SATLAB®
GEOSOLUTIONS

Case Study

Apus Drone LiDAR

Solutions for Large-Scale Mining Data Acquisition

Introduction

Mine surveying is of great significance in promoting and ensuring safety production, improving economic benefits, and rational development and utilization of mineral resources. However, mining surveys present a unique set of challenges due to the remote and rugged terrain of mining sites, as well as the potential hazards associated with working in and around active mining operations.

Traditional mining surveying techniques such as total stations and RTK are time-consuming and inefficient in operation, and surveyors are exposed to the hazardous environments, with risks of rockfalls, equipment malfunctions, and other dangers.

In recent years, the rapid development of unmanned aerial vehicle (UAV) LiDAR scanning technology, has provided new technical means for providing high-precision topographic maps and DEMs for mining exploration, monitoring and design.

Project Need

The survey area is about 2.2 square kilometers, with an average height difference of 40 meters. The owner requires topography description of interested area to define a management plan, the point cloud accuracy should be higher than 5cm, and needs to output multi-period earthwork volume, DEM, and contour lines.

Figure 1 Mining area overview

Solution

Apus drone LiDAR utilized in this project boasts a maximum range of 300m and weight of only 1kg. It incorporates a DJI SKYPORT that seamlessly integrates with DJI M300/M350 RTK UAVs, allowing for single sortie operation durations of up to 40 minutes.

Figure 2 Apus with DJI M350

With a laser rate of 640,000 points per second (single return), the Apus offers simple and convenient operation through a one-button start feature. When paired with the Sat-LiDAR processing software, not only terrain data can be output quickly, volume reports can be exported through automatic classification and volume calculation, making it well-suited for high-precision and high-efficiency mining surveys and application.

Project Parameters

1. Equipment

Apus UAV LiDAR

DJI M350 RTK

SatLab SL900 GNSS Receiver

CORS Network

2. Software

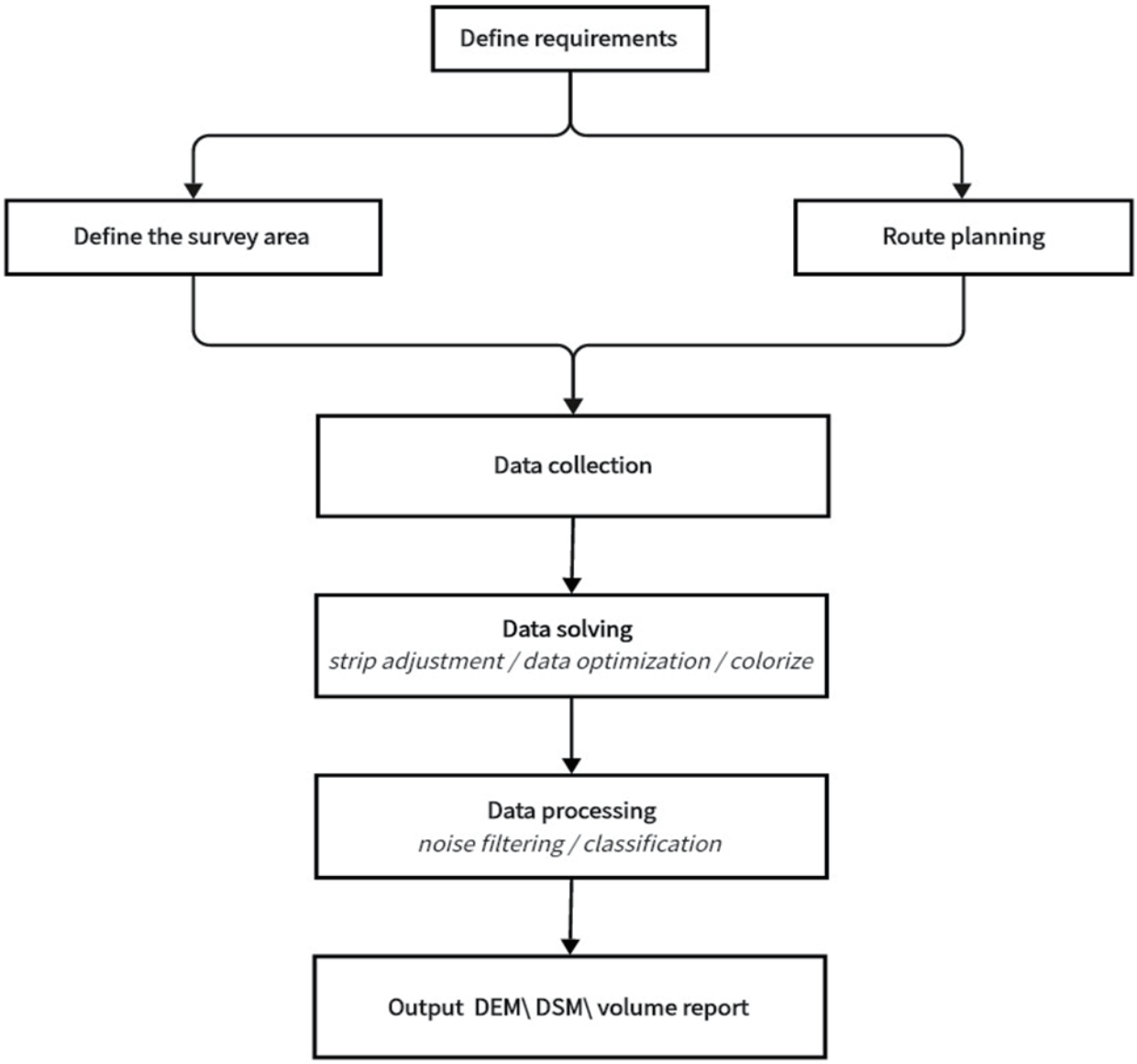
Sat-LiDAR & Satsurv

Specification

Apus UAV LiDAR Specification

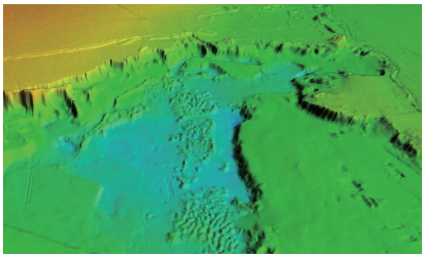
LiDAR Unit	System Accuracy	5cm@100m
	Range Accuracy	1cm@100m
	Measuring Range	300m
	Field of View(FOV)	360°(horizon)*40.3°(Vertical)
	Data	640,000 points/sec (single echo) 1,280,000points/sec (dual-echo) 1,920,000points/sec (Triple-echo)
POS Unit	Position Accuracy(pp)	Horizontal:0.01m; Vertical:0.02m;
	Heading Accuracy(pp)	0.03°
	Rolling/pitch Accuracy(pp)	0.006°
Camera Unit	Effective Pixel	26 Mega Pixel (6252*4168)
	Focal Length	16mm
System	Weight	1kg
	Temperature Range	-20℃~+50℃(operation) -20℃~+65℃(storage)
	Protection Class	IP64
	Data Storage	1TB（SSD 512G+TF Card 512G）
	Data Transmission Mode	TYPE-C, up to 160M/S
	Mounting Interface	DJI SKYPORT
	UAVS	Designed for DJI M300/M350

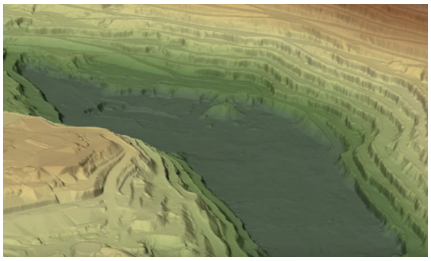
Technical Route



Sat-LiDAR software can automatically solve the collected point cloud data, outputting high-precision color point clouds. By filtering the point cloud data, ground points and their terrain feature classification data in the mining area can be obtained, which can then be used to produce DEM, DSM, contour lines, and other results. Additionally, the software supports multi-phase volume calculation of the mine using TIN grid. It also includes features such as data accuracy inspection, strip adjustment, noise filtering, classification, and point cloud tiling processing.

Results





Control point report interface

rol Point X/m	Control Point Y/m	Control Point Z/m	Precision dX/m	Precision dY/m	Precision dZ/m
		58.8425			-0.0169
		53.7607			0.0105
		53.2700			0.0046
		53.4967			-0.0234
		53.3277			0.0148
		53.5034			0.0245
		54.1536			0.0091
		54.9325			-0.0425

Mean/m:-0.0024(Z) Maximum/m:0.0245(Z)

Mean Square Error/m:0.0214(Z) Minimum/m:-0.0425(Z)

Export

Single-period calculate result

Parameter Setting

First peroid point cloud	ground points.las
Second peroid point cloud	

Grid Size	3.000	m	Base height		m

Result

First peroid maxinum height difference		m	First peroid maxinum diameter		m
Second peroid maxinum height difference		m	Second peroid maxinum diameter		m
2D perimeter		m	3D perimeter		m
2D projected area		m^2	3D surface area		m^2
Cut area		m^2	Fill area		m^2
Cut surface area		m^2	Fill surface area		m^2
Cut volume		m^3	Fill volume		m^3
First peroid minimum height		m	First peroid maxinum height		m
Second peroid minimum height		m	Second peroid maxinum height		m

Multi-period calculate result

Parameter Setting

First peroid point cloud	1c
Second peroid point cloud	2c

Grid Size	2.000	m	Base height		m

Result

First peroid maxinum height difference		m	First peroid maxinum diameter		m
Second peroid maxinum height difference		m	Second peroid maxinum diameter		m
2D perimeter		m	3D perimeter		m
2D projected area		m^2	3D surface area		m^2
Cut area		m^2	Fill area		m^2
Cut surface area		m^2	Fill surface area		m^2
Cut volume		m^3	Fill volume		m^3
First peroid minimum height		m	First peroid maxinum height		m
Second peroid minimum height		m	Second peroid maxinum height		m

Benefits

One of the key advantages of using UAV LiDAR for mining mapping is the ability to collect high-resolution data quickly and efficiently. UAV LiDAR, on the other hand, can capture detailed data from above in a fraction of the time, allowing for faster and more comprehensive mapping of mining sites.

Traditional surveying methods can be time-consuming and labor-intensive, requiring ground-based equipment and personnel to cover large areas. By using drones to collect data from above, mining companies can avoid putting personnel at risk and minimize the impact on the surrounding environment.

Conclusion

Apus drone LiDAR solution can capture precise measurements of the terrain, including elevation, slope, and vegetation coverage, with centimeter accuracy. This level of detail is crucial for mining operations, as it allows for better planning, monitoring, and management of the site.