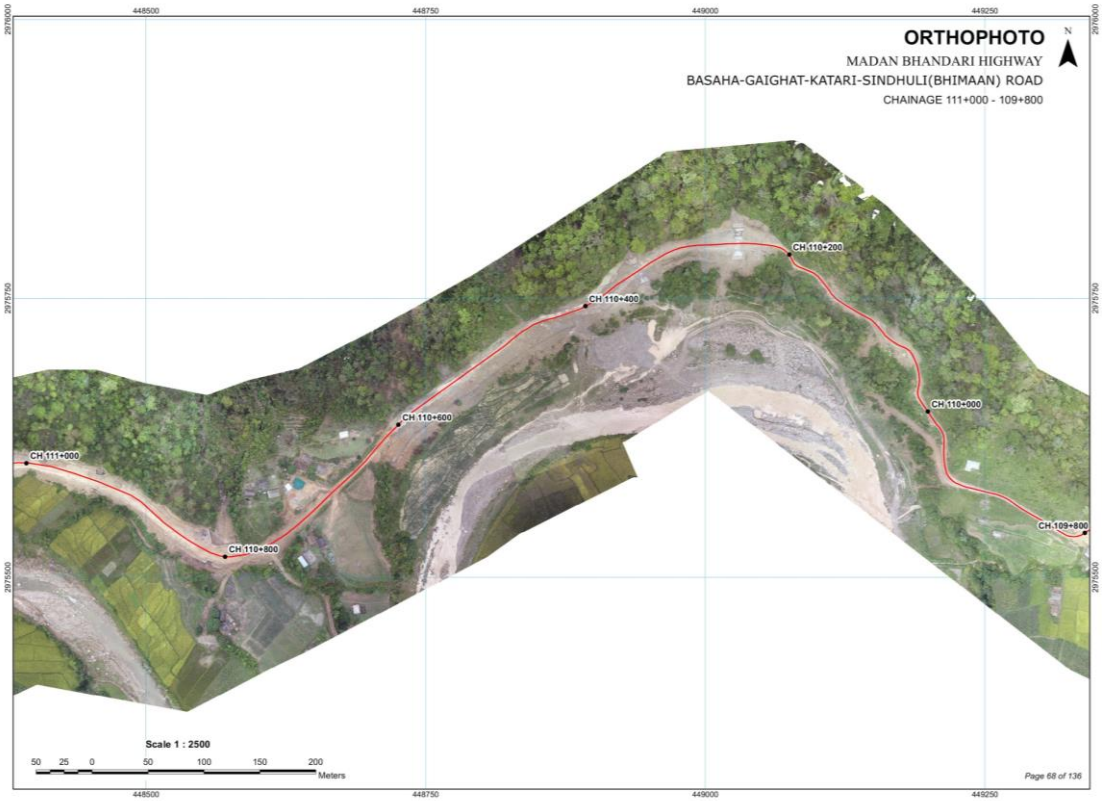
An aerial survey of a 138 km long highway road

Pilot and GIS team setting up the Ground Control Points (GCPs)



Orthophoto map

OVERVIEW	
Flying Labs	Nepal Flying Labs
Geographic area	Districts Sindhuli to Udayapur, Nepal
Date	June - July 2019
Sector program	DevRobotics
SDGs	GOAL 8: Decent Work and Economic Growth GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities

SCOPE	
Project stakeholders	Ministry of Physical Infrastructure and Transport
Beneficiaries	Department of Roads, Nepal Government
Challenge	Planning a road expansion is often difficult if there isn't a proper map of the road, while a physical inspection to monitor the present condition is tiresome and hectic.
Scope	The scope of the project included: 1. Carrying out a drone survey of a 138 km long road segment. 2. Developing a digital inventory of road datasets, where the authorities could visualise the output maps and profile cross-section diagrams, all under the same platform.
Outcome	The department utilized the digital platform to archive their topographical maps for the given road section. High-resolution orthophoto maps and topographic maps were used for site planning during the road expansion.
Impact	This project has proven that high-resolution maps generated using drone-captured images can be used for multiple purposes in road construction, expansion and improvement. These high-resolution maps allow engineers and project planners to have a detailed pictorial view of the road condition and objects around the road network and plan the maintenance and expansion activities accordingly.
Next steps	The data outputs will serve multiple purposes: ● facilitate road extension planning, ● monitor the physical condition of roads, ● monitor other major pieces of infrastructure present along the road (such as bridges, drainage channels etc.).

COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT	
Consent for data acquisition	The field survey team organized community interaction sessions at all major locations, where the road passed through a nearby community in order to get their consent for data collection.
Activities to engage with the community	The project team received official permissions from all authorities for the drone flights. Besides that, the team organized different kinds of meetings at different locations during the data capture. Some meetings were held on-site during data collection, while some were organized at the local government officials together with local representatives.
Community groups engaged with	Government Officials (CAA Nepal), District Administration Office, Representatives from Municipalities and Rural Municipalities, Members of Communities
Community attendance	There were altogether 15 different kinds of community consultations at different locations. The number of participants varied from 5 to 8 people.
Community feedback	Communities at almost all the locations were more concerned about the road condition and expansion rather than drone flights. The community members were excited to see the drones fly, so much that some of them even asked for aerial images of their neighbourhoods to print them.
Stakeholder support	The technical team organized a training on how to use the web-based system to properly store and share the outputs from a drone survey project. All output maps were submitted in a CAD drawing format for ease of use.

DATA ACQUISITION	
Size of area	6700 ha (67 km2)
Drone	DJI Phantom 4 Pro
Sensor(s)	RGB camera
Flight plan software	Pix4Dcapture
Flight height	100 m above the ground
GSD (Accuracy)	5 cm/pix
Number of images acquired	78000
Number of flights	249
Time invested in data acquisition	26 days

Georeferencing	GCPs were not used during the data collection. But, markers placed on the ground were later used during image matching.

DATA PROCESSING & ANALYSIS	
Processing software	Pix4Dmapper
Processing time	28 days
Data products	High-resolution raw images and orthomosaics, topographical maps
Analysis tools	ArcGIS Pro, AutoCAD and GoogleEarth, custom-built web-based data portal for data storage and sharing
Analysis outputs	Detailed topographical map with 1 m contour intervals, profile and cross-section maps at each chainage, web-based road inventory to store images and different outputs of the project
Final outputs shared with stakeholders	A web-based application to store, visualize and share all the maps, high-resolution orthophoto maps with road network layer overlaid as a line feature, topographical map of 1 m contour interval
Data sharing	Hard drive and an interactive custom-built web-based data portal for data storage and sharing