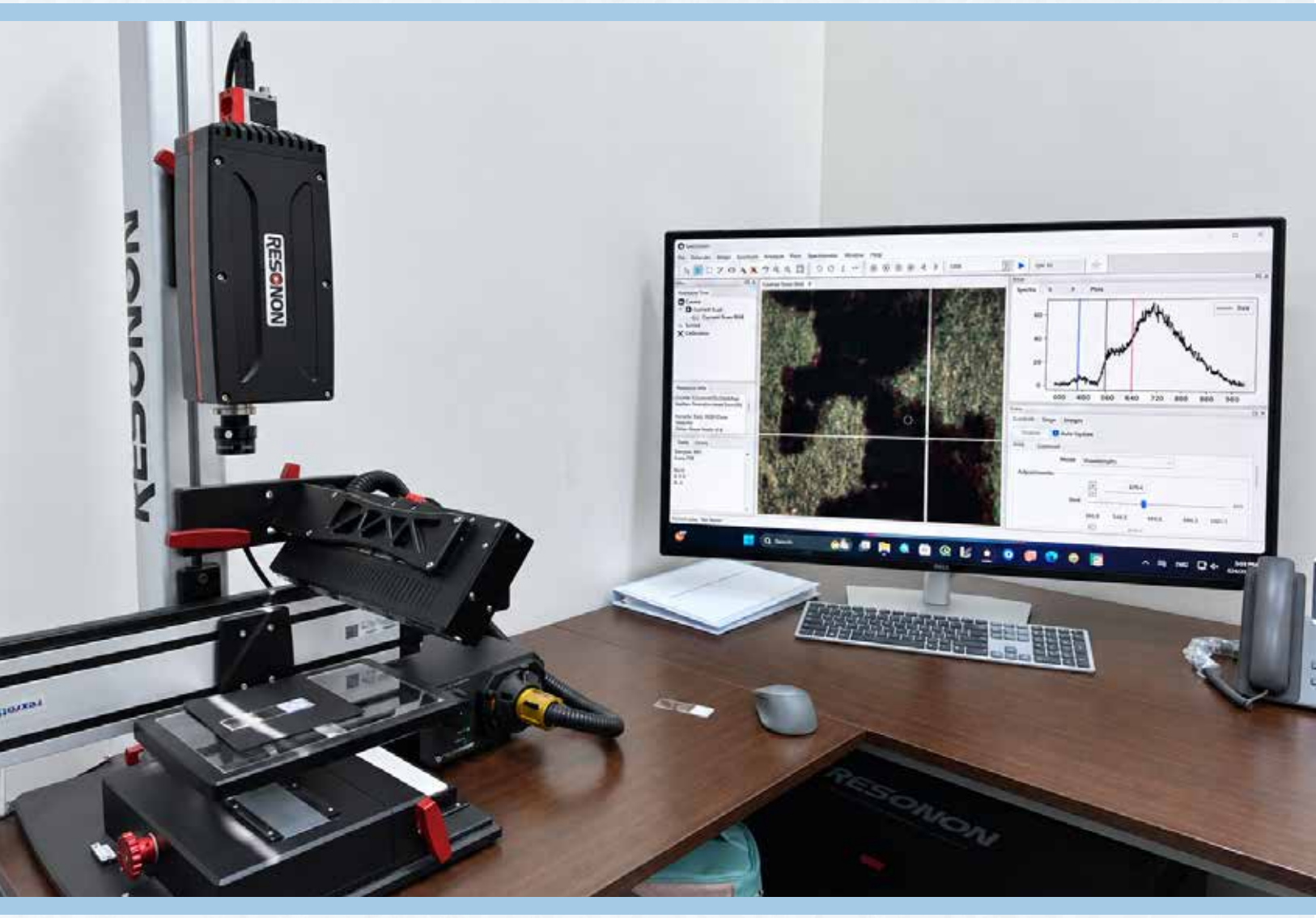
Hyperspectral Imaging Laboratory:

The First Facility of Its Kind in Qatar



The Environmental Science Center (ESC) at Qatar University established the Hyperspectral Imaging Laboratory (HIL), the first facility of its kind in the State of Qatar dedicated to hyperspectral imaging applications in Earth sciences, environmental studies, and biomedical research. The laboratory serves as a national platform that supports scientific research and innovation while contributing to the development of advanced technologies and solutions that benefit society and the environment and strengthen Qatar's position in advanced sensing and imaging technologies.

The laboratory provides state-of-the-art hyperspectral imaging infrastructure for field measurements and high-precision spectral data analysis, supporting scientific research and environmental monitoring in Qatar. The HIL is equipped with the Pika XC2 hyperspectral camera, which operates within the 400–1000 nm wavelength range and can collect data through 1,600 spatial pixels distributed across 447 spectral bands with a spectral resolution of 1.9 nm. The associated hardware and software systems provide advanced capabilities for data acquisition and analysis, enabling studies of



From left: Dr. Rajendran Sankaran, Laboratory Supervisor, and Prof. Fares Al-Momani, Director of the Environmental Science Center.

natural resources and environmental systems, expanding the applications of hyperspectral imaging, and supporting innovative scientific solutions that serve society and the environment in Qatar.

The laboratory is also equipped with advanced image processing systems, including DELL workstations, as well as specialized software packages such as ENVI 6, IDL 9 (NV5) and ArcGIS Pro 3.2 for spatial mapping applications. In addition, several open-source software tools are utilized for the identification and mapping of terrestrial, environmental, and biomedical resources.

The hyperspectral imaging system is highly sensitive to the optical, physical, and chemical properties of different materials, enabling both qualitative and quantitative remote sensing applications for resource identification and mapping in both field and laboratory environments. The laboratory also benefits from national and international open-access databases and satellite imagery with varying spatial resolutions, supporting international research initiatives and collaborative studies.

The research expertise and advanced capabilities available within the laboratory have created a stimulating environment for researchers and graduate students while enhancing the center's ability to attract nationally competitive research projects. One of the most notable achievements is securing the collaborative research project "HyperBrain," funded by the Qatar Research, Development, and Innovation Council (QRDI). The project focuses on developing advanced biomedical imaging technologies for brain tumor detection, supporting innovation in the healthcare sector and contributing to improved quality of life and healthcare services.

As part of its commitment to community service and scientific advancement in Qatar, the laboratory participated in a collaborative research project with the College of Engineering at Qatar University entitled "Hyperspectral Imaging of Early Quranic Manuscripts." The project aims to employ advanced imaging technologies to study and preserve Quranic manuscripts dating back to the early centuries of Islam and was funded by the Qatar Research, Development, and Innovation Council. The laboratory facilities also supported a research project funded by Earthna, a Qatar Foundation initiative, highlighting the Environmental Science Center's role in supporting national research initiatives and strengthening institutional collaboration for the benefit of society, cultural heritage preservation, and environmental sustainability.

The expertise and resources available within the laboratory have further provided valuable opportunities for graduate students and contributed to securing several research projects funded by the Qatar Research, Development, and Innovation Council.

The research team has actively promoted the capabilities and applications of hyperspectral imaging through publications in peer-reviewed scientific journals, demonstrating the importance of this technology in environmental and biomedical research. Laboratory activities have also contributed to research capacity building, strengthened interdisciplinary collaboration, and opened new opportunities for applying advanced technologies in service of society and the environment.

The laboratory is supported by a specialized research team with extensive expertise in reflectance spectroscopy and hyperspectral imaging. Through collaborations with academic institutions and industry partners both within Qatar and internationally, the team conducts multidisciplinary applied research that supports innovation and reinforces the role of scientific research in serving society and promoting sustainable development.

