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AFFIDAVIT OF ELIZABETH ROSENBERG

1. I am a Records Request Processor at the Internet Archive, located in San Francisco, California. I make this declaration of my own personal knowledge.
2. The Internet Archive is a website that provides access to a digital library of Internet sites and other cultural artifacts in digital form. Like a paper library, we provide free access to researchers, historians, scholars, and the general public. The Internet Archive has partnered with and receives support from various institutions, including the Library of Congress.
3. The Internet Archive has created a service known as the Wayback Machine. The Wayback Machine makes it possible to browse more than 450 billion pages stored in the Internet Archive's web archive. Visitors to the Wayback Machine can search archives by URL (i.e., a website address). If archived records for a URL are available, the visitor will be presented with a display of available dates. The visitor may select one of those dates, and begin browsing an archived version of the Web. Links on archived files in the Wayback Machine point to other archived files (whether HTML pages or other file types), if any are found for the URL indicated by a given link. For instance, the Wayback Machine is designed such that when a visitor clicks on a hyperlink on an archived page that points to another URL, the visitor will be served the archived file found for the hyperlink's URL with the closest available date to the initial file containing the hyperlink.
4. The archived data made viewable and browseable by the Wayback Machine is obtained by use of web archiving software that automatically stores copies of files available via the Internet, each file preserved as it existed at a particular point in time.
5. The Internet Archive assigns a URL on its site to the archived files in the format `http://web.archive.org/web/[Year in yyyy][Month in mm][Day in dd][Time code in hh:mm:ss]/[Archived URL]` aka an "extended URL". Thus, the extended URL `http://web.archive.org/web/19970126045828/http://www.archive.org/` would be the URL for the record of the Internet Archive home page HTML file (`http://www.archive.org/`) archived on January 26, 1997 at 4:58 a.m. and 28 seconds (1997/01/26 at 04:58:28). A web browser may be set such that a printout from it will display the URL of a web page in the printout's footer. The date indicated by an extended URL applies to a preserved instance of a file for a given URL, but not necessarily to any other files linked therein. Thus, in the case of a page constituted by a primary HTML file and other separate files (e.g., files with images, audio, multimedia, design elements, or other embedded content) linked within that primary HTML file, the primary HTML file and the other files will each have their own respective extended URLs and may not have been archived on the same dates.
6. Attached hereto as Exhibit A are true and accurate copies of printouts of screenshots of the Internet Archive's records of the archived files for the URLs and the dates specified in the attached coversheet of each printout.



7. I declare under penalty of perjury that the foregoing is true and correct.

DATE: 11/02/2020

Elizabeth Rosenberg
Elizabeth Rosenberg

JURAT

State/Commonwealth of TEXAS

☐ City ☒ County of Wise

On 11/02/2020, before me, Shannara Ann Franzel,
Date *Notary Name*

the foregoing instrument was subscribed and sworn (or affirmed) before me by:

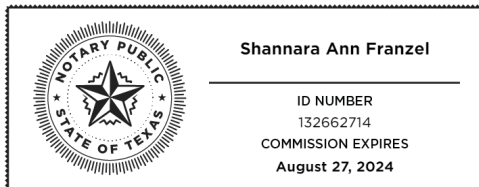
Elizabeth Rosenberg

Name of Affiant(s)

☐ Personally known to me -- **OR** --

☐ Proved to me on the basis of the oath of _____ -- OR --
Name of Credible Witness

☒ Proved to me on the basis of satisfactory evidence: passport
Type of ID Presented



WITNESS my hand and official seal.

Notary Public Signature: Mannara Hrantranzel

Notary Name: Shannara Ann Franzel

Notary Commission Number: 132662714

Notary Commission Expires: 08/27/2024

Notarized online using audio-video communication

DESCRIPTION OF ATTACHED DOCUMENT

Title or Type of Document: Affidavit of Authenticity

Document Date: 11/02/2020

Number of Pages (including notarial certificate): 3

Exhibit A

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Spinoff 2010

Image Sensors Enhance Camera Technologies



Consumer Goods

Originating Technology/NASA Contribution

Buzz Aldrin standing on the stark surface of the Moon. The towering gas pillars of the Eagle Nebula. The rocky, rust-colored expanses of Mars. Among NASA's successes in space exploration have been the indelible images the Agency's efforts have returned to Earth. From the Hubble Space Telescope to the Hasselblad cameras in the hands of Apollo astronauts, many of NASA's missions involve technologies that deliver unprecedented views of our universe, providing fuel for scientific inquiry and the imagination.

Less known than Hubble's galactic vistas or the Mars rovers' panoramic landscapes is the impact NASA has had on the era of digital photography on Earth.

While the first digital camera was built by Eastman Kodak in 1975, the first to actually develop the concept of the digital camera was Jet Propulsion Laboratory (JPL) engineer Eugene Lally, who in the 1960s described the use of mosaic photosensors to digitize light signals and produce still images. During the following decades, NASA continued the work of developing small, light, and robust image sensors practical for use in the extreme environment of space.

In the 1990s, a JPL team led by Eric Fossum researched ways of improving complementary metal-oxide semiconductor (CMOS) image sensors in order to significantly miniaturize cameras on interplanetary spacecraft yet maintain scientific image quality. An image sensor contains an array of photodetectors called pixels that collect single particles of light, or photons. (The word "pixel"—short for picture element—was first published in 1965 by JPL engineer Frederic Billingsley.) The photons entering the pixel are converted to electrons, forming an electrical signal a processor then assembles into a picture. CMOS sensors represented a number of appealing qualities for NASA compared to the charge coupled device (CCD), the prevalent image sensor at the time. Crafted by the same process used to build microprocessors and other semiconductor devices, the CMOS image sensors can be manufactured more easily than CCDs and at lower cost. The CMOS sensor components are integrated onto a single chip, unlike CCDs, which have off-chip components. This integrated setup consumes as much as 100 times less power than CCDs, allows for smaller camera systems, and can be designed with radiation-hard pixel architectures for space applications.

At JPL, Fossum invented the CMOS active-pixel sensor (CMOS-APS), which integrates active amplifiers inside each pixel that boost the electrical output generated by the collected photons. The CMOS-APS featured improved image quality over passive-pixel sensors (without amplifiers) and included a number of on-chip functions, providing for complete miniature imaging systems that operate quickly with low power demands. JPL validated the technology through a series of prototypes.

Partnership

Fossum realized the CMOS-APS technology would be useful not only for imaging in space but on Earth as well. In 1995, he, his colleague and then-wife Sabrina Kemeny, and three other JPL engineers founded Photobit, based in Pasadena, California. Photobit exclusively licensed the CMOS-APS technology from JPL, becoming the first company to commercialize CMOS image sensors.

"We saw an expanding number of applications for these miniaturized cameras," says Roger Panicci, one of Photobit's founders. The company quickly positioned itself on the cutting edge of the field of CMOS imaging, and by June 2000, it had shipped 1 million sensors for use in popular Web cameras, machine vision solutions, dental radiography, pill cameras, motion-capture, and automotive applications. The company was featured in *Spinoff* 1999 and founders Fossum, Panicci, Kemeny, and Robert Nixon were inducted into the Space Foundation's Space Technology Hall of Fame that same year.

In 2001, the company was acquired by semiconductor memory producer Micron Technology, of Boise, Idaho, and became a division of Micron Imaging Group. With the exploding popularity of the camera phone in the mid-2000s, the CMOS-APS proved ideal for crafting cameras that fit into slim cell phones and produce good photos without draining batteries. Riding the wave of camera phone demand, in 2006 the group became the world's leading supplier of CMOS image sensors. In 2008, Micron Imaging Group was spunoff from Micron to form *Aptina Imaging Corporation*, based in San Jose, California. That same year, it shipped its 1 billionth sensor.

Product Outcome

Aptina has continued to improve on the original, NASA-developed CMOS-APS. The company has invented increasingly small pixel architectures, as well as a process for optimizing the amount of light that hits a pixel, boosting sensitivity and image quality while allowing the company's customers to design more compact camera systems.

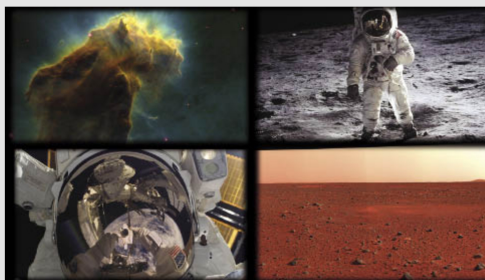
"Our technology is taking advantage of semiconductor innovation," says Panicci, now Aptina's vice president of product development. "As transistors shrink, we can build smaller pixels, meaning that, in a given area of silicon, we can provide higher and higher resolution for products like camera phones."

Aptina's line of sensors allows for advanced camera features like electronic pan, tilt, and zoom, as well as applications requiring motion detection, target tracking, and image compression. The sensors are also incorporated into the company's line of system-on-a-chip (SOC) devices—synergistic packages that enhance imaging, are easier and cheaper to integrate into products, and provide benefits like anti-shake compensation that corrects blurring from subject motion or an unsteady camera.

Aptina has grown from its NASA roots into a leader of the CMOS image sensor industry. Its sensors are currently integrated into one of every three cell phone cameras and are part of every major brand personal computer camera worldwide, as well as many embedded cameras for notebook computers. The company is also advancing CMOS sensors for digital still and video cameras—products that have traditionally featured CCD sensors, and has produced the first 10-megapixel CMOS image sensor for point-and-shoot cameras, a device that incorporates the company's High Speed Serial Pixel Interface (HISPI) capabilities, enabling a camera to create high-definition (HD) imagery.

The NASA-derived CMOS-APS can also be found in other, less obvious applications. Aptina produces tiny sensors for use in endoscopes for minimally invasive medical diagnostic procedures. The sensors do not generate potentially painful heat during examinations and are cheap enough to allow for disposable scope tubes, eliminating potential complications from improperly sterilized scopes. The company also worked with a medical imaging partner to develop the PillCam, an ingestible camera for imaging a patient's gastrointestinal tract.

The automotive and surveillance industries represent other major markets for Aptina's sensors. Major international auto brands like Daihatsu and Volvo employ Aptina designs for applications like backup cameras that help with parking and ensure safe reverse motion. Aptina estimates its customers will be building up to 25 million backup camera systems annually by 2011, potentially reducing backover accidents by about 20,000 per year. The company also has partnerships within the field of network surveillance, designing imaging technology that can spot cheating in casinos or intruders in unauthorized areas.



Images like these of (clockwise from top left) the Eagle Nebula, Apollo 11 astronaut Buzz Aldrin on the Moon, the Martian landscape, and an astronaut self-portrait taken during a spacewalk bring the wonders of space exploration down to Earth.



Aptina Imaging Corporation's 10-megapixel complementary metal-oxide semiconductor sensor is the first such device for point-and-shoot cameras.

Last year, Aptina became a stand-alone company, and while Photobit once saw 1 million sensors shipped as a major milestone, says Panicacci, Aptina often ships over 1 million sensors a day. As demand rises for high-end capabilities like HD imaging and the market for camera products booms, Aptina's NASA-developed technology should play an even greater role in products benefiting the public every day. Research by the International Data Corporation, an independent market research company, predicts annual sales of more than 1 billion camera phones beginning in 2010, all featuring one or more CMOS-APS cameras.

HISPI™ is a trademark of Aptina Imaging Corporation.
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