The Use of Drones in Disaster Preparedness, Mitigation and Response

Stjwetla Informal Settlement, Alexandra Township, North of Johannesburg - South Africa

South Africa Flying Labs Team
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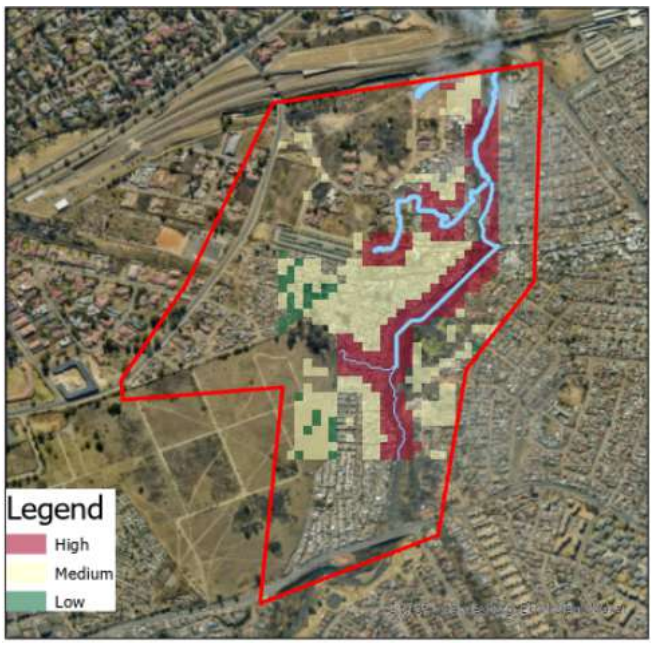

Flood risk map with an overlay of highest water accumulation

OVERVIEW	
Flying Labs	South Africa Flying Labs
Geographic area	Alexandra Stjwetla Informal Settlement, North of Johannesburg - South Africa
Date range	April - June 2022
Sector program	AidRobotics
Main SDGs	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action

SCOPE	
Project stakeholders	Gauteng eGovernment Department City of Johannesburg (CoJ) Youth of Alexandra South Africa Flying Labs United Nations International Children's Fund South Africa (UNICEF SA)
People impacted	City of Johannesburg Community of Alexandra (Stjwetla Informal Settlement) Youth of Alexandra
Number of people impacted	2000+ people
Challenge	Every year during the rainy season, the Jukskei River bursts its banks resulting in people from Stjwetla Informal Settlement being affected by the flooding. No map currently exists that forms the basis for disaster response planning, response and mitigation. At this point the response teams can only come in aerially or on foot which can be costly in both human life and financially.
Scope	The project aimed at creating a use case to demonstrate to the city how drones can be used to map an area for purposes of preparing for natural and unnatural disasters. In addition, to also create a map of the informal settlement to identify shacks on floodlines and ensure the council can use this as a basis for disaster preparedness and planning. This interactive map will be used as a basis:

	1. for critical decision-making based on current and reliable information, 2. to identify access routes for response teams during disaster and areas prone to flooding and fire hazards and areas which can be used as assembly points, 3. and for spatial planning for the council.
Outcome	1. A mitigation plan for potential disasters in the Stjwetla Informal Settlement comprising of: a. a high resolution orthomosaic, b. a Digital Elevation Model (DEM), c. a flood risk analysis, d. and a fire risk analysis. 2. Recommendations of access routes for fire and other emergency response teams. 3. A presentation to various stakeholders to inform their decisions including a much wider project of mapping the entire township.
Impact	This project will potentially lead to replanning of the informal settlement to ensure the shacks on floodlines are moved. It will also help in reducing the use of fire prone materials and increasing the distances between the shacks to minimise fire risks. Finally, it will facilitate generation of access routes for emergency response teams in case of disaster.
Next steps	Mapping the entire township and eventually training the community on disaster awareness and mitigation in conjunction with the City of Johannesburg (CoJ). Facilitate a workshop with the CoJ planning, Emergency Management Services and Environmental Management Planning, to make them consider enrolling in a Disaster Management Course.

COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT	
Consent for data acquisition	Meetings were held with community leaders, councillors and youth. Presentations were made on the value that will accrue based on the work to be performed.
Activities to engage with the community	Meeting 1 was on awareness training with youth and Small Medium and Micro Enterprises (SMMEs) at the Alexandra Sports Complex. Meeting 2 was held with the Gauteng eGovernment department at the eGovernment Offices. Meeting 3 involved data acquisition and awareness including stakeholders like UNICEF, Corporate Governance and Traditional Affairs (COGTA) dept. , and the Youth at the Alex soccer ground. Meeting 4 consisted of feedback sessions with the youth, local government and community on June 17, 2022. This session was held virtually. A virtual feedback session was also done with UNICEF SA.
Community groups engaged with	Government officials, community in general, young people, representatives of community-based organisations
Community attendance	Meeting 1: 19 Meeting 2: 4 Meeting 3: 27
Community feedback	The community was excited about the initiative and wanted more involvement in use of Fourth Industrial Revolution (4IR) technologies and ensuring youth in the area is involved.
Stakeholder support	The program outputs were shared with the team in accessible formats depending on the exposure of the relevant stakeholders. Low resolution maps which are less resource intensive were produced so that they can be opened from computers with less capacity. The community members and others were also encouraged to download and use GoogleEarth Pro.

DATA ACQUISITION	
Size of area	150 ha (1.5 km^2)
Drone	DJI Phantom Pro 4
Sensor(s)	RGB
Flight plan software	PIX4Dcapture
Flight height	80 meters above ground
GSD (Accuracy)	2.63 cm/pix
Number of images acquired	2028 images
Number of flights	5 flights
Time invested in data acquisition	4 hours
Georeferencing	Onboard GPS

DATA PROCESSING & ANALYSIS	
Processing software	Agisoft Metashape
Processing time	08 hrs:08 min:13 sec
Data products	Point cloud, orthomosaic, Digital Elevation Model (DEM)
Analysis tools	ArcGIS Online, ArcGIS Pro
Analysis outputs	Flood risk map, fire risk map
Final outputs shared with stakeholders	Orthomosaic, DEM, flood risk map, fire risk map, presentation
Data sharing	Google Drive and other online tools, email