of the most common uses for LiDAR is tracking the speed of vehicles. Law enforcement agencies use it for that reason and for accident investigations.Here are just a few of the many applications of LiDAR today:

Agriculture – LiDAR can help agriculture technology (AgTech) companies pinpoint areas with optimal sunshine for more efficient growing. It also can be used to train machine learning systems to identify crops that need water or fertilizer.Archeology – This technology has revolutionized the world of archeology, helping experts discover hidden structures around the globe. There are two archeologists from the University of Colorado who are on a mission to scan the entire planet with LiDAR.

Astronomy – NASA (U.S. National Aeronautics and Space Administration) used LiDAR technology to explore Mars. They were able to create a topographic map and detect snow falling in the atmosphere.Climate change – Climate scientists use LiDAR to study and track changes in the atmosphere. Researchers in Germany have developed an airborne LiDAR system that can track atmospheric gases and may even be usable from space. Botanists are using it to track patterns in changes to forested areas. LiDAR also is used to calculate changes in glaciers over time.Land management – Land management organizations can monitor land resources in real-time, allowing for faster and more efficient mapping compared to aerial surveys. They also use it in disaster assessment, early warning systems, emergency response (e.g., to fight forest fires), and location-based investigations.

Land mapping – The National Oceanic and Atmospheric Administration (NOAA) uses LiDAR to create accurate shoreline maps and digital elevation models for GIS (geographic information systems). They also use it to assist with emergency response missions. Oil and gas exploration – Since it has a shorter wavelength than other technologies, LiDAR can detect tiny molecules in the atmosphere. New technology, called Differential Absorption LiDAR (DIAL), helps to trace oil and gas deposits.

Meteorology – Since it was first used, LiDAR has helped meteorologists study clouds and their patterns by using the wavelength to detect small particles in the cloud. There are many different types of LiDAR used in meteorology.Renewable Energy – LiDAR can be used to identify basic requirements for harnessing solar energy, such as optimal panel positioning. It is also used to calculate direction and wind speed to allow the operators of wind farms to build and place turbines.

Robotics – LiDAR is used to equip robots with mapping and navigation capabilities. For self-driving cars, the technology is used to train an autonomous system to recognize the distance between the vehicle and other objects in the environment.Tsunami modeling – LiDAR is used to inform systems that warn people when a tsunami might occur in their area. It also is used to determine the elevation value of a seashore and underwater elevation. The LiDAR data can be layered into the GIS, and experts are able to predict which areas will be most affected by a tsunami.

Correspondence to: Dr. Arthur B. Weglein, Professor, Department of Physics, University of Houston, USA; E-Mail: aweglein@uh.edu

Received: June 11, 2021; Accepted: June 25, 2021; Published: July 2, 2021.

Citation: Weglein AB (2021) Lidar Remote Sensing applications in recent years. . J Remote Sens GIS. 10:e118.