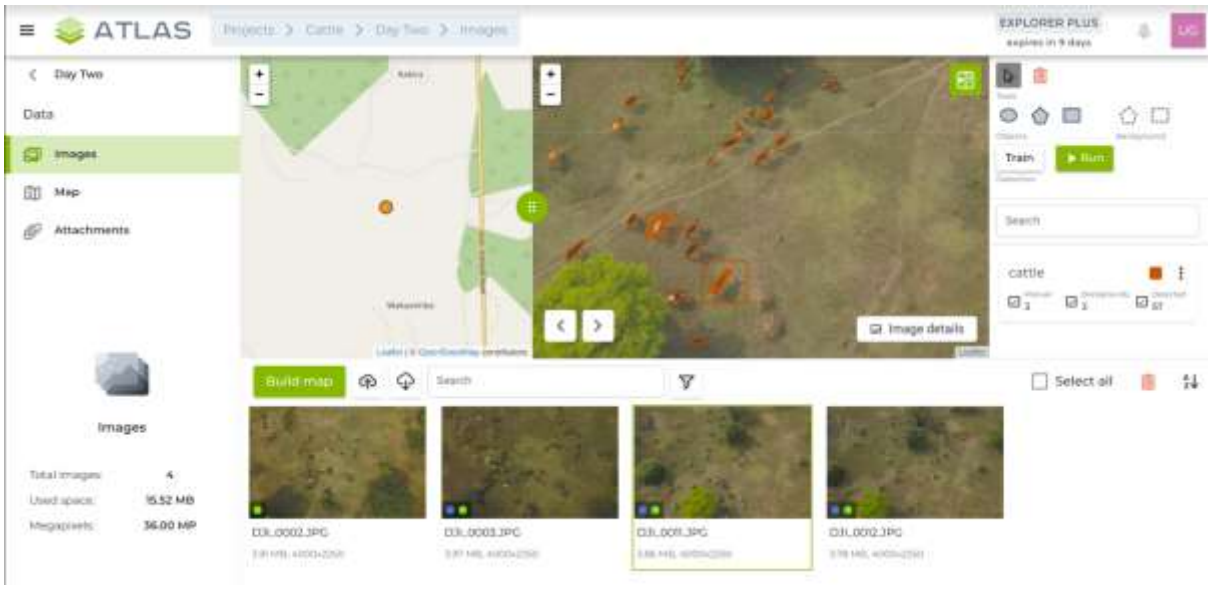
Livestock management using drones and Artificial Intelligence

Kakira Farm cattle

The Uganda Flying Labs team at Katikiza Farm



The results after automatically identifying location and number of the animals

OVERVIEW	
Flying Labs	Uganda Flying Labs
Geographic area	Nakasongola, Central District, Uganda
Date range	Mid January-February 2021
Sector program	EcoRobotics
Main SDGs	GOAL 2: Zero Hunger

SCOPE	
Project stakeholders	Makerere University School Veterinary Medicine, Ministry of Agriculture, Nakasongola District Veterinary Department, Nakasongola District Council, Farmers
People impacted	Farmers, MUK School of Veterinary services, Ministry of Agriculture Veterinary Services, Cattle corridor (Nakasongola)
Number of people impacted	40

Challenge	Overcrowding animals in trucks causes trauma to the animals, which requires monitoring. Moreover, mixing different breeds of animals in a single truck could lead to disease outbreaks or other accidents. Some of MUK's challenges were revenue accountability at the animal auction market, stock inventory, and to some extent, assessing animal health by inspecting farm grasslands.
Scope	The project aimed to reduce illegal animal trafficking, increase disease control at checkpoints, trigger introducing procedures for veterinary compliance and use emerging technologies (namely drones and Artificial Intelligence) to assess body mass of cattle. Farmstock inventory was equally important because it would give the farmers and agricultural planners a larger view of the veterinary department and beef industry.
Outcome	We produced the following outputs and identified potential applications: ● the location of the animals - useful in case they are lost (obtained by accessing GPS information of the images); ● the number of animals at the market and farms (automatic detection and counting of animals from images by training AI detectors); ● information on the level of security of the animals while grazing, for example by detecting predators; ● cattle body scores from videos by assessing the number of ribs visible through the skin of the animal; ● the quality of the farmer's grazing land to determine if relocating the cattle was necessary, especially where there was little grass cover and soil was exposed. All of these features can be seen by naked eye, but the effects are magnified by using ATLAS. Thanks to this project, the veterinary department understood the opportunities that come with robotic technology and AI and are likely to use them.
Impact	This project was a proof of concept and we hope that it is going to attract funding for the long term drone application in livestock farming in order to have sustainable projects. If the concept of robotics is used and proves successful, the government is likely to set a budget aside for technology application in livestock management in farms and veterinary services.

	An article published in a local newspaper allowed us to present the application and spawned interest within the community of farmers, thus attracting more people and promoting the potential of drones and AI in agriculture. The technology used helped the veterinary department to get access to detailed technical reports which allow it to respond quicker.
Next steps	At this point we are looking for partnerships or Twin University to develop some of the concepts and keep supporting the University. The major interest of the university is assessing animals' health using drones that can remotely measure the temperature. The implication is that we have to use a drone with heat sensors. We envision having AI software that can be linked to a dashboard where veterinary doctors can monitor animals that may be ill remotely and send a team with a remedy. Instead of the revenue authorities struggling with numerous heads of cattle at the market, a drone can capture images that will be used for inventory and projections of taxes.

COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT	
Consent for data acquisition	MUK drafted a letter for permission to: ● The Chief Administrative Officer- Nakasongola ● The Resident District Commissioner-Nakasongola ● The Officer in Charge-Nakasongola ● The District Chief Veterinary Officer who has oversight for animal checkpoints, animal markets and livestock farms in case there is an outbreak of diseases in the cattle corridor. The authorisation was granted after a long waiting period and meetings held to explain the scope of activities.
Activities to engage with the community	We had an official meeting in the offices of all the four above-mentioned authorities, each lasting at most 30 minutes. In the department of veterinary services we had a team of vet doctors and other support staff.
Community groups engaged with	The largest community group we engaged with included the farm labourers and manager, all of whom watched our work to learn how drones can be used in livestock management.

	We also engaged with the animal checkpoint team at a highway, as well as with interested passers-by. At the animal market there was a crowd of people surrounding the pilot to see how he was operating the drone.
Community attendance	N/A
Community feedback	The team does not speak the local language, but the body language and facial expressions made it clear that the community members were very excited.
Stakeholder support	One of the veterinary staff members was moving with us on all the tasks, because he had connections within the community in all the points of interest. This provided us with a lot of confidence and security.

DATA ACQUISITION	
Size of area	2500 ha (25 km2)
Drone	Mavic Pro
Sensor(s)	Multispectral
Flight plan software	N/A (manual flights)
Flight height	80 - 120 meters above ground
GSD (Accuracy)	N/A
Number of images acquired	85
Number of flights	5
Time invested in data acquisition	2 hours
Georeferencing	Onboard GPS

DATA PROCESSING & ANALYSIS	
Processing software	N/A
Processing time	3 hours
Data products	Raw images, videos
Analysis tools	ATLAS
Analysis outputs	Classes and labels
Final outputs shared with stakeholders	Images with training output classifying cattles and grassland, Powerpoint presentations
Data sharing	WeTranfer, external hard drives