Focus-free camera created with ultra-thin lens

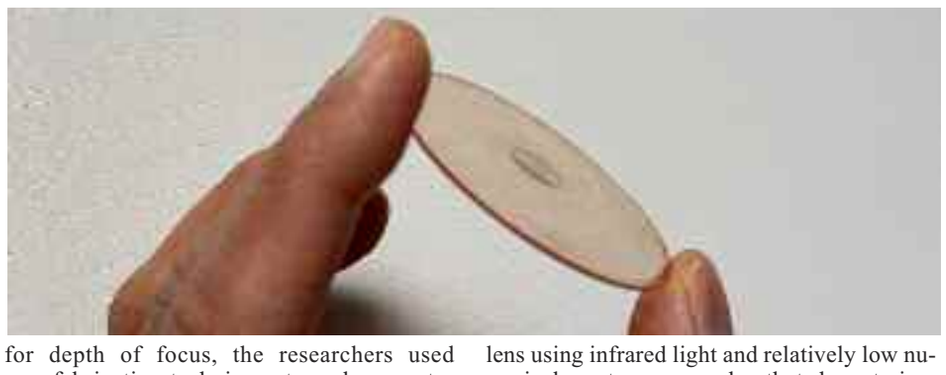
They believe the technology offers considerable benefits over traditional cameras such as the ones in most smartphones, which require multiple lenses to form high-quality, in-focus images.

"Our flat lenses can drastically reduce the weight, complexity and cost of cameras and other imaging systems, while increasing their functionality," said research team leader Rajesh Menon from the University of Utah. "Such optics could enable thinner smartphone cameras, improved and smaller cameras for biomedical imaging such as endoscopy, and more compact cameras for automobiles."

The new flat lens can maintain focus for objects that are about 6m apart from each other. Flat lenses use nanostructures patterned on a flat surface rather than bulky glass or plastic to achieve the important optical properties that control the way light travels. "This new lens could have many interesting applications outside photography such as creating highly efficient illumination for LIDAR that is critical for many autonomous systems, including self-driving cars," said Menon.

The researchers say the design approach they used could be expanded to create optical components with any number of properties such as extreme bandwidth, easier manufacturability or lower cost. Conventional cameras, whether used in smartphones or for microscopy, require focusing to ensure that the details of an object are sharp. If there are multiple objects at different distances from the camera, each object must be focused separately. "The new lens eliminates the need for focusing and allows any camera to keep all the objects in focus simultaneously," said Menon. "Conventional cameras also use multiple lenses to keep different colours of light in focus simultaneously. Since our design is very general, we can also use it to create a single flat lens that focuses all colours of light, drastically simplifying cameras even further."

To focus light, traditional lenses transform parallel light waves into spherical waves that converge into a focal spot. In an important breakthrough, the researchers realised that waves with other shapes could produce a similar effect, vastly increasing the number of possible lens designs. "In stark contrast to what is taught in optics textbooks, our research has shown that there is more than one way that light transmission is affected by an ideal lens – a concept known as pupil function," said Menon. "This opened essentially infinite possibilities for the lens pupil function, and we searched through these possibilities for one that achieved an extreme depth of focus." After choosing the best lens design



for depth of focus, the researchers used nanofabrication techniques to make a prototype lens. Experiments confirmed that the new lens performed as expected and achieved a depth of focus several orders of magnitude larger than that of an equivalent conventional lens. The researchers demonstrated the new lens using infrared light and relatively low numerical aperture – a number that characterises the range of angles over which the lens can accept or emit light.

They plan to extend the lens to larger numerical apertures and to use it with the full visible light spectrum. **—Agencies**

Smart motorway safety plans laid out by DfT

A 'smart motorway' uses live traffic management to relieve congestion as an alternative to widening roads, such as with the temporary introduction of flexible speed limits and use of the hard shoulder as an extra lane. Smart motorways are most common in the UK, where they can be found on sections of the M1, M4, M5, M6, M25, M42 and M62.

Proponents of smart motorways argue that these adaptations will allow for more reliable car journeys. However, there is a low level of trust in the motorways among drivers, with an AA survey finding that just nine per cent of people feel relaxed or safe driving on a smart motorway. A recent report by the all-party parliamentary group for roadside rescue and recovery strongly criticised the implementation of smart motorways. The report characterised smart motorways as "death traps" which – despite only comprising a tiny fraction of the UK's motorways – have killed at least 38 road users. 'Stopped Vehicle Detection' technology, which detects stationary vehicles within 20 seconds and automatically summons assistance, has only been implemented in around six per cent of the smart motorway network (two sections of the M25). In response to criticism, transport secretary Grant Shapps has released an "action plan" [PDF] to improve safety on smart motorways.

Safety measures will include providing more places for drivers to stop in an emergency (which Shapps claims will be safer than the hard shoulder) with a new standard for the spacing of emergency stopping regions every three-quarters of a mile, down from the current maximum spacing of one mile. The report has also promised that the rollout of the Stopped Vehicle Detection system to all smart motorways will be accelerated so that all smart motorways without a hard shoulder have the technology after three years. Shapps claimed that while he was "greatly concerned" by the reported number of fatalities, smart motorways are as safe or safer than conventional motorways. This is because the risk of a collision between two or more moving vehicles is lower on account of speeding, tailgating and rapid changes of speed being discouraged, smoothing the flow of traffic. However, he acknowledged that the risk of a collision between a stopped and moving vehicle is higher on a smart motorway. "I am clear that there is more we can do to raise the bar on smart motorway safety," he wrote in his introduction to the report. Jim O'Sullivan, Highways England chief executive, said: "Every death in any road accident is tragic and we are determined to do all we can to make our roads as safe as possible. We will be taking forward the measures the Secretary of State for Transport has set out and we will be improving further our information to drivers to help them be safer on all of our roads, including our smart motorway network." While the measures were welcomed by the AA, Nicholas Lyes - head of roads policy at the RAC - warned that it "remains to be seen" whether they will go far enough to protect drivers who suffer breakdowns on smart motorways. **—Agencies**

Electric vehicle fast chargers shown to damage internal batteries

Engineers at the University of California, Riverside are developing a method to remedy the problem by charging at lower temperatures, which has shown to lower the risk of catastrophic damage and loss of storage capacity.

The researchers charged one set of discharged Panasonic NCR 18650B cylindrical lithium-ion batteries, such as those found in Tesla cars, using the same industry fast-charging method as the fast chargers typically found along US freeways. They also charged a set of batteries using a new fast-charging algorithm based on the battery's internal resistance, which interferes with the flow of electrons.

The internal resistance of a battery fluctuates according to temperature, charge state, battery age, and other factors. High internal resistance can cause problems during charging. The new charging method uses an adaptive system that learns from the battery by checking its internal resistance during charging. It rests when internal resistance kicks in to eliminate loss of charge capacity.

For the first 13 charging cycles, the battery storage capacities for both charging techniques remained similar. After that, however, the industry fast-charging technique caused capacity to fade much faster: after 40 charging cycles, the batteries retained only 60 per cent of their storage capacity. Batteries charged using the internal resistance charging method retained more than 80 per cent capacity after the 40th cycle.

At 80 per cent capacity, rechargeable lithium-ion batteries have reached the end of their useful life for most purposes. Batteries charged using the industry fast-charging method reached this point after 25 charging cycles, while internal resistance method batteries were good for 36 cycles. "Industrial fast-charging affects the lifespan of lithium-ion batteries adversely because of the increase in the internal resistance of the batteries, which in turn results in heat generation," co-author Tanner Zerrin said.

Worse, after 60 charging cycles, the industry method battery cases cracked, exposing the electrodes and electrolyte to air and increasing the risk of fire or explosion. High temperatures of 60°C accelerated both the damage and the risk.

"Capacity loss, internal chemical and mechanical damage and the high heat for each battery are major safety concerns, especially considering there are 7,104 lithium-ion batteries in a Tesla Model S and 4,416 in a Tesla Model 3," Mihri Ozkan said. Internal resistance charging resulted in much lower temperatures and no damage.

"Our alternative adaptive fast-charging algorithm reduced capacity fade and eliminated fractures and changes in composition in the commercial battery cells," said engineer Cengiz Ozkan. The researchers have applied for a patent on the adaptive internal resistance fast-charging algorithm that could be licensed by battery and car manufacturers. In the meantime, the team recommends that electric vehicle owners minimise the use of commercial fast chargers, recharging before the battery is completely drained and preventing overcharging. **—Agencies**

Secret-sharing app exposes intimate details of nearly a billion users

Launched in 2012, the Whisper app declared itself to be a place where anyone could post their private thoughts and to discuss private matters such as sexuality, unwanted pregnancies and domestic abuse. In its promotional material, it describes itself as "the largest online platform where people share real thoughts and feelings… without identities or profiles".

The database contained a variety of compromising user details that are tied to each 'whisper' (the platform's name for a post) including sexual orientation, gender, age, ethnicity, nickname, place of work and the location data for the user's last post.

The leak was discovered following an investigation by The Washington Post wherein its researchers said they were concerned that the amount of information included could lead to individuals being uncovered and even blackmailed due to the sensitive nature of the data.

According to the researchers, although this would be a concern for any user, it is especially troubling considering Whisper allows anyone over the age of 13 to sign up. As part of the investigation, a reporter with the Post found 1.3 million results when searching the database for users that had listed their age as being 15. Information on the platform was not password protected, with Whisper claiming that it was "not designed to be queried directly". The database has since been taken down, with the researchers alerting both the company and law enforcement to the database.

In response, a representative of Whisper told the Post that the extra data tied to posts was "a consumer-facing feature of the application which users can choose to share or not share". Cyber-security experts, however, warned that the data breach could have implications far beyond the initial breach, with criminals potentially able to exploit the exposed data to carry out further attacks.

"If companies are still leaving data online, unprotected without a password, they should face the consequences of their actions. Sensitive information should be considered their most valuable asset and requires constant monitoring for its security," said Jake Moore, a security specialist at Slovak internet security company ESET.

He added: "Such information as 'nickname' could even pose a risk with answering basic 'forgotten password' security questions, should criminals want to gain access to accounts when requesting new passwords." This is not the first time that Whisper has been caught up in a privacy scandal. In 2014, a report by The Guardian claimed that Whisper was tracking the location of users, regardless of whether or not they opted out of sharing their location data, a charge which the social media company denied. **—Agencies**

Wikipedia research on diseases strongly synchronised with news coverage

During outbreaks of a newly emerging infection, such as the current coronavirus pandemic, media outlets play a leading role in communicating risks and the ways in which people can protect themselves.

Previously, researchers have investigated how the public responds to media coverage during the early stages of disease outbreaks, although this marks the first such study based on observational data rather than surveys.

In this study, Michele Tizzoni and his colleagues looked specifically at the relationship between media coverage and public attention to the 2015-16 Zika epidemic. The epidemic, which was caused by the mosquito borne Zika virus, spread from the Americas to several Pacific Islands and parts of Southeast Asia, resulting in birth defects such as microcephaly.

Tizzoni analysed the number of times that people in the US accessed Wikipedia pages related to Zika in 2016 and compared those data with Zika incidence rates and media coverage of the outbreak. The researchers found that Zika-related Wikipedia page views were highly synchronised with coverage of the outbreak in online news and broadcast news at both the state and national level. Despite confirmed Zika cases varying significantly between states, patterns of Wikipedia page views were very similar across the US. Media coverage appeared to have a far larger impact on Zika-related Wikipedia page views than local disease risk. "Wikipedia page view data represent an invaluable and granular resource to study global patterns of collective attention during outbreaks," said Tizzoni. "We can use such critical data to find patterns across a country and how behaviour changes by region." Tizzoni suggests that his team's findings could help public health officials refine their crisis communication strategies, although further research is required to clarify whether this close pattern of synchronisation is similar across different disease outbreak scenarios, and in different countries. This is particularly important in light of the ongoing coronavirus pandemic, in which internet platforms, governments and health experts are battling a tide of often-dangerous disinformation about the outbreak. "Wikipedia is a trove of freely available content, but many people might not know that it is also a vast resource for open data that can provide valuable insight into what's capturing the attention of the world at any given moment," said Miriam Redi, research scientist at the Wikimedia Foundation. She added that the Wikipedia page view dataset used in the ISI Foundation study would soon be released as a publicly-available research resource. **—Agen-**