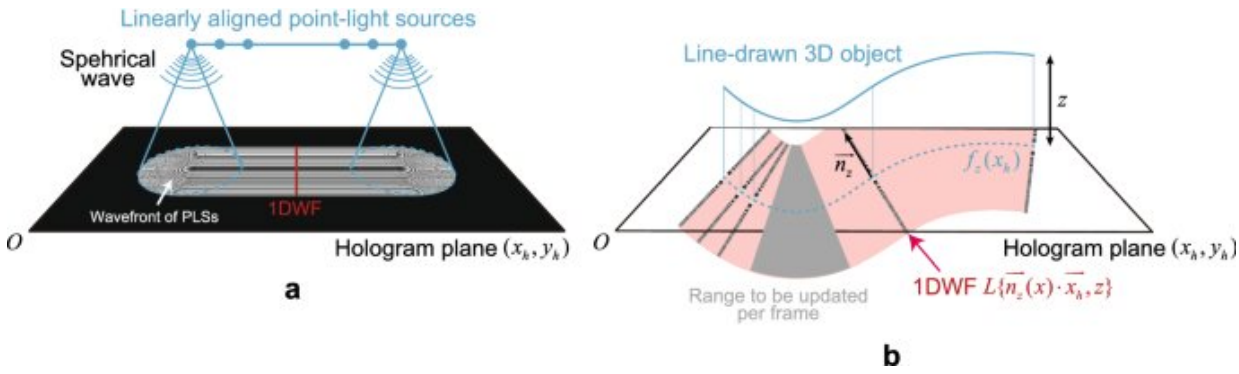
'Doodles of light' in real time mark leap for holograms at home

March 22 2021



Overview of the CG-line method. (a) Principle of obtaining 1DWF. (b) Method to create CGH using the CG-line method in the proposed system. Credit: *Scientific Reports* (2021). DOI: 10.1038/s41598-020-78902-1

Researchers from Tokyo Metropolitan University have devised and implemented a simplified algorithm for turning freely drawn lines into holograms on a standard desktop CPU. They dramatically cut down the computational cost and power consumption of algorithms that require dedicated hardware. It is fast enough to convert writing into lines in real time, and makes crisp, clear images that meet industry standards. Potential applications include hand-written remote instructions superimposed on landscapes and workbenches.

T potential applications of holography include important enhancements

to vital, practical tasks, including remote instructions for surgical procedures, electronic assembly on circuit boards, or directions projected on landscapes for navigation. Making holograms available in a wide range of settings is vital to bringing this technology out of the lab and into daily life.

One of the major drawbacks of this state-of-the-art technology is the computational load of hologram generation. The kind of quality we've come to expect in our 2D displays is prohibitive in 3D, requiring supercomputing levels of number crunching to achieve. There is also the issue of power consumption. More widely available hardware like GPUs in gaming rigs might be able to overcome some of these issues with raw power, but the amount of electricity they use is a major impediment to mobile applications. Despite improvements to available hardware, the solution can't be achieved by brute force.

A key solution is to limit the kind of images that are projected. Now, a team led by Assistant Professor Takashi Nishitsuji have proposed and implemented a solution with unprecedented performance. They specifically chose to exclusively draw lines in 3D space. Though this may sound drastic at first, the number of things you can do is still impressive. In a particularly elegant implementation, they connected a tablet to a PC and conventional hologram generation hardware, i.e., a laser and a spatial light modulator. Their algorithm is fast enough that handwriting on the tablet could be converted to images in the air in real-time. The PC they used was a standard desktop with no GPU, significantly expanding where it might be implemented. Though the images were slightly inferior in quality to other, more computationally intensive methods, the sharpness of the writing comfortably met industry standards.

All this means that holograms might soon be arriving in our homes or workplaces. The team is especially focused on implementations in heads-

up displays (HUDs) in helmets and cars, where navigation instructions might be displayed on the landscape instead of voice instructions or distracting screens. The light computational load of the algorithm significantly expands the horizons for this promising technology.

More information: Takashi Nishitsuji et al, An interactive holographic projection system that uses a hand-drawn interface with a consumer CPU, *Scientific Reports* (2021). DOI: 10.1038/s41598-020-78902-1

Provided by Tokyo Metropolitan University