



## **The mined volume calculation in the traditional mining area by using the Unmanned Aerial Vehicle (UAV) approach in the observation area of CV. Sinergi Karya Solutif, Patikraja district, Banyumas regency, East Java province, Indonesia**

Sigit Allobunga <sup>\*1</sup>, Ratih Hardini Kusuma Putri <sup>1</sup>, Muhammad Abdurrozak Siamashari <sup>2</sup>, Ika Justita Julita <sup>2</sup>, Ahmad Ubaidillah Fathoni <sup>2</sup>, Heru Dwiriawan <sup>3</sup>, Rangga Pramayoga <sup>4</sup>

<sup>1</sup> Institut Teknologi Adhi Tama Surabaya, Surabaya, Indonesia

<sup>2</sup> CV. Sinergi Karya Solutif, Banyumas, Indonesia

<sup>3</sup> Institut Sains & Teknologi AKPRIND Yogyakarta, Yogyakarta, Indonesia

<sup>4</sup> PT. Pilar Tujuh Abadi Sentosa, Surabaya, Indonesia

\*e-mail: [shigitallobunga28@gmail.com](mailto:shigitallobunga28@gmail.com)

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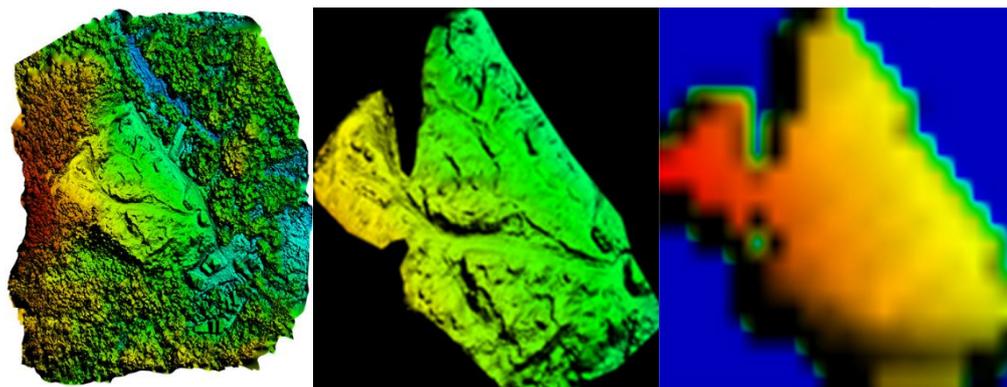
### **Abstract**

The studies become performed in Notog Village, Patigkraja District, Banyumas Regency, Central Java Province withinside the statement place of CV. Sinergi Karya Solutif with the purpose of comparing the extent of minerals and describing the way to calculate the extent mined with a greater green approach. In measuring and calculating the volumetric minerals, its miles are executed via way of means of the use of the UAV (Unmanned Aerial Vehicle) approach or drones which include drones to get aerial photos. The gathered records may be the number one records utilized in carrying out volumetric analysis. They have a look at becoming performed for 2 (two) months. The consequences acquired withinside the shape of aerial image records as number one records and a base map inclusive of geography, topography, and geology as assisting records. Mined extent acquired via way of means of processing records the use of assisting software program is 11.568.136 m<sup>3</sup> at the same time as in records processing the use of different techniques on this guide is 123,365 m<sup>3</sup>. From the 2 calculation techniques, its miles recognized that the distinction withinside the mined extent is 768.363 m<sup>3</sup>.

### **1. Introduction**

Notog area is one of the regions in Patikraja sub-district, Banyumas District, Central Java, Indonesia. The Notog area is blessed with diverse forms of herbal wealth. Judging from the geological sciences, the Notog area has the ability for plentiful minerals [1]. The herbal wealth of the Notog area is due to the fact it's miles a place placed around Mount Slamet which is an energetic mountain [2], [3].

The availability of minerals that can be utilized in the Notog area can be said as an opportunity to develop mining activities, with methods that are more efficient from all aspects by using good methods in research. As for this research which focuses on mapping, the technology that can support this research is remote sensing technology. Advances in remote sensing technology are directly proportional to advances in mapping and survey programs [4]. In measuring and calculating the volumetric minerals, it is done by using the UAV (Unmanned Aerial Vehicle) method or drones such as drones to get aerial photos [5]. The collected data will be the primary data used in conducting volumetric analysis. The use of a UAV itself has the advantage of efficiency in the implementation of field measurements, namely measurements can be carried out in a short time and are able to cover a large area at an affordable cost [6].



**Figure 1.** The generated DEM by photogrammetry of the whole area (left), the focused DEM on the mining area (middle), as a comparison the DEMNAS that available online (right)

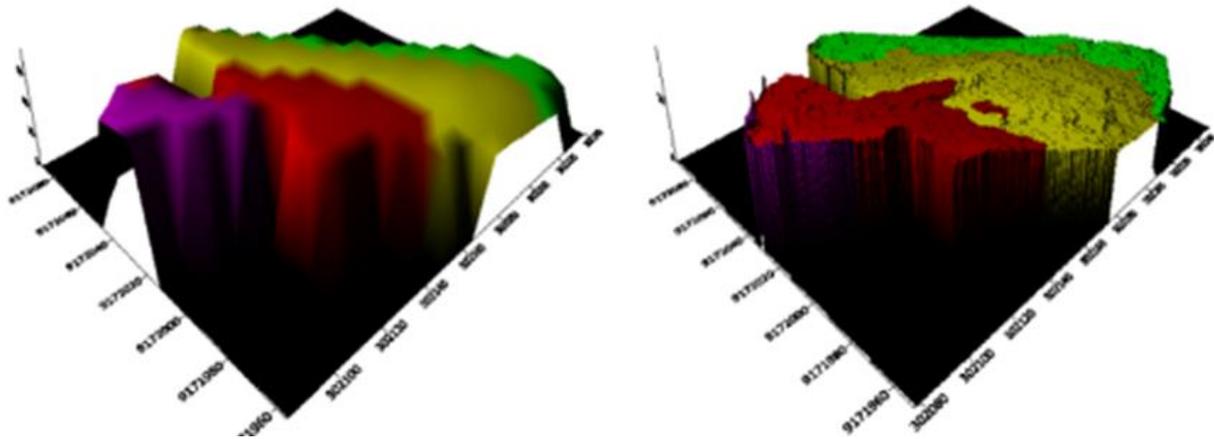
## 2. Methodology

In this study's interest became finished the use of aerial photo statistics. Where statistics series became finished withinside the studies area, specifically Notog Village, Patikraja District, Banyumas Regency, Central Java. After doing the preliminary processing within side the aerial image modeling application, it's far recognized that the range of aerial snapshots taken is 97 (ninety-seven) snapshots and the identity of image factors is 55,033 factors. Identify image factors based on the decision according to decide photo model. In this study, statistics processing into three-D fashions makes use of medium decisions. The steps for statistics processing are:

Creating an aerial photo 3-D version with the use of the photogrammetry application. The stages of making a 3-D model are as follows [7]:

- a. Add Photo is the stage of entering aerial photo data in the application. Aerial photos that were processed at this stage were 97 photos.
- b. Align Photo is the stage to identify the points of each photo or combine photos based on the similarity of locations. At this stage, the data processing identified 55,033 points.
- c. Point Clouds are collections of high points in the number of thousands to millions of points generated from aerial photogrammetric processing or LIDAR. Dense point clouds will then be further processed to produce digital surface models, digital terrain models, which are the main information in the orthophoto production process and related mapping results. At this stage, the data processing identified 49,469 points.
- d. The mesh build is the next step to combine the photo points from the dance clone results into one plane. At this stage, the data processing identified 49,469 The results created a clear plan of the points identified in the previous stage. At this stage, the data processing identifies the surface points of 412,304 with a vertical shape of 207,577.
- e. Build Texture is a 3D physical model that appears to be in the photo coverage area or a process of coloring the field according to the color of the photo. This stage completes the fields and colors according to the results of drone photos in one field in 3D form. The results of the texture build stage will be used as a benchmark for aerial photos for DEM data.
- f. Next create a DEM model. DEM is a field result or digital field model. From DEM data, it can be derived to determine elevation, slope, aspect, the direction of irradiation, to further modeling such as cut and fill, visibility, watershed creation, and others.

The data processing in this case creates mined polygons using mapping software. The polygons are then saved in the shapefile (SHP) format. The file with the shapefile format will be used to cut the mine opening raster and DEMNAS [8]. Based on shapefile data processed on earth viewing software [9], it is known that the mined surface area is 1,34 hectares and the mined area is 2,59 hectares.



**Figure 2.** The comparison figure of the before mined (using the DEMNAS data) that has a pixel size 0.27 arcsecond (left), the model DEM after mined (generated from photogrammetry reconstruction) that has 0.3 meters a pixel size (right)

The further process is to cut the raster using the mapping application. The reason for choosing mapping as an alternative to raster cutting is because QGIS can cut the desired raster down to 0 masl. So that the cut raster can be processed in other data processing applications. The difference between Aerial Photography DEM and National DEMNAS after cropping can be seen in the following image [10].

The data that has been cut in the Qgis application is then formatted into a surfer grid using the Global Mapper application. The data that has been converted into a surfer grid format [11], will then become Surfer software data to determine the volume.

Calculation of the mined volume is closely related to understanding the initial volume before being mined. The volume before being mined, which in this case is the volume of DEMNAS, will be reduced by the volume of the area after being mined [12]. Before calculating the mined volume, the two data are inputted into a 3D model. as for the stage of finding the volume in the software.

The Inputing data through 3D Surface tools with grd format that has been exported from Global Mapper [13]. The step to find the volume of the two 3D models is to enter the Grids tools menu, then the Grid Volume tool. Next on the Grid Volume menu, enter the grid file whose volume will be calculated [13]. At this stage, the volume calculation of the two models is carried out alternately with each constant value being 0. A value of 0 means that the volume calculation starts from an elevation of 0 masl.

### 3. Results

From the calculation results, each volume is obtained as follows (see figure 2). The volume of the area before being mined in this case DEMNAS is equal to 1.034.332,087 m<sup>3</sup>. The area volume after being mined in this case is Aerial Photo DEM equal to 1.308.290,718 m<sup>3</sup>

From the results of the volume calculation, it is known that it is not possible to directly calculate the volume using the desired formula. The problem that was found was that the volume of the National DEMNAS which should have been more than the volume of the Aerial Photography DEM was actually the smallest [14]. After evaluating the two data, it is known that the cause of this problem is the elevation of the Aerial Photography DEM (after mining) is higher than that of the National Demography (before mining) [15]. At the same coordinate points, namely E 109°12'29" and S 7°29'15" DEM Aerial Photography has an elevation of 40 m, while the DEMNAS is 25 meters. At the second coordinate point, namely E 109°12'28" and S 7°29'13", the elevation of DEM Aerial Photography is 45 m while DEMNAS is 30 m [16]. The two coordinate points used for comparison provide evidence that the difference in elevation between the DEM Aerial Photography and the National Demography is 15 meters.

After knowing the elevation ratio, the data will be corrected. The elevation that is used as a benchmark in this volume calculation is National Demography data, while the data to be corrected is Aerial

Photography DEM data by reducing the difference in elevation that has been obtained. How to correct the data can be done with the formula:

$$\text{Formula: Volume} - (\text{Area} \times \text{Difference}) \dots\dots\dots (1)$$

The correction results are as follows:

Known:

|                               |                |                                |
|-------------------------------|----------------|--------------------------------|
| Area                          | = 2,59 hectare | = 25.976 m                     |
| Mined Area                    |                | = 1,35 hectare                 |
| Aerial Photography DEM Volume |                | = 1.308.290,718 m <sup>3</sup> |
| Elevation Difference          |                | = 15 meter                     |

$$\begin{aligned} \text{Aerial Photo Volume} &= \text{Volume} - (\text{Area} \times \text{Difference}) \\ &= 918.650,718 \text{ m}^3 \end{aligned}$$

$$\text{Aerial photo volume after correction} = \mathbf{918.650,718 \text{ m}^3}$$

#### 4. Conclusion

Based on the results of the calculation of the volume mined using the Unmanned Aerial Vehicle (UAV) approach in Notog Village, Patikraja District, Banyumas Regency, Central Java Province in the CV. Sinergi Karya Solutif can be concluded that the volume mined in the mine openings of the research area is 11.568.136 m<sup>3</sup>.

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