

## Drone technology bringing reality of farm land use



*Orthomosaic produced*

OVERVIEW	
<b>Flying Labs</b>	Uganda Flying Labs
<b>Geographic area</b>	Mazzi, Uganda
<b>Date range</b>	September 2024
<b>Sector program</b>	<a href="#">DevRobotics</a>
<b>Main SDGs</b>	<a href="#">GOAL 2: Zero Hunger</a>

SCOPE	
<b>Project stakeholders</b>	Riziki Farm
<b>People impacted</b>	The farm owners, stakeholders and partners
<b>Number of people impacted</b>	50
<b>Problem statement</b>	The farm being large, the stakeholders were unable to track all activities in the farm. There was also some fear that the land was being utilized by illegal squatters.
<b>Project objectives</b>	<ul style="list-style-type: none"> <li>● To Identify terrain patterns.</li> <li>● To identify the land use of the farm.</li> <li>● To capture informal and formal buildings.</li> <li>● To identify illegal activities on the farm.</li> </ul>

	<ul style="list-style-type: none"> <li>● To understand the quantities of pastures for ranching.</li> <li>● To retrieve an inventory of under-utilized land and plan for development.</li> <li>● To ascertain the temporary land lease to the community.</li> </ul>
<b>Scope</b>	The purpose of our flights was to do an aerial survey in Mazzi, Luwero to capture the data for clear alignment for development and decision making.
<b>Outcome</b>	<ul style="list-style-type: none"> <li>● An orthomosaic was generated from the data which was digitized into a vector map for land use.</li> <li>● The data was evaluated to ascertain if there were any illegal buildings and cultivated land. The farmers also realized that there were remote areas that had been intruded by the local community.</li> <li>● It was also discovered that some of the dams were shared between two farms because they were located on the boundaries.</li> <li>● Overgrazed land was identified, with a plan to relocate the herds of cattle and goats to fresher pastures.</li> <li>● The road network in the farm was exposed to help the farm managers, clients that come to buy cattle know the most accessible routes for the collection trucks and other cars that come to collect and deliver farm supplies.</li> </ul>
<b>Impact</b>	<ul style="list-style-type: none"> <li>● The farmer will lease out land to some of the community to use for pineapples cultivation for their substance because they have little financial power to acquire their own land.</li> <li>● Real time data was shared with stakeholders as a tool for informed decision making.</li> <li>● Land use was established and all the fears were allayed.</li> </ul>
<b>Challenges</b>	<ul style="list-style-type: none"> <li>● The datasets were too huge and took more than a week to process the images.</li> <li>● There were gaps in some areas after stitching due to insufficient overlaps in other areas and failure of some images to calibrate.</li> <li>● We failed to capture some images even after a re-flight. The data took a long time to stitch.</li> <li>● The gaps were difficult for the digitizing team to identify with, we had some videos and pictures in critical spots captured with a smaller drone. That was our bridge to identifying the missed spaces.</li> </ul>

	<ul style="list-style-type: none"> <li>• The first orthomosaic was merged from 6 chunks with PIX4Dmapper but the output was not flawless; the connecting lines for the blocks were visible. Therefore, we had to reprocess it with PIX4Dmatic to achieve a smooth look.</li> <li>• We also discovered that PIX4Dmapper has limitations of processing beyond 5000 images.</li> <li>• For the first flight, we tried using ground station Pro but it was difficult to draw every chunk and ensure that they align on the seams because it was not kml supported.</li> </ul>
<b>Next steps</b>	<ul style="list-style-type: none"> <li>• We expect to fly in hot spots that are underutilized to analyze the quality and fertility of soil to facilitate data for decision making on the suitable crops.</li> <li>• Some of the underutilized land had grown into dense thickets hence there is a need to have follow-up flights to analyze the soil quality with a multispectral camera in order for the proprietor to plant suitable crops as part of the development.</li> </ul>

### COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT

<b>Consent for data acquisition</b>	The project was dedicated to the farm owners needs hence the data is solely for their consumption.
<b>Community engagement activities</b>	<ul style="list-style-type: none"> <li>• The farm manager informed all the neighboring farms about the flight to minimize any suspicion.</li> <li>• The local chairman was informed, including security bodies. The flight did not need a lot of engagement because the interest was limited to the owners of the project.</li> </ul>
<b>Community groups engaged with</b>	Farm stakeholders.
<b>Community attendance</b>	Not applicable.
<b>Community feedback</b>	Not applicable.
<b>Stakeholder support</b>	After handover of the datasets, we also did a demonstration of software applications that would support continuous visualization of the data beyond our presence. We also helped the stakeholder to install QGIS.

DATA ACQUISITION	
<b>Size of area</b>	9.4 km <sup>2</sup> / 940 ha
<b>Drone</b>	DJI Phantom 4 Multispectral and DJI Mavic mini
<b>Sensor(s)</b>	RGB only and deactivated other sensors
<b>Flight plan software</b>	Measure
<b>Flight height</b>	100m
<b>GSD (Accuracy)</b>	5.79 cm/pix
<b>Number of images acquired</b>	23208
<b>Number of flights</b>	23
<b>Time invested in data acquisition</b>	5 days
<b>Georeferencing</b>	Onboard GPS and GCP automated on drone 3D GCP

DATA PROCESSING & ANALYSIS	
<b>Processing software</b>	PIX4Dmapper and PIX4Dmatic
<b>Processing time</b>	PIX4Dmapper - 7 days in chunks and merging PIX4Dmatic - 10 hrs 16 minutes
<b>Data products</b>	Point Cloud DSM Orthomosaic
<b>Analysis tools</b>	ArcGIS Pro and QGIS
<b>Analysis outputs</b>	RGB raster data (orthomosaic) Contour map Land use vector map
<b>Final outputs shared with stakeholders</b>	Raw data Quality reports Processed data in chunks and merged Orthomosaic Maps
<b>Data sharing</b>	External drive G-drive