Kristen Zahra

Make your life a little LiDAR

So you wanna be an amateur geologist?

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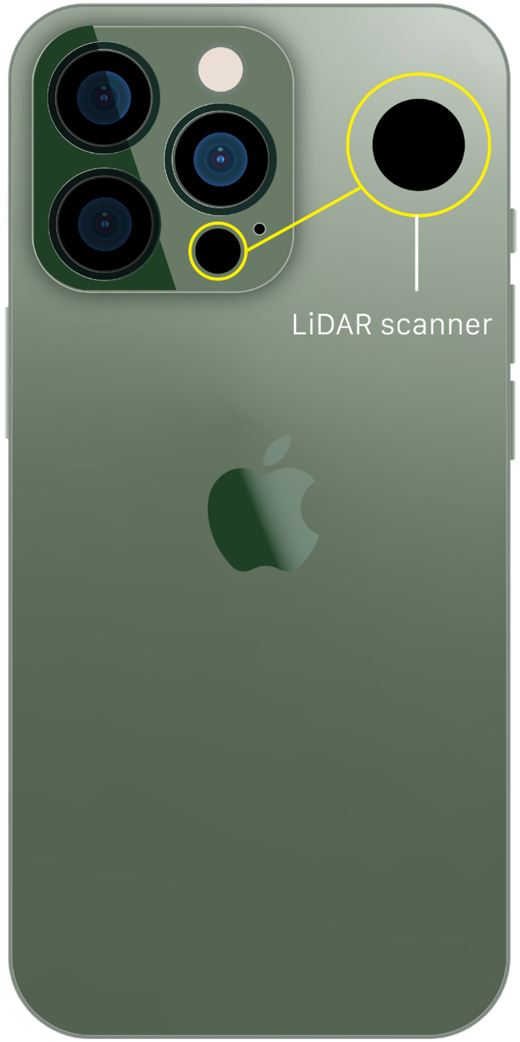
You may be wondering what that black circle is doing on the back of your iPhone if it's not a camera then what is it? Well for those who don't know you don't need to worry. It's called a LiDAR sensor (Light Detection and Ranging) if you haven't heard of it before. It's a built-in technology that uses a laser beam to get information about surrounding objects. The device consists of a scanner, laser and GPS receiver which collects measurements that can be processed into 3D visualizations creating objects, maps and surroundings.

As consumers we can use this piece of technology on our iPhones for both educational and entertainment purposes to measure surfaces and objects, scan real-world environments and display virtual objects within them, assist in enhancing the performance of both photo and video abilities and use the LiDAR in AR applications which can place objects in real world environments. Pretty cool right, well in comparison let's look at how the survey grade LiDAR tools are used for practical applications in the real world. LiDAR technology started in the 1960's, it started when laser scanners were mounted to planes. They called this airborne LiDAR; it would emit light beams



towards the surface of the ground to provide distance measurements. This data provided accurate geospatial measurements in the late 1980s.

There are two types of LiDAR systems such as terrestrial and airborne. Airborne is where the laser is attached to an aircraft to create 3D point visualizations of the landscape. Terrestrial LiDAR systems are installed on stationary or mobile objects on the earth's surface collecting accurate data points. These systems allow scientists and mapping professionals to examine both natural and manmade environments with accuracy, precision, and flexibility.

So how can we use this piece of technology on our iPhone to assist in geological fieldwork apart from being an awesome feature that is super fun to play with firstly introduced on the iPhone 12 pro and newer models.

The scanner offers a fundamental change in digital geological fieldwork as these devices are becoming more robust and diverse, putting them at the leading edge of smartphones for contemporary fieldwork for many field geologists.

With many supported 3d scanning apps promising to provide additional approaches to virtual outcrop data capture and analysis for field geologists.

The Apple LiDAR sensor was tested on a coastal cliff in Denmark for a study. The aim of this study was to test and assess the application of the LiDAR scanner in the iPhone for geoscientific research by investigating its technical capabilities, including accuracy and precision of the LiDAR sensor in the controlled environment by comparing the output of the iPhone LiDAR sensor with smartphone photogrammetry and survey grade LiDAR tools.

In technical terms the Apple iPhone laser is emitted from a VCSEL (Vertical Cavity Surface Emitting Laser). This VCSEL emits an array

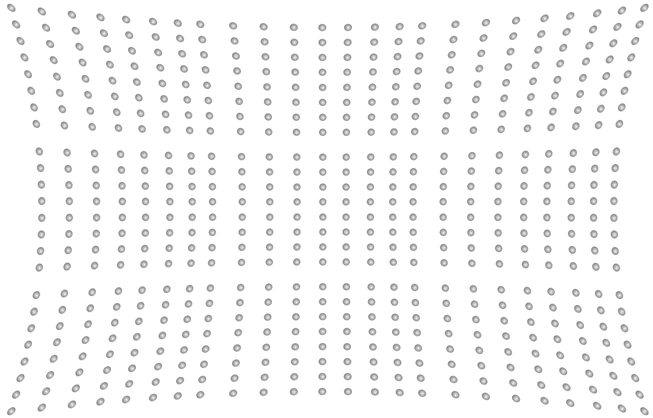
containing 8 by 8 points that is separated into 3 by 3 grid sections making a total of 576 points to assist with point density and focal length. *(figure 1)*

The results showed that when scanning the side length of surfaces that were less than 10cm the accuracy of measurement starts to decrease, therefor the data starts to become unreliable. *(figure 2)*

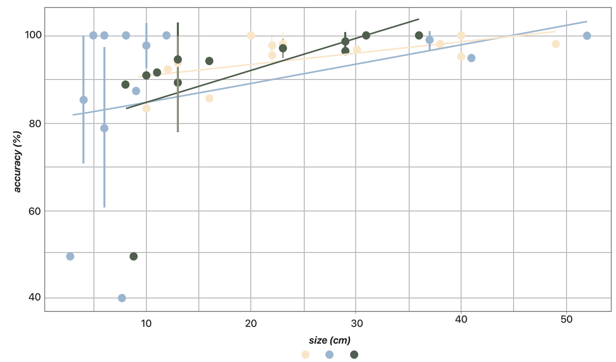
The iPhone LiDAR produced clear and consistent visual representations using the 3D scanner app of a deadfall tree. Small structures such as stems, and boulders are captured realistically. The iPhone LiDAR return signal was stronger when scanning flat surfaces with less vegetation on the cliff face than the areas covered with vegetation.

Yet, the iPhone LiDAR represents an excellent, highly portable, user friendly

tool for rapid documentation of 3D outcrop geometry and texture sharing geological exposures of landscapes and landforms for the purpose of the audience for educational, expert and hobbyists' motives.



(figure 1)



(figure 2)

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