

# GIS application: Mapping and Area Analysis for MAEU Campus

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**Abstract:** This paper emphasizes implementation of GIS mapping and area analysis for MAEU campus. The processes of overlapping aerial photos, drawing shape files, making 3D model, adding specific data and image classification provide GIS mapping with area analysis for MAEU campus using efficient applicable softwares such as Agisoft photoscan, QGIS and ArcGIS. With Agisoft photoscan, it makes overlapping photos taken by drones or Unmanned Aerial Vehicles. With QGIS, it has transformed the geo-tagged photos into shape files. By using Arc Map of ArcGIS, it has added the surveying data in the attribute tables. The main purpose of this project work is to develop 3D map of MAEU by Arc Scene of ArcGIS. To generate the thematic map, it has also conducted image classification on MAEU campus with Arc Map. In addition, area of MAEU campus has been analysed in this paper.

**Keywords:** area analysis, GIS mapping, image classification, MAEU campus.

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## 1. Introduction

A map is not enough with a picture and the more data are added the more it is useful, thus, it becomes valuable. In today technology, many people can obtain the specific data from GIS map. Geographic Information Systems (GIS) is a computer-based information system designed for capturing, storing, analysing, managing, and displaying spatial data representing human and natural phenomena from the real world (Paolo Tarolli and Marco Cavalli, 2013).

In this project work, the scope area of GIS mapping and area analysis is Myanmar Aerospace Engineering University (MAEU) campus that is located in Meiktila city, Mandalay Region, upper Myanmar. It has developed a 3D map of MAEU campus with specific data with the aids of Agisoft photoscan, QGIS and ArcGIS software. Through image classification, analysis on MAEU area has been partially fulfilled the development of planning buildings, stadiums, swimming pools, parks and recreation centres in the university campus.

## 2. Software Implementation

There are three main portions in this project work: (1) developing 3D map of MAEU campus and (2) analysing on area of MAEU campus and (3) image classification. To make 3D map of MAEU campus with the required information, it needs many processes of overlapping, drawing shape files, adding surveyed specific data with GIS software. Figure 1 shows the processes of software implementation.

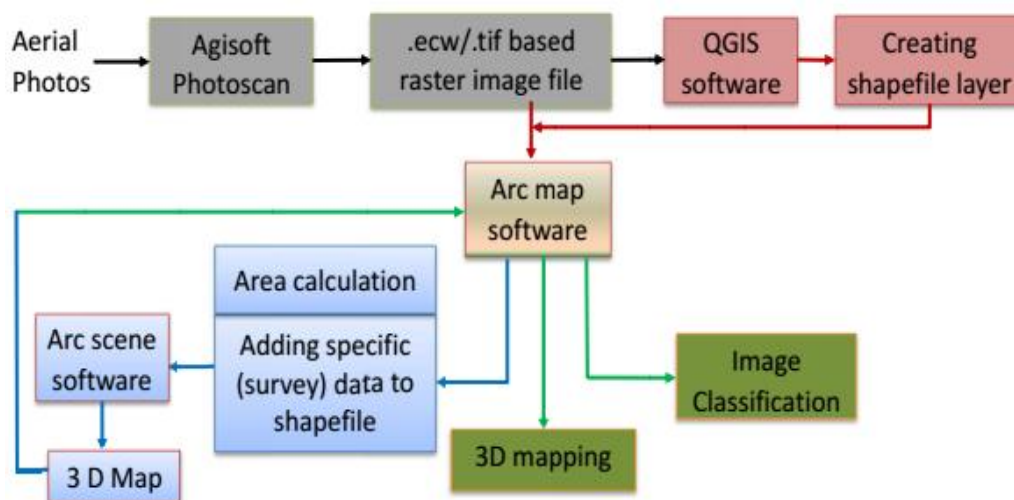


Figure 1. Process block diagram

### 2.1 Implementation of 3D Mapping of MAEU Campus

Firstly, it needs to be collected and analysed the aerial photos with Agisoft photoscan software. Before drawing shape files, image analysis (overlapping process) has been conducted with the eight steps of (i) adding photos, (ii) aligning photos, (iii) building dense cloud, (iv) building mesh, (v) building texture, (vi) building tiled model, (vii) building DEM model and (viii) building orthomosaic model.

Secondly, it needs to be transformed the geo-tagged photos analysed with Agisoft photoscan into the shape files layer with QGIS software. In these steps, it has processed of drawing shape file, editing layer and attribute table and making 3D map. For editing attribute tables, it needs the required data to survey geological specification such as numbers of rooms, buildings and numbers of residents around the university campus.

### 2.2 Implementation of Image Classification

Image classification uses spectral information represented by digital numbers in one or more spectral bands and attempts to classify each individual pixel based on the spectral information. The objective is to assign all pixels in the image to particular classes or themes (e.g., water, forest, residential, commercial, etc.) and to generate a thematic map. Generally, there are two approaches to image classification: supervised and unsupervised classification (Qihao Weng, 2010).

In a supervised classification, the analyst identifies in the imagery homogeneous representative samples of different cover types (i.e., information classes) of interest to be used as training areas. Each pixel in the imagery then would be compared spectrally with the training samples to determine to which information class they should belong. In an unsupervised classification, spectral classes are first grouped based solely on digital numbers in the imagery, which then are matched by the analyst to information classes.

In image classification, it has processed of choosing supervised classification, converting raster to polygon, calculating geometry, classifying the objects, elimination, cutting desired polygons and merging polygons. It has implemented interactive supervised classification for this project work.

### 3. Implementation Results

It has described 3D map of MAEU campus, area analysing on MAEU campus and image classification with implementation results. For this implementation, it has been used the aerial photos taken by Department of UAV Research in 2016, which have the spatial resolution of 5 meters GSD (ground sample distance).

#### 3.1 Results on 3D Map of MAEU Campus



**Figure 2. Overlapped aerial photo**

Figure 2 shows the overlapped aerial photos by Agisoft photoscan. Figure 3 shows the complete shape file of MAEU campus with different objects. Figure 4 shows the 3D map of MAEU campus with specific information after overlapping aerial photos. Graduated students of Avionics in GIS team have collected the required data with surveying according to different types of buildings such as classrooms, workshops, departments, residents, hostels and sport fields. It has added these specific data in the corresponding attribute tables. However, Figure 4 shows just four attribute tables as sample work done.

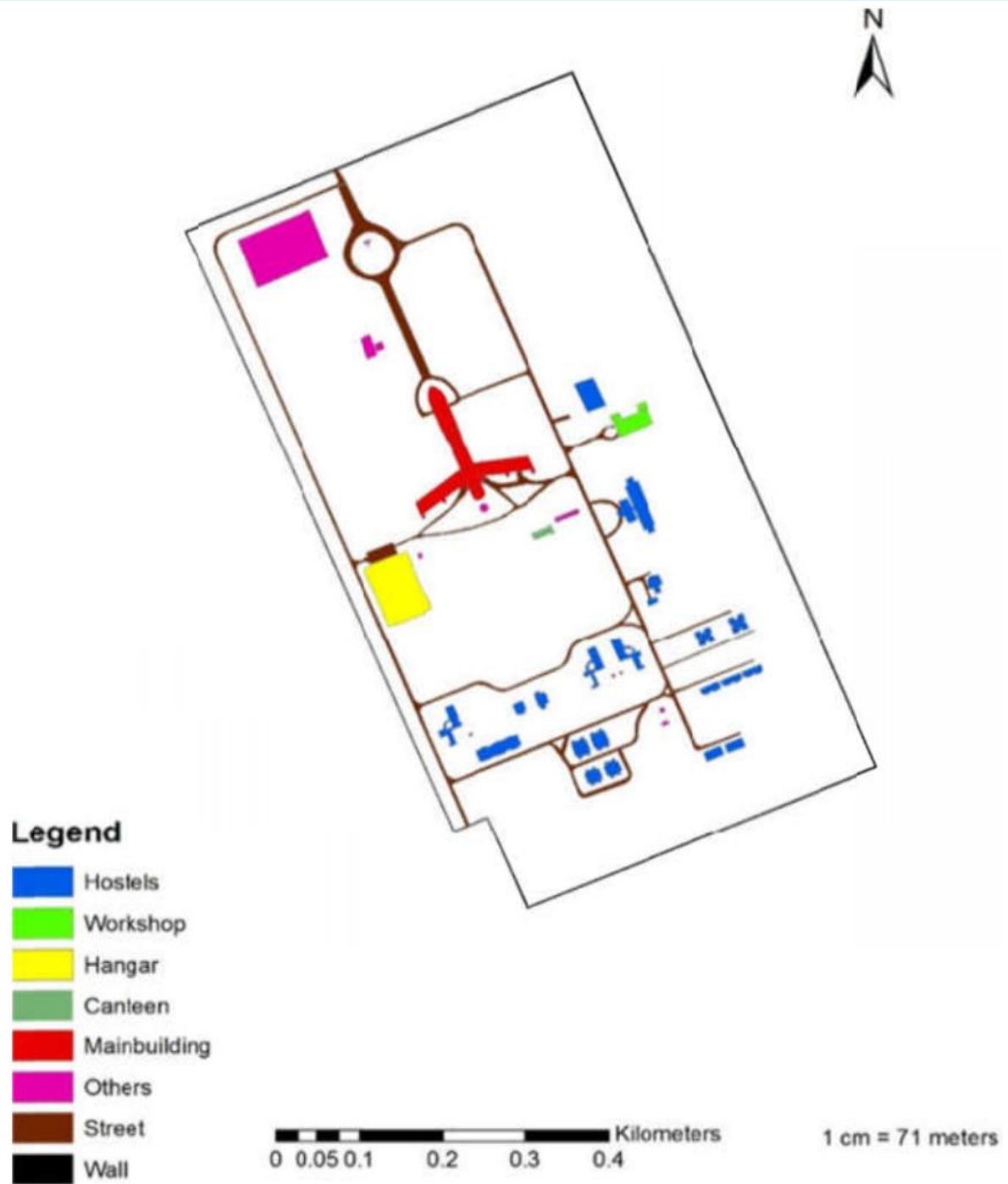
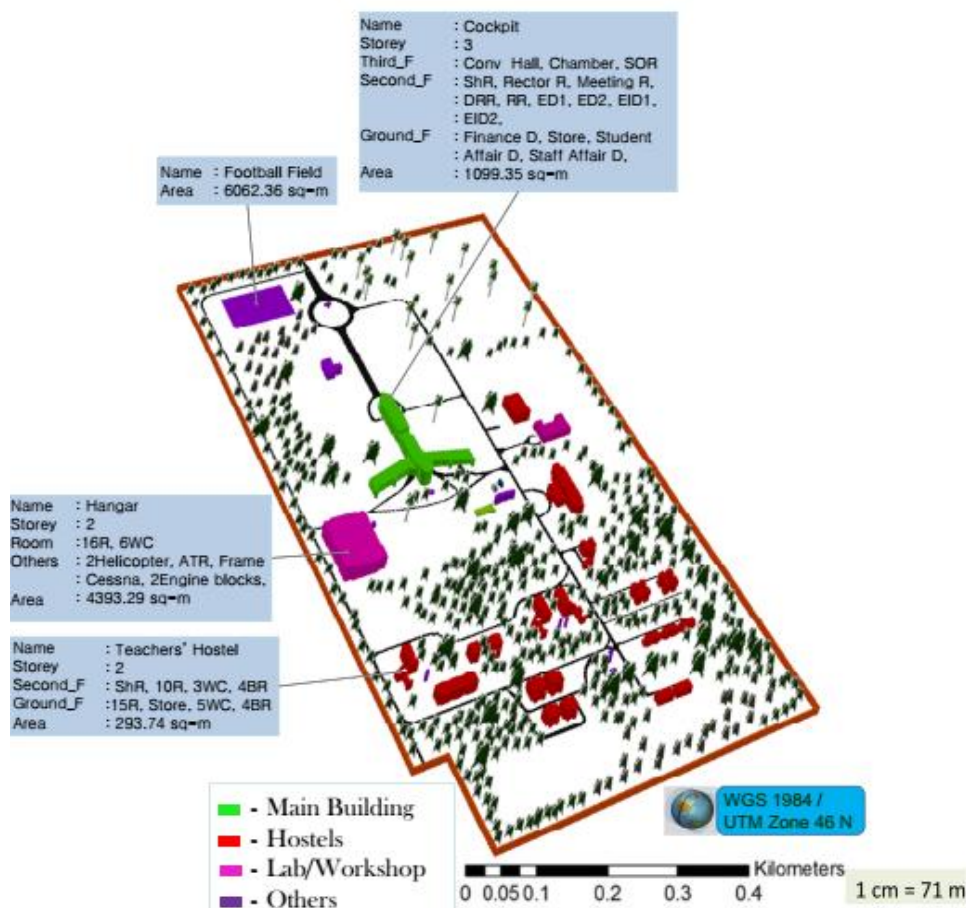


Figure 3. Complete shapefile layer of MAEU campus



ShR = Shrine Room, BR = Bathroom, F = Floor, R = Room, WC = Water-closet, D = Department, Conv = Convocation, AVD = Avionics Department, AMD = Airport Management Department, MtD = Aircraft Material Department, FPD = Fuel & Propellant Department, PhyD = Physics Department, MyD = Myanmar Department, ChD = Chemistry Department, Mt = Aircraft Material, DRR = Deputy Rector Room, RR = Registrar Room, EID = Electrical & Instrumentation Department, ED = English Department, SOR = Staff Organization Room

Figure 4. 3D map of MAEU campus with specific information

### 3.2 Area Analysis on MAEU campus

It has observed from implementation results by ArcGIS that analysis area on different types of buildings for MAEU campus with the pie chart has shown in Figure 5.

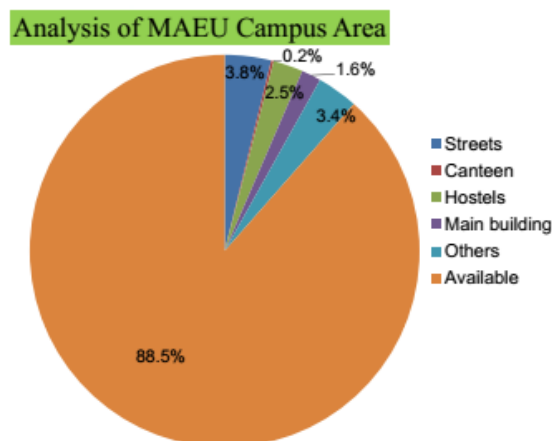


Figure 5. Area analysis on MAEU campus

### 3.3 Result on Image Classification

Image classification on area of MAEU campus has been analysed in Figure. 6. It has trained on classification different types of objects such as buildings' roof soils, street and trees. According to implementation results on image classification, available area remains the percentage of 88.5. Soils are the largest area among the different kinds of objects. As the sample work done, it has classified four kinds of objects: roofs, soils, streets and trees with the different four colours in Figure 5. In image classification, this implementation result will provide the landscape planning and management on land usage for surveying of analysis available area.

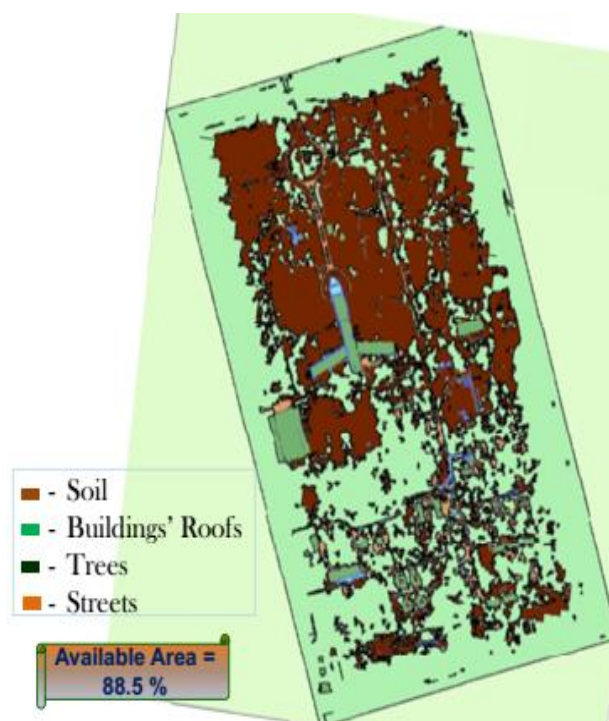


Figure 6. Result of image classification

### 4. Discussion and Conclusions

According to implementation results and comparisons with ground surveying measurement, the precision of the length is 0.143 meter (14.3 cm) referencing with the streets within the campus and of the height is 0.6 meter (60 cm) referencing with the height of the main building in the campus. In making 3D map of MAEU campus, scale on map is 1 cm = 71 m and specific data that is surveyed support the 3D map.

In analysis on area of MAEU campus, it is evident from the implementation results that the available area is 88.5 %. This reserved available area can provide the future development planning on buildings within the university campus. Most area of MAEU is available which include trees. The smallest building area is university canteen.

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