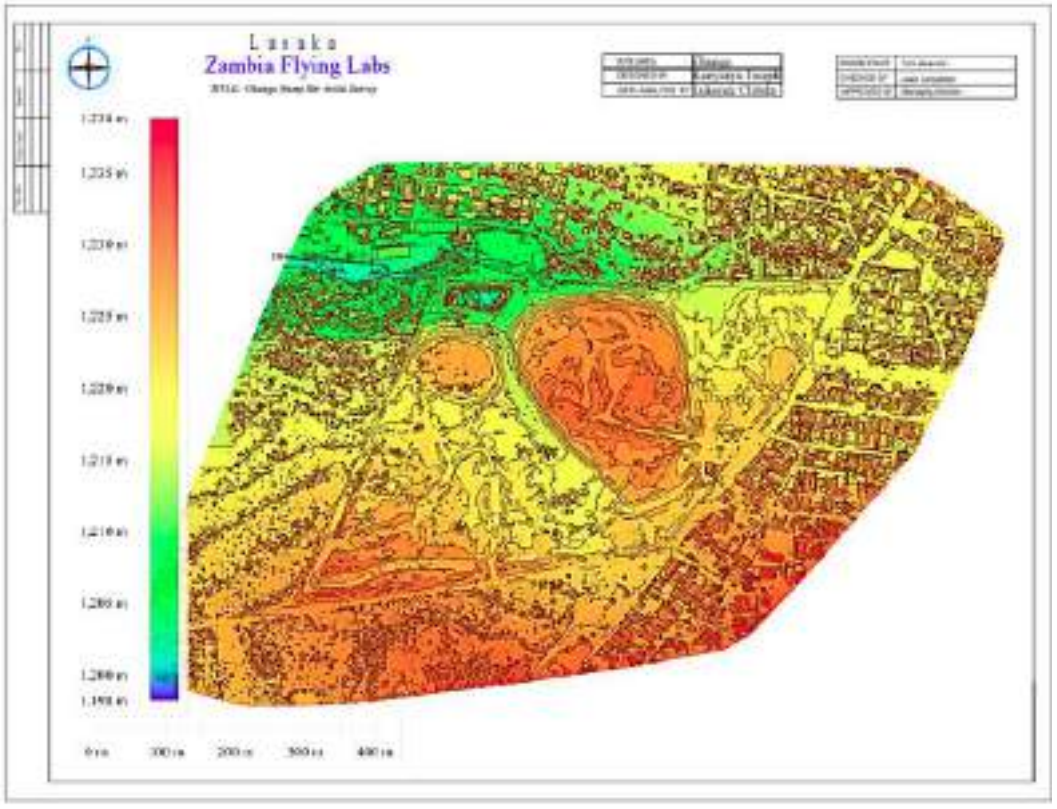
Using drones for stockpile audits for Chunga dumpsite

Ground survey information



Elevation map of the dumpsite

Stockpile volume 1, boundary

Stockpile volume 2, boundary

Slope map

OVERVIEW	
Flying Labs	Zambia Flying Labs
Geographic area	Lusaka, Zambia
Date range	May - June, 2021
Sector program	DevRobotics
Main SDGs	GOAL 3: Good Health and Well-being GOAL 6: Clean Water and Sanitation GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities

SCOPE	
Project stakeholders	Lusaka City Council (LCC) - main stakeholder Zambia Civil Aviation Authority Disaster Management and Mitigation Unit Ministry of Housing and Infrastructure Ministry of Higher Education Sustainable Sanitation Alliance Japan International Cooperation Agency

People impacted	People who live near the dumpsite
Number of people impacted	Approximately 500
Challenge	In 2014, the Lusaka City Council embarked on a project to construct a wall around the only dumpsite in the city of. The reasons for securing the dumpsite were simple: (1) improve the sanitary conditions at the site and (2) control garbage from spilling over. The wall fence was also meant to deter scavengers from flocking to the dumpsite. However, three years down the line, the situation at Chunga dumpsite has not improved due to over-reliance on inappropriate monitoring technology that did not support efficient service delivery in a city that is largely informal with many areas being inaccessible due to settlement form that has many structures with no direct access or a proper road. Thus, the infrastructure and physical planning challenges were compounding the waste management issue in the city. The other challenge was uncoordinated waste disposal by various waste management companies. This has not only resulted in shortage of space, but has created a health hazard to people living nearby. The landfill, which is the only modern engineered landfill in the country, is surrounded by residential houses. Some of the litter from the dumpsite has even found its way on the newly constructed ring road.
Scope	The scope of the project included: ● Monitoring the overspill using processed drone outputs. ● Determining stockpile volumes from processed outputs using drones (volume calculations). ● Establishing the extent of encroachment by tracing boundaries from processed outputs.
Outcome	In collaboration with our main key stakeholder, Lusaka City Council, our proposed solution involved providing accurate high resolution 2D maps, 3D models, volume of stockpile, spillover monitoring as well as data for landfill inventory systems over regular intervals, through the use of drones and data analytics platforms (PIX4Dmapper as our processing software and CloudCompare as our analysis tool). The objectives for this project was achieved by understanding the main challenges the client was facing, based on this information. We were able to generate relevant outputs such as: ● Height & Slope Maps for client to understand landscape

	• 3D Maps for Client to measure stockpile volumes • 2D Maps for clients to determine extent of boundary and encroachment into residential areas. The overspill was determined by tracing the boundary coordinates of the dump site provided by the client.Then extract the area between the clients boundary layer and the layer showing current boundary.
Impact	Firstly, the project allowed the client to get insightful tools for planning the future renovation of the dumpsite. Secondly, guidelines on the disposal of waste to avoid overspill were created. Finally, the stockpile volume will help determine the lifespan of the dumpsite.
Next steps	Integration of drones into the workflow of the client in monitoring overspill, stockpile volumes and keeping boundaries of the dumpsite in check.

COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT	
Consent for data acquisition	Written consent from main stakeholders to carry out the project
Activities to engage with the community	• Training participants of the project (the activity took place at the university of Zambia). • Project launch - on 5th June, 2021 at the University of Zambiaduring the World Environmental Day. • Mapping demo - took place on site, 5th June, 2021.
Community groups engaged with	1.Disaster Management and Mitigation Unit 2.Ministry of Housing and Infrastructure 3.Ministry of Higher Education 5.Sustainable Sanitation Alliance 6.Japan International Cooperation Agency
Community attendance	25
Community feedback	Received positive feedback to and permission to carry out regular check-ups of the overspill.
Stakeholder support	Based on the guidelines provided in the Turning Data into Action program, we were able to communicate clearly and effectively about the objectives for the projects, as well as manage the expectations of the client.

DATA ACQUISITION	
Size of area	80.2 ha (0.802 km²)
Drone	Phantom 4 RTK
Sensor(s)	RGB
Flight plan software	DJI GS Pro
Flight height	117 m
GSD (Accuracy)	2.92 cm/pix
Number of images acquired	671
Number of flights	2 flights
Time invested in data acquisition	1 day of data acquisition
Georeferencing	Phantom 4 RTK referenced to surveyor general CORS stations

DATA PROCESSING & ANALYSIS	
Processing software	PIX4Dmapper
Processing time	33m 25s
Data products	Orthomosaic, DTM
Analysis tools	CloudCompare Global Mapper
Analysis outputs	Elevation maps, slope map and stockpile volume
Final outputs shared with stakeholders	Orthomosaic and DTM Analysis Outputs prepared in AutoCad (Height Maps,Slope maps & Stockpile volume information)
Data sharing	Google Drive