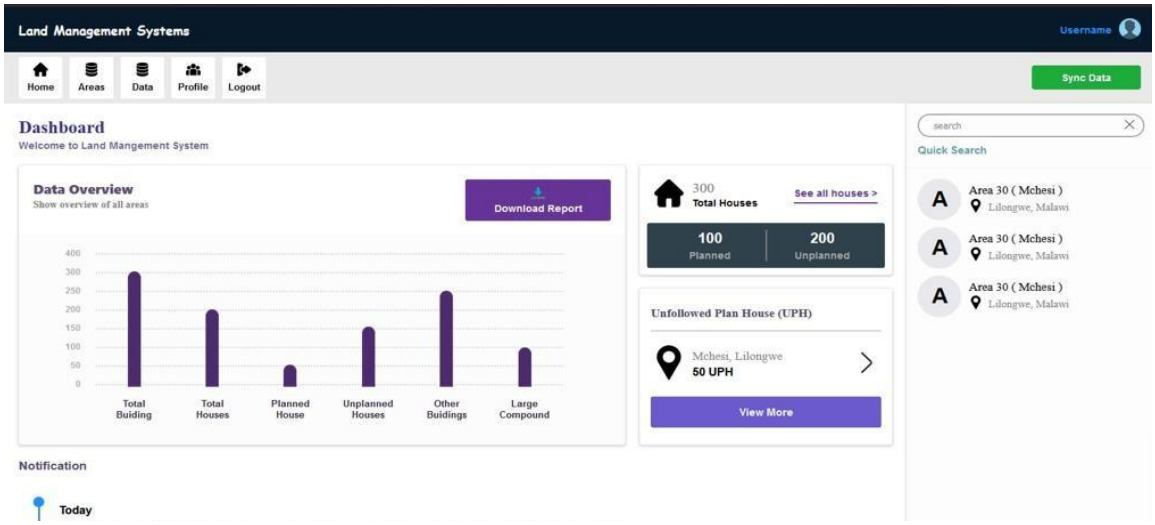
Using Machine Learning Models on Drone Maps for Town Planning



The dashboard overview of the land management system with sample analytics

The prototype interface, with a selection showing the search area requested by the user

Drone pilot showing students from Dzenza Secondary School what a flight plan looks like and how the drone follows it

OVERVIEW	
Flying Labs	Malawi Flying Labs
Geographic area	Lilongwe, Malawi
Date range	March - June 2022
Sector program	DevRobotics
Main SDGs	GOAL 11: Sustainable Cities and Communities

SCOPE	
Project stakeholders	Client: Ministry of Finance Stakeholders: Ministry of Lands Lilongwe City Council Department Of Physical Planning Malawi Revenue Authority Department Of Housing
People impacted	People of Lilongwe North in Area 49 and Area 50
Number of people impacted	Approximately 6000 people
Challenge	With the lack of geospatial data and analytical tools for town planning in Lilongwe, it has currently become unyielding to keep track of development changes happening on the ground, due to the continuous, fast-paced growth of urbanization and the rate at which settlements are developing in the city. Citizens do not adhere to zoning or town planning requirements, most plans go unchecked and a lot of structures are built in areas not fit for such developments.
Scope	The entirety of the project is based on the development of a prototype system that leverages machine learning models to sort through drone maps. The purpose is to accurately differentiate between the types of infrustructure in Lilongwe North Area 49 and Area 50. This tool will allow the stakeholders to access richer datasets to track and monitor residential settlements within the city with ease.
Outcome	A prototype, which was successfully produced and launched. The prototype met the client's specifications with an accuracy of 70%. The system developed can currently identify finished and unfinished residential houses, differentiate between a house and

	other types of structure such as a church, warehouse, school and also counting units per square meter.
Impact	The system will allow: ● Improved town planning, ● Improved enforcement of zoning regulations, ● Increased revenue collection of city rates and tax on commercial structures.
Next steps	The project was a proof of concept for the Turning Data Into Action program. Potentially, if adopted on a larger scale, it will impact the urban citizens in all four major cities of Malawi, estimated to have a population of 9 million people: Blantyre, Zomba, Mzuzu and Lilongwe. Further discussions will be held with the client to develop a fully functioning system by mapping larger areas and eventually the four cities to feed more maps into the system.

COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT	
Consent for data acquisition	A concept note was shared with the stakeholders. Lilongwe City Council then gave access to the town plans and residential plans for the 100 ha study area which was mapped to support the project.
Activities to engage with the community	A series of meetings were held: ● Two meetings at the initiation of the project with the Ministry of Finance, ● Two more meetings during the development of the prototype, ● Two meetings at the end of the development of the prototype with Lilongwe City Council Planning Department and the Department of Housing, ● A final meeting and demonstration was held with the Ministry of Finance. In addition, contact was made with the community leaders in the area of interest to brief them on the purpose of the flights. Within this area of study there was a school to be mapped.

	Contact was made with the school authorities and students and a short demonstration on the use of drones and purpose of the project were made.
Community groups engaged with	Government officials, community leaders and students
Community attendance	8 community leaders and 250 students at the school assembly
Community feedback	The school authorities were excited about the project and thankful for the presentation
Stakeholder support	Due to the resources gathered and used from the Turning Data Into Action program, such as the stakeholder map, the team was made aware and more intentional on how to communicate with the different stakeholders throughout the duration of the project

DATA ACQUISITION	
Size of area	101 ha (1.01 km2)
Drone	DJI Phantom 4
Sensor(s)	RGB
Flight plan software	DroneDeploy
Flight height	91.5 m above ground level
GSD (Accuracy)	3.6 cm/pix
Number of images acquired	1157 images
Number of flights	4 flights
Time invested in data acquisition	2 days
Georeferencing	Onboard GPS (image geotags)

DATA PROCESSING & ANALYSIS	
Processing software	DroneDeploy
Processing time	5 hours
Data products	2D orthomosaic
Analysis tools	
Analysis outputs	-
Final outputs shared with stakeholders	Prototype of the system
Data sharing	Dropbox

INTERNAL USE ONLY - this will not be published	
Financial project outcome	Breakeven
Changes in scope	No changes in scope
Additional pictures	Optional - add link to gallery folder