



Ansys + INAOE

“Having a simulation of the optics in Ansys Zemax OpticStudio before entering the laboratory saves us a great deal of time. We can preview our results ahead of time and make design changes as needed, and if a material in the simulation isn’t available to us, we know right away which one we need to buy.”

— **Jorge de Jesus Alvarado-Martinez**

Ph.D. Candidate in Optics / INAOE Instrumentation and Optical Metrology group

/ INAOE Designs Thermal Camera For Spotting COVID-19 Exposures in Densely Populated Spaces

During the COVID-19 pandemic, Jorge de Jesus Alvarado-Martinez, a doctoral candidate at the Instituto Nacional de Astrofísica, Óptica, y Electrónica (INAOE) studying optical instrumentation and metrology, and some of his colleagues grew interested in the ways thermal imaging could be adapted to help with syndromic surveillance, which is the systematic collection, analysis, and interpretation of health data for the purposes of reducing exposure to infectious diseases. Syndromic surveillance helps public health officials detect, monitor, and understand health events in ways that enable timely response and intervention to protect populations from exposure.

/ Challenges

Elevated body temperature is a key indicator of many serious infections, including COVID-19. In recent years, airports, hospitals, schools, work centers, and other public and private facilities have begun deploying thermal cameras in their waiting areas to help identify potentially infected persons so that health and security authorities can intervene and isolate them as needed. This approach, while being a step in the right direction for public health, has a few severe limitations, starting with its unsuitability for monitoring large crowds.

Wide-angle lenses can be used to image crowds, but for syndromic surveillance, thermal technology must be precise enough to detect which people in the image have elevated temperatures. Meanwhile, traditional thermal cameras have a long reporting delay, but in this case the data must travel fast so that infected individuals can be separated immediately from the crowd.

/ Engineering Solution

For Alvarado and his team, improving thermal imaging technology for syndromic surveillance was a matter of finding an alternative optical design that assesses whole groups of people in a public setting, as well as speeds up the detection process by only identifying people with elevated temperatures. To meet this challenge, Alvarado's team designed an optical system that differentiates members of a crowd based on bioclinical signals, such as cough and temperature, directly related to the physical symptoms of COVID-19.

Off-axis mirrors were ideal for this solution because they eliminate obscuration in the light path while reducing alignment complexity by providing a wide field of vision (FOV) with no intermediate image required. Using mirrors also helps reduce materials cost during manufacturing.

The team started their design with a coaxial system, then introduced decentered parameters to remove obscuration and tilting parameters to move the system off-axis. The resulting system achieves the team's aim of more effectively and efficiently reporting on discrete anomalies within a wide-angle thermal image using only off-axis mirrors.

/ Benefits

- The Footprint Diagram tool in Ansys Zemax OpticStudio was used to observe parameter values based on their dependency on aperture size and FOV.
- Ansys Zemax OpticStudio provided optimization tools for designing a complex system with non-conventional surfaces, analysis tools for modeling the design at various stages of development, and merit function tools for rapidly determining and optimizing system parameter values.
- The team achieved cost savings, faster development, and easier materials selection.

/ Company Description

Instituto Nacional de Astrofísica, Óptica, y Electrónica (INAOE) is a public research center in the Mexican state of Puebla. Created in 1971 as part of Mexico's National Council for Science and Technology, the center has departments for studying astrophysics, optics, electronics, and computer science. The optics division, started one year after INAOE was founded, comprises a range of focus areas from biophotonics and quantum optics to optoelectronics and image processing. Its postgraduate optics program trains researchers to identify and solve problems in the field of optics through experiments that test the boundaries of optical scientific discovery.

ANSYS, Inc.
Southpointe
2600 Ansys Drive
Canonsburg, PA 15317
U.S.A.
724-746-3304
ansysinfo@ansys.com

When visionary companies need to know how their world-changing ideas will perform, they close the gap between design and reality with Ansys simulation. For more than 50 years, Ansys software has enabled innovators across industries to push boundaries by using the predictive power of simulation. From sustainable transportation to advanced semiconductors, from satellite systems to life-saving medical devices, the next great leaps in human advancement will be powered by Ansys.

Ansys and any and all ANSYS, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of ANSYS, Inc. or its subsidiaries in the United States or other countries. All other brand, product, service and feature names or trademarks are the property of their respective owners.

Visit www.ansys.com for more information.

©2023 ANSYS, Inc. All rights reserved.