Smart Campus: Enhancing Geography Education at Hills Grammar School with SenseCAP Devices in Australia

In February 2010, the Department of Industry, Innovation and Science funded a nation-wide Citizen Engagement Program: Inspiring Australia. With the goal to improve science communication and help engage the Australian community with science, Inspiring Australia has rolled out a range of programs and expanded existing ones to help achieve its goals, among which improving urban weather and environmental data for use in science and geography education in schools all around the country has been an important approach. Set in over 52 acres of campus, including an eminently beautiful and natural parcel of land in Kenthurst, 30km north-west of Sydney CBD, the Hills Grammar School is one of the schools that is dedicated to embracing the Inspiring Australia program.

With an enrolment of over 1,000 students, providing diverse and inclusive education for children from Pre-K to Year 12, the Hills Grammar School has been applying STEM education and curriculum-aligned classroom activities for some years. However, the challenge at hand was to make education more immersive, data-driven, and globally connected. Hills Grammar School wanted to empower its students to explore the complexities of the environment and climate, bridging the gap between theory and real-world observation.

To enhance geography education for Year 11 and 12 students, Hills Grammar School partnered with One Planet Education Network (OPEN). They developed a smart campus solution using SenseCAP sensors and weather stations to collect real-time data on geography, biodiversity, soil conditions, CO2 levels, and microclimate zones. By virtually connecting with students from the University of Maryland, they gained practical insights into using these sensors for data collection, highlighting the importance of geography education in addressing environmental challenges.

- **Solution:** A Sensational Learning Experience with Real-time Environmental Data
- **Partners:** One Planet Education Network (OPEN), Hills Grammar School, Helium Network, Hitechdb, Ubidots
- **Seeed Products:** SenseCAP M1 LoRaWAN Indoor Gateway, SenseCAP S2120 8-in-1 LoRaWAN Weather Sensor, SenseCAP S2102 LoRaWAN Light Intensity Sensor, SenseCAP S2103 LoRaWAN® CO2, Temperature, and Humidity Sensor, SenseCAP S2104 LoRaWAN® Soil Moisture and Temperature Sensor, and SenseCAP A1101 LoRaWAN Vision AI Sensor
- **Industry:** Education
- **Deployed in:** Hills Grammar School, Kenthurst, Australia
To help its students to engage with the science in a more interactive way and prepare the students with skills of mastering emerging IoT technologies, the Hills Grammar School collaborated with One Planet Education Network (OPEN), and set out to revolutionize geography education for Year 11 and 12 students. OPEN, a mission-driven social enterprise founded by George Newman, specializes in STEM+Project-Based Learning, with a focus on sustainable community development and the United Nations' 2030 Sustainable Development Goals (SDGs). This innovative partnership aimed to enrich students' learning experiences and deepen their understanding of the environment.

The sensor data is sent to the cloud via the Helium LoRaWAN Network, which is already accessible in the area without any special network infrastructure needed, only a Seeed Studio SenseCAP M1 LoRaWAN Indoor Gateway. Together with the live dashboard created by OPEN and its partner Hitechdb, which is based on Ubidots software, the data can be visualized and accessed during the classroom activities, allowing students to engage directly with their surroundings, thus turning the school's campus into a living laboratory for geography education.

The solution lay in the deployment of 15 SenseCAP sensors in 6 different sites across the school's campus. These sensors included four SenseCAP S2103 CO2 sensors, three SenseCAP S2104 soil moisture/temperature sensors, three SenseCAP S2102 light intensity sensors, and three SenseCAP A1101 vision AI sensors. In addition, two SenseCAP S2120 LoRaWAN 8-in-1 Weather Stations were installed to collect microclimate data.
Why SenseCAP

SenseCAP sensors were the perfect choice for this project due to their reliability, accuracy, and real-time data capabilities. SenseCAP sensors are known for their ease of use and seamless integration, making them ideal for educational environments.

These sensors provided students with the opportunity to access valuable data that enhanced their understanding of geography. Moreover, SenseCAP's ability to provide real-time data ensured that students could actively monitor and analyze the ever-changing weather conditions, air quality, soil moisture, light levels, and CO\textsubscript{2} levels, and impacts on local biodiversity, facilitating a more hands-on and engaging learning process. This first hand exposure to sensor technology has equipped students with the practical skills necessary for future academic and professional pursuits.

“OPEN’s partnership with Seeed Studio has allowed for the evolutionary development of hands-on citizen science field research programs by OPEN. This is a truly remarkable development for education, and for all of us. The combination of Seeed's versatile SenseCAP sensor technologies and OPEN’s open network data, academic researchers and student citizen scientists can begin to better understand the underlying forces that are rapidly changing life on our small planet. Backed by this empirical data we see students taking the lead in formulating novel and practical solutions to our many global environmental challenges.” - George Newman, CEO at One Planet Education Network, LLC.

Results

The deployment of SenseCAP sensors played a pivotal role in enriching the educational experience at Hills Grammar School. Year 11 and 12 Geography students at Hills Grammar School engaged in an international learning initiative in collaboration with One Planet Education. During this program, the students had the unique opportunity to virtually connect with the University of Maryland in the USA.

The virtual sessions featured students from the undergraduate course in the Environmental Monitoring Lab at the University of Maryland, specializing in Atmospheric and Oceanic Science and Mechanical Engineering. They shared their profound insights into how the SenseCAP sensors were effectively utilized for real-time data collection. This data, including weather conditions, air quality, and greenhouse gas measurements, was employed to quantify and monitor various environmental factors.

This unparalleled learning experience enabled Hills Grammar School students to grasp the practical application of SenseCAP sensors and understand their critical role in addressing real-world environmental challenges. By expanding their global perspective, it underscored the immense value of geography education in contemporary environmental studies and problem-solving.
With this all in mind, on deck next, University of Maryland student researchers are currently in the process of analyzing a number of Hills data sets from their Seeed sensor network and are tentatively scheduled to present their findings to Hills year 11 and 12 students early in 2024.

“With low-cost low-power long range global sensor data networks now in place, students have the full benefit of this environmental monitoring technology and are capable of doing their own tech-supported citizen science research backed by OPEN support teams. Through their citizen science projects and experiments students will greatly contribute to the body of knowledge of science professionals, even just by offering volumes of anonymized data they are collecting through OPEN’s globally networked LoRaWAN systems.” comments George Newman, CEO at OPEN.

Hills students can take OPEN’s soon to be released High School level online data analytics course, where they will be required to analyze their own as well as ecosystem data sets from other OPEN and Seeed Studio sites around the world, opening up more opportunities for learning and for additional rewarding academic collaborations. Stay tuned for more in ’24.

This project also contributes to the following Sustainable Development Goals (SDG 9, 11, 13, 15, and 17.)

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https://www.oneplaneteducation.com/

OPEN One Planet Education Network is an organization with a goal to make students worldwide enthusiastic about science and understanding different cultures. They want to ensure students are ready to work in a modern, technology-focused world and solve big problems that affect us all. OPEN gives students the chance to use new technologies, to communicate with each other and experts globally, and to share their cultures and histories. They value respect, equality and listening to everyone, including traditional cultures.

Hills Grammar School is a renowned educational institution that offers a comprehensive and enriching learning experience to its students. Known for its commitment to academic excellence and holistic development, the school provides a diverse range of programs and extracurricular activities that foster intellectual growth, creativity, and personal growth. With a strong emphasis on values, character development, and community engagement, Hills Grammar strives to empower students to become compassionate and responsible global citizens.

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