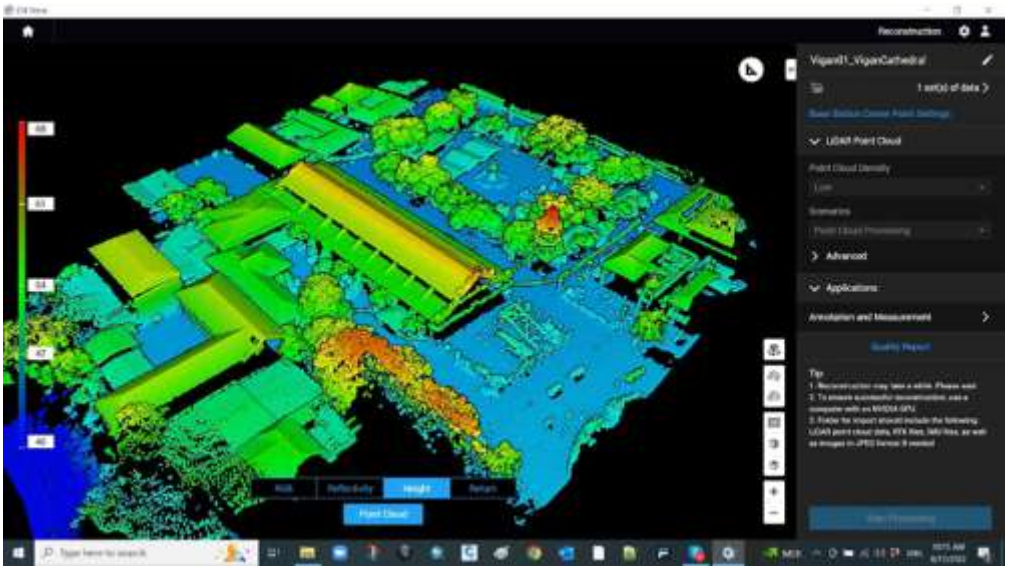
Vigan Post-Earthquake Damage Assessment of Historical Structures

Philippines Flying Labs team setting up DJI M300 for aerial field mapping



Vigan city cathedral point cloud results

OVERVIEW	
Flying Labs	Philippines Flying Labs
Geographic area	Vigan City, Philippines
Date range	August 2022
Sector program	AidRobotics

Main SDGs	GOAL 11: Sustainable Cities and Communities

SCOPE	
Project stakeholders	● Council of Engineering Consultants in the Philippines (CECOPHIL) consisting of these consultancy firms: ○ SRDP Consulting Inc. ○ AMH Philippines ○ ESCA Incorporated
People impacted	The Local population of Vigan city.
Number of people impacted	An estimate of 53,000 people (2020 Census)
Problem statement	A powerful Magnitude 7.0 earthquake struck Vigan city in July 2022, a city renowned for its preserved Spanish colonial and Asian architecture. CECOPHIL initiated a team from SRDP Consulting Inc, ESCA Incorporated and AMH Philippines (local consulting firms) and Philippines Flying Labs to assess the post-earthquake damage to ancestral houses, government facilities, and infrastructure. The objective was to evaluate the extent of the destruction and devise a plan for restoration, crucial for preserving cultural heritage and ensuring safety for both residents and tourists in this historic city. This problem statement highlights the urgent need to address the earthquake's impact on Vigan city's iconic structures and civic amenities.
Project objectives	● Conduct a structural damage assessment using drones ● Provide a geohazard assessment to Vigan city LGU to assist in making informed decisions regarding the repair and planning of their post-earthquake rebuilding efforts.
Scope	To achieve the project objectives, the team engaged in the following activities; ● Identifying and prioritizing historical sites & critical infrastructures that require assessment based on their cultural and historical significance, structural vulnerability, and potential geohazards.

	• Identifying what kind of drone will be used for this type of project. • Aerial works - data collection using a drone to capture detailed imagery & structural data including photos. • Data processing - processing raw images and videos to create high resolution orthophoto for analysis. • Geohazard assessment - utilizing the output from the drone and field verification of experts such as geologists, structural engineers, etc. to assess potential geohazards such as landslides, liquefaction, ground settlements. • Structural Assessment - utilizing the output from the drone and field verification of structural damage such as cracked, weaknesses, and other issues in the historical & infrastructure • Presenting the results of the assessment to the stakeholders.
Outcome	The engineer and geologist consultants were able to assess the structural and geohazard situation of the city. The team presented the results to Vigan Local Government Unit (LGU) so they can use this new information in decision-making in rebuilding Vigan city.
Impact	Going forward, this case study can prepare Vigan city to ensure that Vigan city remains a vibrant and culturally rich destination. Medium-term impact: The assessments will enable informed decision-making, improve safety, promote cultural heritage, boost the local economy, and enhance community resilience in the future. Long-term impact: The assessments will foster structural resilience, sustain tourism and heritage promotion, support risk mitigation strategies, empower communities, and contribute to international recognition and sustainable development in Vigan city.
Challenges	Vigan city is far from Metro Manila, so the team had to travel a total of 12 hours to the city.
Next steps	Following the assessment by the consultants, they successfully imparted the necessary skills to Vigan city's engineers, enabling them to conduct independent assessments. Furthermore, this

	collaboration established a valuable resource for potential future consultations with the experienced consultants.

COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT	
Consent for data acquisition	Describe (if relevant) how you organized to receive consent from the relevant stakeholders and community members for data acquisition Philippines Flying Labs coordinated with Vigan city since the beginning of the project. PFL requested from the city to conduct aerial mapping, inspection and field verification with structural and geologist consultants. The team submitted a formal letter to Vigan city addressed to the mayor stating all their planned inspection and survey and attended online meetings to discuss technical details with the City Engineering Office. Vigan city Mayor understood the urgency of the inspection and granted permission and consent to conduct aerial works in the city.
Community engagement activities	The team requested a courtesy call with the Vigan city Mayor, Planning and Engineering Office to discuss objectives, logistics, field survey schedule, and structures/buildings of interest. The meeting took place in Vigan City Hall.
Community groups engaged with	Government Officials.
Community attendance	A total of 12 people attended, including government officials, SRDP / Philippines Flying Labs, ESCA Incorporated, and AMH Philippines.
Community feedback	Vigan city engineers were satisfied with the assessment that was conducted and a high resolution imagery of their city.
Stakeholder support	After data collection and post-processing, the team and the stakeholders had a technical session to discuss the structural integrity of the buildings. The orthophoto, and 3D model of some important historical structures were supplementary data story visuals to show the stakeholders. The city engineers were given the data to load in QGIS.

DATA ACQUISITION	
Size of area	117.59 ha or 1.175km2
Drone	DJI M300
Sensor(s)	LiDAR Sensor
Flight plan software	DJI Pilot
Flight height	120 meters above ground
GSD (Accuracy)	5.31 cm/pix
Number of images acquired	218
Number of flights	One (1)
Time invested in data acquisition	One (1) day
Georeferencing	No Georeferencing used here

DATA PROCESSING & ANALYSIS	
Processing software	PIX4Dmapper
Processing time	Two (2) hours
Data products	Orthomosaic, Point Lidar Cloud (Some Historical Structures)
Analysis tools	- GIS - Global Mapper
Analysis outputs	N/A
Final outputs shared with stakeholders	Orthophoto, Point Lidar Cloud (Some Historical Structures), Structural and Geohazard Reports
Data sharing	Google Drive