Palestine Polytechnic University

College of Engineering

Civil Engineering and Architecture Department

Graduation Project

"Evaluation of the Drones and their Applications in Cadasral Surveying"

Project Team

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This project submitted to the College of Engineering in partial fulfillment of requirements of the Bachelor degree of Civil Engineering

H e b r o n - P a l e s t i n e

July 2 0 2 1

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Evaluation of the Drones and their Applications in Cadasral Surveying

Supervisor : Eng.musab shahin

Project Team: Ismael Abu Rgag & Darin Abdalhady

ABSTRACT

This project aims to study the use of drones in the work of facilitating the settlement procedures, as we chose the study area in Al Dhahiriya, in block number 127, which has a total area of 385.851 acres. And make a comparison between the current settlement and the settlement using a drone.

In this regard, everything related to aerial photography and drones has been studied. And how to shoot on the right way to get the highest accuracy, A detailed structural study was also conducted to determine the accuracy of the aerial photographs in the survey work.

After that, imaging was done using the drone, and these images were entered into the Agisoft program, and a three-dimensional model was made from them, and then all the calculations were made on the images to obtain results and compared them with the pre-existing settlement work, Where the comparison was made in terms of the accuracy of the site and the accuracy of the information.

تقويم الطائرات بدون طيار وتطبيقاتها في المسح الكادستدرائي

فريق العمل : اسماعيل ابو رقاق ، دارين عبد الهادي

إشراف: د.مصعب شاهين و د.غادي زكارنة

الملخص

يهدف هذا المشروع إلى دراسة استخدام الدرون في اعمال تسهيل اجراءات التسوية ، حيث قمنا باختيار منطقة الدراسة في الظاهرية ، في الحوض ١٢٧ والذي تبلغ مساحته الإجمالية ٣٨٥,٨٥١ دونمًا. وإجراء مقارنة بين التسوية الحالية والتسوية باستخدام طائرة بدون طيار.

في هذا الصدد ، تمت دراسة كل ما يتعلق بالتصوير الجوي والطائرات بدون طيار. وكيفية التصوير بالطريقة الصحيحة للحصول على أعلى دقة ، كما أجريت دراسة هيكلية مفصلة لتحديد دقة الصور الجوية في أعمال المسح.

بعد ذلك تم التصوير باستخدام الطائرة بدون طيار ، وتم إدخال هذه الصور في برنامج Agisoft ، وتم عمل نموذج ثلاثي الأبعاد منها وتحويليه لصورة (ortho photo) ، ثم تم عمل جميع الحسابات على الصور للحصول على النتائج ومقارنتها مع أعمال التسوية القائمة حاليا ، حيث تمت المقارنة من حيث دقة الموقع ودقة المعلومات.

DEDICATION

To those who have always believed in us …

To those who have been our source of inspiration …

To those who gave us strength …

To those who provide us their endless support and encouragement …

To our families …

to our friends…

...To everyone who carries love in his heart for us

Project Team

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It has been a great opportunity for us to gain a lot of knowledge through working on this project ,but the successful completion of any task would be incomplete without mention of the people who made it possible.

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Thanks for all instructors for all efforts they did to provide us with all useful information and sharing their knowledge and experience to make from us successful engineers .

Finally, our deep gratitude and sincere thanks to our parents, brothers and sisters for their patience, for everyone who tried to help us during our work and gave us strength to complete this task.

Project Team

Table of Contents

List of Figures

Figure (5-2) : Check points and their locations on the ortho photo 67

List of Tables

CHAPTER 1

INTRODUCTION

1.1General Overview

1.2Project Problem

1.3Project Objectives

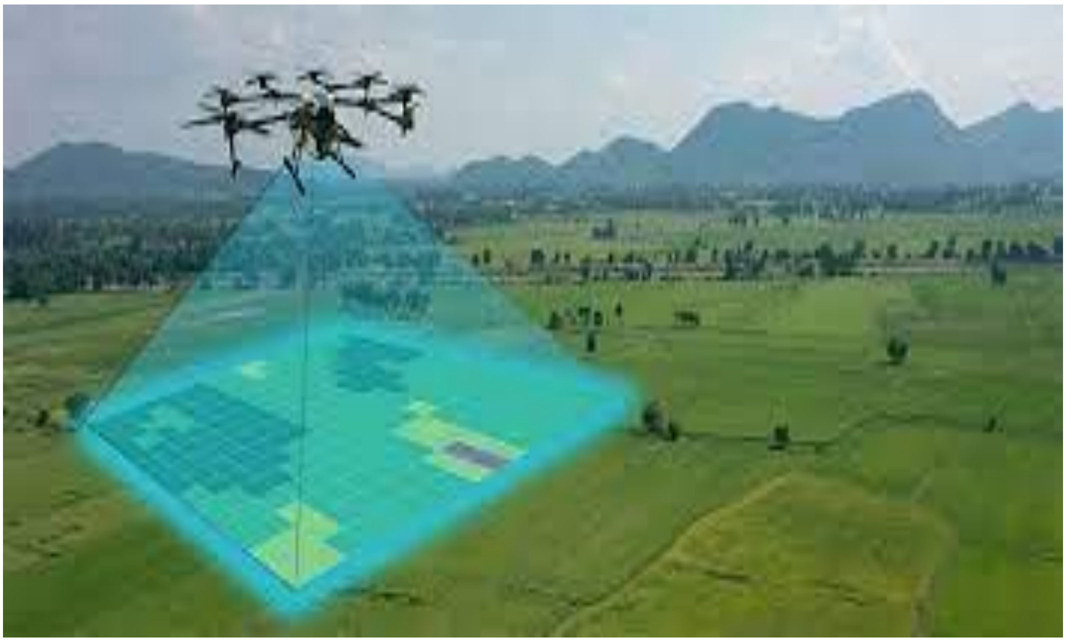
1.4Methodology

1.5study area

1.6Project Timeline

1.7 Programs Used In The Project

1.8 The problems we encountered in the project



1.1 General Overview

Land is the basis of the Palestinian-Israeli conflict, land is one of the important and basic production factors that no development project should ignore, and land use planning is the key to the effective development of natural resources

A prerequisite for achieving optimal use of land resources is the availability of accurate surveys and settlements, as well as a comprehensive real estate registration. Some information indicates that the area of land that has not been surveyed and settled within Area A and Area B constitutes 64% of the total land area. the two regions together**.**

Development and technology in the field of photography and drones have facilitated land surveying operations at the lowest cost and fastest time.

1.2 Project Problem

The methods of ground surveying and measurement using conventional surveying devices are varied, on the other hand, it was necessary to find a survey method that would save time, reduce cost and be safer.

1.3 Project Objectives

This Project was chosen to achieve the following galls:

- Linking the theoretical information acquired during the study period to practical

Life.

- Surveying a plot of land using a drone.

- Using the aerial photo from the drone and inserting them into the agisoft program to make a 3D model.

- Preparing a complete settlement of the plot of land using aerial photographs and comparing this result with the pre-existing settlement works.

- Comparing the old aerial photos with the new ones in terms of the accuracy of the location and the accuracy of the information.

1.4 Methodology

Determine the topic of research and inquire about the topic from the supervisor and the competent authorities such as the Ad-Dahryia Municipality and the Al-Dahryia Settlement Commission. Information has been obtained from the Municipality and the Ad-Dahryia Settlement Commission, such as the structural plans and an attempt to provide many aerial photographs of the area then:

1-Determine the work area and then make an exploratory visit to the site and take a full idea of the nature of the project and the problems related to it and the important details in order to obtain the best and most accurate results.

2- Start writing the introduction to the project, taking into account the principles and conditions to be met in the introduction, reviewing the supervisor and taking his advice and opinion.

3-Collect the Aerial photography.

4-Bring the floor plan of the work area.

5-georeferencing photos by GIS.

6-Monitor control points

7-Surveying a plot of land using a drone.

8-Inserting photos into Agisoft and making a 3D model of them to Produce ortho photo.

9-Get the results and compare the accuracy of the current settlement with these results.

1.5 study area

The plot of land (No. 107) with the name Umm Al-Dahab Al-Sharqi, It contains 57 plots of land , with an estimated total area of 385,851 dunams, located in the western region of Al-Dhahiriya city, specifically in the area between Al-Dhahiriya and Al-Ramadin.

Figure (1- 1) : study area

1.6 Project Timeline

Project Timeline in Introduction :

Table (1- 1) : Introduction timeline

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	the week	Activity
															Project selection	
															Data collection	
															Exploratory space	
															Determine and monitor control points	
															Officework georeferencing phtos	
															Preparing the initial project report for the Introduction	
															Preparing the final report for the Introduction of project	

Project Timeline:

Table (1-2) : project timeline

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	the week	Activity
															Surveying the area with the drone	
															Inserting pictures into the agisoft program	
															3D model making and extraction ortho photo	
															Determine and monitor cheak points	
															Link the ortho photi to the ground survey plan and compare the results	
															Prepare all maps	
															Preparing the final report for the project	

1.7 Programs used in the project

-Microsoft Office: It was used in various parts of the project such as text writing, formatting, and project output.

- AUTOCAD 2016

-ARC MAP 10.4.1

-AGI SOFT

-CIVIL 3D

1.8 The problems we encountered in the project

1- The inability to reach all areas covered by aerial photography because the topography of the area or the Disallow of the owners of the plots to access it.

2- The border points that were monitored for settlement work do not appear.

3- The project needs modern computers and has a high durability in order to work on high accuracy.

CHAPTER 2

surveying

2.1 Definition, Categories, and Purpose of Surveying

2.2History of Surveying

2.3 The Survey Process

2.4Units of Measurement

2.5 Six of the Most Common Surveying Instruments

2.6 drone survey

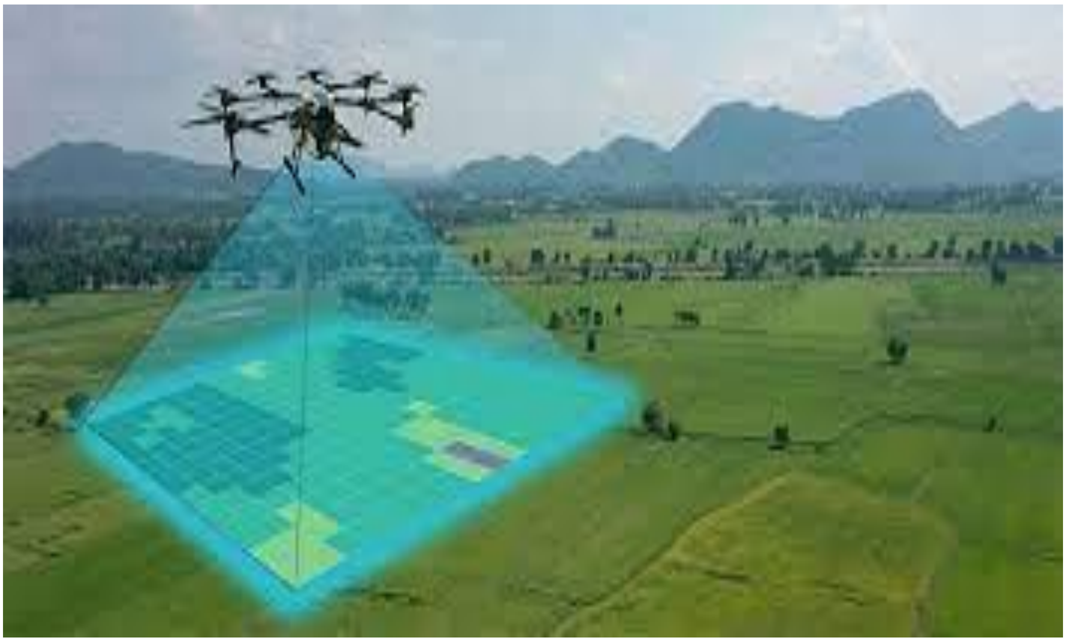
2.7The benefits of drones in surveying

2.8 Uses of drones

2.9 Accurate of drone survey

2.10 drone survey Procedure

2.11 Drone survey data processing



2.1 Definition, Categories, and Purpose of Surveying

Definition

Surveying is the process of determining the relative position of natural and manmade features on or under the earth's surface, the presentation of this information either graphically in the form of plans or numerically in the form of tables, and the setting out of measurements on the earth's surface. It usually involves measurement, calculations, the production of plans, and the determination of specific locations. The surveyor may be called on to determine heights and distances; to set out buildings, bridges and roadways; to determine areas and volumes and to draw plans at a predetermined scale.

Categories

There are two major categories of surveying:

1. Plane Surveying Plane surveying deals with areas of limited extent and it is assumed that the earth's surface is a plane and therefore no corrections necessary for the earth's curvature.

2. Geodetic Surveying Geodetic surveying is concerned with determining the size and shape of the earth and it also provides a high-accuracy framework for the control of lowerorder surveys. The highest standards of accuracy are necessary. Geodetic surveys cover relatively large areas (eg a state or country) for which the effects of earth curvature must be considered.

Branches

Apart from the two main categories, we may also classify surveys according to their different branches and those disciplines directly associated with surveying:

1. Topographic Surveys are concerned with the measurement and mapping of the physical features of the earth. These features are all natural and manmade features.

2. Engineering Surveys cover surveys carried out as part of the preparation for, and carrying out of, engineering works, including roads, railways, pipelines, drainage etc.

3. Cadastral Surveys are concerned with the measurement, definition and mapping and recording of property boundaries.

4. Hydrographic Surveys are those made for determining the shape of the bottom of lakes, rivers, harbours and oceans. They also include the measurement of the flow of water in streams and the estimation of water resources.

5. Aerial Surveys are made from an aeroplane, and for the purpose of mapping the terrain. The control for such a map is obtained from ground surveys, but the details are obtained from aerial photographs. This includes making measurements and interpretations from aerial photographs.

6. Astronomic Surveys are surveys made to determine the latitude, longitude and azimuth from observations to the stars.

7. Mining Surveys are those made to determine survey control for the development of both surface and underground mines within the mining industry, and the determination of volumes in mine production.

8. Computing is a specialised area of surveying where complex computer programs are used to solve problems within the surveying industry.

9. Consulting is another specialised area of surveying where specialist surveyors are hired for a short period of time to advise on the requirements for a specific task or to perform the specific task. The above surveys have a common stem in skills and training. They have little or nothing in common with marine surveys, public opinion surveys, quantity surveys etc.

2.2History of Surveying

It is quite probable that surveying had its origins in ancient Egypt. The Great Pyramid of Khufu at Giza was built c. 2700 BC, 755 feet long and 480 feet high. Its nearly perfect squareness and north-south orientation affirm the ancient Egyptians' command of surveying.

Evidence of some form of boundary surveying as early as 1400 BC has been found in the fertile valleys and plains of the Tigris, Euphrates, and Nile rivers. Clay tablets of the Sumerians show records of land measurement and plans of cities and nearby agricultural areas. Boundary stones marking land plots have been preserved.

There is a representation of land measurement on the wall of a tomb at Thebes in Egypt (1400 BC) showing head and rear chainmen measuring a grain field with what appears to be a rope with knots or marks at uniform intervals. Other persons are shown. Two are of high estate, according to their clothing, probably a land overseer and an inspector of boundary stones.

There is some evidence that, in addition to a marked cord, wooden rods were used by the Egyptians for distance measurement.

The Egyptians had the groma, which was used to establish right angles. It was made of a horizontal wooden cross, pivoted at the middle and supported from above. From the end of each of the four arms hung a plumb bob. A plumb bob is a shaped weight that hangs from a string. Because of the weight, the string will always be vertical.

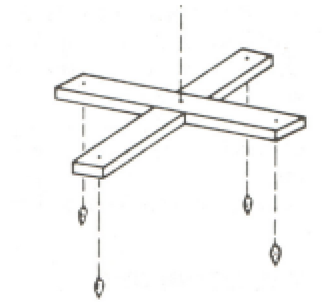


Figure (2- 1) : Egyptian Groma

By sighting along each pair of plumb bob cords in turn, the right angle could be established. The device could be adjusted to a precise right angle by observing the same angle after turning the device approximately 90°. By shifting one of the cords to take up half the error, a perfect right angle would result.

There is no record of any angle-measuring instruments of that time, but there was a level consisting of a vertical wooden A-frame with a plumb bob supported at the peak of the A so that its cord hung past an indicator, or index, on the horizontal bar. The index could be properly placed by standing the device on two supports at approximately the same elevation, marking the position of the cord, reversing the A, and making a similar mark. Halfway between the two marks would be the correct place for the index.

Thus, with their simple devices, the ancient Egyptians were able to measure land areas, replace property corners lost when the Nile covered the markers with silt during floods, and build the huge pyramids to exact dimensions.

The Greeks used a form of log line for recording the distances run from point to point along the coast while making their slow voyages from the Indus to the Persian Gulf about 325 BC. The Greeks introduced the astrolabe, which is an instrument to measure the altitude of stars above the horizon, in the 2nd century BC. It took the form of a graduated arc suspended from a hand-held cord. A pivoted pointer that moved over the graduations was pointed at the star. The instrument was not used for nautical surveying for several centuries, remaining a scientific aid only.

During their occupation of Egypt, the Romans acquired Egyptian surveying instruments, which they improved slightly and to which they added the water level and the plane table.

About 15 BC the Roman architect and engineer Vitruvius mounted a large wheel of known circumference in a small frame, in much the same fashion as the wheel is mounted on a wheelbarrow; when it was pushed along the ground by hand it automatically dropped a pebble into a container at each revolution, giving a measure of the distance travelled. It was, in effect, the first odometer.

The water level consisted of either a trough or a tube turned upward at the ends and filled with water. At each end there was a sight made of crossed horizontal and vertical slits. When these were lined up just above the water level, the sights determined a level line accurate enough to establish the grades of the Roman aqueducts.

In laying out their great road system, the Romans are said to have used the plane table. It consists of a drawing board mounted on a tripod (a three legged stand similar to that used by photographers) or other stable support.

It also consists of a straightedge ruler, usually with sights for accurate aim (the alidade) to the objects to be mapped, along which lines are drawn. It was the first device capable of recording or establishing angles. Later adaptations of the plane table had magnetic compasses attached.

Arab traders brought the magnetic compass to the west in the 12th century AD. Plane tables were in use in Europe in the 16th century. Surveyors practised the principle of graphic triangulation and intersection. In 1615 Willebrord Snell, a Dutch mathematician, measured an arc of meridian by instrumental triangulation.

In 1620 the English mathematician Edmund Gunter developed a surveying chain, which was superseded only by the steel tape in the beginning of the 20th century.

2.3 The Survey Process

The following sequence of steps is commonly followed when carrying out a survey:

(i) Reconnaissance During the reconnaissance phase, the surveyor will obtain an overall picture of the area that the project will be conducted in. They will select where the control points will be located, the accuracy required for the control, and which survey instruments will be required for the project.

(ii) Measurement and Marking During the measurement and marking phase, the surveyor will perform all the observations in the field required to accurately determine the control points, as well as placing and observing to any temporary points such as wooden pegs. They would also perform any calculations from the observations, such as angular and linear misclose and area and volume calculations.

(iii) Plan Preparation During the plan preparation phase, the calculations that were performed from the field observations would be further enhanced and used to produce the final plans for the project.

Note:

Control – The accepted surveying practice is to work from the whole to the part when establishing control. That is, select a small number of primary control points that cover the whole area and form a well-defined network of figures. These are broken down into a smaller network of figures as required.

Accuracy – Some projects do not require the highest possible accuracy, and, therefore, it is not always necessary to use the highest possible precision. This point is further reinforced by the usual contracting requirement that the job be done in the shortest possible time at the least possible cost. Equipment and techniques to be used need to be carefully considered so that the project is completed according to instructions, using the most appropriate methods.

2.4Units of Measurement

SI units the most commonly used in surveying being shown below:

Quantity	Unit	Symbol
Length	kilometre metre millimetre	km m mm
Area	square metre hectare	m^2 ha
Volume	cubic metre	m^3
Angle	degrees minutes seconds	° ' "
Mass (Weight)	Kilogram	kg
Temperature	Degrees Celsius	°C

The S1 unit for an angle is the radian (rad), but most surveying instruments measure in degrees, minutes and seconds, which is known as the sexagesimal system. This is the only unit of measure that is not SI.

2.5 Six of the Most Common Surveying Instruments

Surveying is one of the oldest professions, with records of land surveys dating back to ancient Roman times. You might assume that equipment used in the past was rudimentary and crude, but evidence indicates that ancient measuring tools for surveying were developed with surprising accuracy. Romans used an instrument called a groma to "trace on the ground simple and orthogonal alignments necessary to the construction of roads, city, temples, and agricultural lands subdivision1." Since then, surveying instruments have evolved with respect to exponential developments in technology. These days, surveyors use elite electronic equipment in addition to more basic tools to aid in measuring and mapping efforts. Curious to know more about the equipment surveyors use? We have compiled a list of the six most used surveying tools, including:

1. Theodolite: A surveying instrument with a rotating telescope for measuring horizontal and vertical angles to make precise measurements of areas and triangulate the position of objects in a specific area2.

2. Measuring tape: A length of tape or thin flexible metal, marked at intervals for measuring size or distance. Surveyors commonly use tape measures (known as measuring wheels) in lengths of over 100 meters3.

3. Total station: A theodolite that uses electronics to calculate angles and distances and contains an on-board computer to collect data and perform triangulation calculations. This tool is used to record features in topographic surveying or to set out features (roads, houses, or boundaries)4.

4. 3D scanners: A surveying instrument that can accurately measure and collect data from objects, surfaces, buildings, and landscapes. This tool collects information in the form of point cloud data, which consists of millions of 3D coordinates. These coordinates can be used to create 3D computer-aided design (CAD) models, which can then help analyze topographic features and structures. The high accuracy of 3D scanners helps reduce project costs5.

5. Level and rod: A graduated wooden or aluminum rod, used with a levelling instrument to determine the difference in height between points or heights of points above a vertical datum7. This tool is used to establish and verify elevations.

6. GPS/GNSS: The use of Global Positioning System signals and/or Global Navigation Satellite System signals via a receiver and antenna to determine the form, boundary, position, objects, or points in space relative to other forms, boundaries, or points. This technology has dramatically increased the speed and productivity of surveyors using on-demand centimeter-level accuracy provided by Real-Time Kinematic (RTK) positioning.

difference between GNSS and GPS:

GNSS stands for Global Navigation Satellite System, and is an umbrella term that encompasses all global satellite positioning systems. This includes constellations of satellites orbiting over the earth's surface and continuously transmitting signals that enable users to determine their position.

The Global Positioning System (GPS) is one component of the Global Navigation Satellite System. Specifically, it refers to the NAVSTAR Global Positioning System, a constellation of satellites developed by the United States Department of Defence (DoD). Originally, the Global Positioning System was developed for military use, but was later made accessible to civilians as well. GPS is now the most widely used GNSS in the world, and provides continuous positioning and timing information globally, under any weather conditions.

Besides GPS, the GNSS currently includes other satellite navigation systems, such as the Russian GLONASS, and may soon include others such as the European Union's Galileo and China's Beidou.

GNSS is used in collaboration with GPS systems to provide precise location positioning anywhere on earth. GNSS and GPS work together, but the main difference between GPS and GNSS is that GNSS-compatible equipment can use navigational satellites from other networks beyond the GPS system, and more satellites means increased receiver accuracy and reliability. All GNSS receivers are compatible with GPS, but GPS receivers are not necessarily compatible with GNSS.

Both GPS and GNSS consist of three major segments: the space segment (satellites), the ground segment (ground control stations), and the user segment (GNSS or GPS receivers), and the exact location of each satellite is known at any given moment. Satellites are continuously sending radio signals toward earth, which are picked up by GNSS or GPS receivers. The ground control stations that monitor the Global Navigation Satellite System continuously track satellites, update the positions of each and enable information on earth to be transmitted to the satellites.

Currently, GNSS/GPS is being used in a variety of fields where the use of precise, continually available position and time information is required, including agriculture, transportation, machine control, marine navigation, vehicle navigation, mobile communication and athletics.

Figure (2- 2) : GNSS and GPS

GPS Accuracy:

it depends. GPS satellites broadcast their signals in space with a certain accuracy, but what you receive depends on additional factors, including satellite geometry, signal blockage, atmospheric conditions, and receiver design features/quality.

For example, GPS-enabled smartphones are typically accurate to within a 4.9 m (16 ft.)

However, their accuracy worsens near buildings, bridges, and trees.

High-end users boost GPS accuracy with dual-frequency receivers and/or augmentation systems. These can enable real-time positioning within a few centimeters, and long-term measurements at the millimeter level.

Figure (2- 3) : Surveying Instruments

Where 14 control points have been set using GPS , whose coordinates are as follows:

Table (2- 1) : coordinates of control point

#of point	E	N	Z
1	92167.195	144630.145	624.148
2	92220.826	144779.361	623.617
3	92308.145	145134.173	627.204
4	92377.964	145380.149	635.36
5	92412.859	145286.616	634.529
6	92637.764	145177.382	630.693
7	92716.084	145058.221	630.109
8	92690.043	145058.221	622.7
9	92682.75	144927.471	607.151
10	92830.336	144493.617	587.545
11	92734.089	44579.088	593.739
12	92446.022	44842.584	618.703
13	92423.252	144691.599	616.021
14	92412.813	144545.917	624.328

These points were **monitored** using **spectra sp60** device, Who has these specifications:

The Spectra Geospatial SP60 is a new generation GNSS receiver offering a high level of flexibility to cover any demand from GIS all the way up to sophisticated RTK and Trimble RTX™ capable solutions.

Combining the unique all-signals-tracking and processing Z-Blade GNSS-centric technology and L-band capability for satellitedelivered Trimble RTX correction services, the SP60 receiver provides the most reliable measurements and the highest possible accuracy under any conditions anywhere in the world.

we determined the control points for our project , were distributed on the sides and in the middle as follows:

Figure (2- 4) : control point

In addition, check points were monitored using GPS:

Table (2- 2) : coordinates of check point

point	X	Y	Z
1	145127.862	92649.309	626.522
2	145075.122	92622.355	617.114
3	144845.079	92402.052	622.225
4	144917.978	92314.281	632.299
5	144927.355	92319.968	632.178
6	144937.973	92291.54	627.502
7	144601.686	92366.029	623.543
8	144665.2	92404.407	616.627
9	144711.127	92445.516	607.879
10	144872.547	92638.874	619.553
11	144863.742	92629.839	620.468

12	144820.094	92634.405	616.718
13	144772.618	92633.194	605.57

2.6 drone survey

A drone survey refers to the use of a drone, or unmanned aerial vehicle (UAV), to capture aerial data with downward-facing sensors, such as RGB or multispectral cameras, and LIDAR payloads. During a drone survey with an RGB camera, the ground is photographed several times from different angles, and each image is tagged with coordinates.

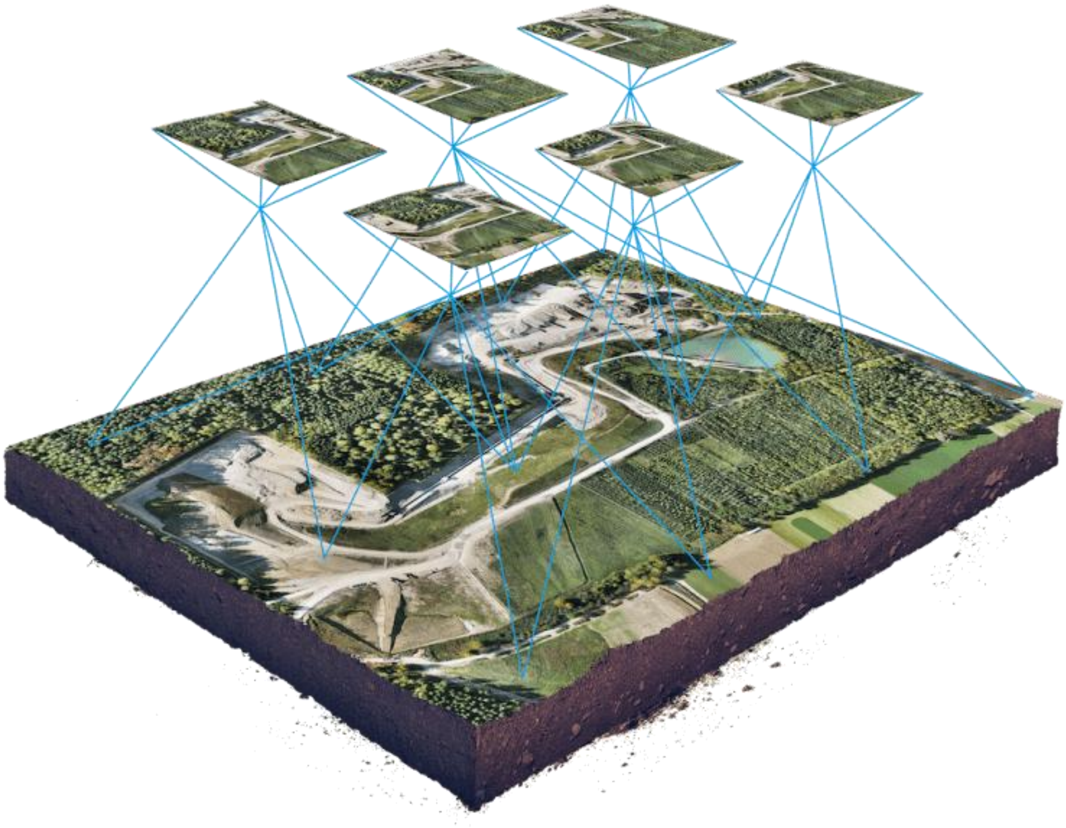


Figure (2- 5) : Photogrammetry combines images that contain the same point on the ground from multiple vantage points to yield detailed 2D and 3D maps.

From this data, a photogrammetry software can create geo-referenced orthomosaics, elevation models or 3D models of the project area. These maps can also be used to extract information such as highly-accurate distances or volumetric measurements.

Unlike manned aircraft or satellite imagery, drones can fly at a much lower altitude, making the generation of high-resolution, high-accuracy data, much faster, less expensive and independent of atmospheric conditions such as cloud cover.

2.7The benefits of drones in surveying

Some of the benefits of using drones in surveying:

1-Reduce field time and survey costs

Capturing topographic data with a drone is up to five times faster than with land-based methods and requires less manpower. With PPK geo-tagging, you also save time, as placing numerous GCPs is no longer necessary. You ultimately deliver your survey results faster and at a lower cost.

2-Provide accurate and exhaustive data

Total stations only measure individual points. One drone flight produces thousands of measurements, which can be represented in different formats (orthomosaic, point cloud, DTM, DSM, contour lines, etc). Each pixel of the produced map or point of the 3D model contains 3D geo-data.

3-Map otherwise inaccessible areas

An aerial mapping drone can take off and fly almost anywhere. You are no longer limited by unreachable areas, unsafe steep slopes or harsh terrain unsuitable for traditional measuring tools. You do not need to close down highways or train tracks. In fact, you can capture data during operation without an organizational overhead.

2.8 Uses of drones

1-Land surveying / cartography

Survey drones generate high-resolution orthomosaics and detailed 3D models of areas where low-quality, outdated or even no data, are available. They thus enable high-accuracy cadastral maps to be produced quickly and easily, even in complex or difficult to access environments. Surveyors can also extract features from the images, such as signs, curbs, road markers, fire hydrants and drains.

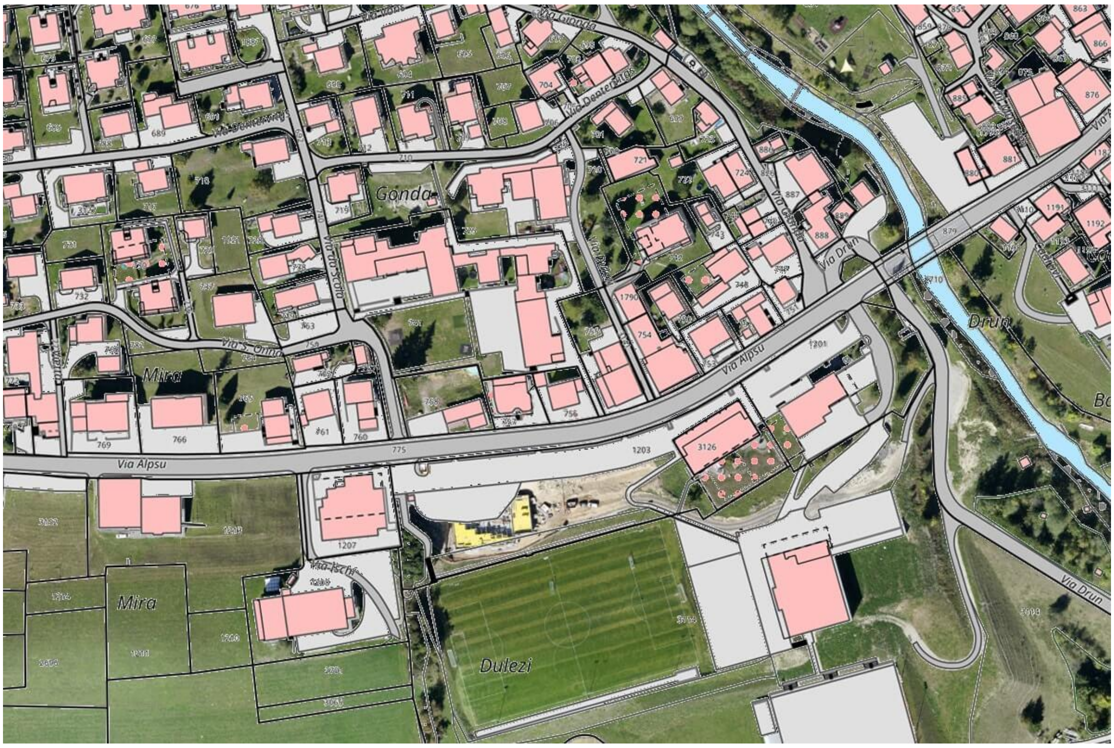


Figure (2-6) : cadastral map overlayed on aerial images

After post-processing with a photogrammetry software, these same images can produce very detailed elevation models, contour lines and breaklines, as well as 3D reconstructions of land sites or buildings.

2-Land management and development

Aerial images taken by drones greatly accelerate and simplify topographic surveys for land management and planning. This holds true for site scouting, allotment planning and design, as well as final construction of roads, buildings and utilities.

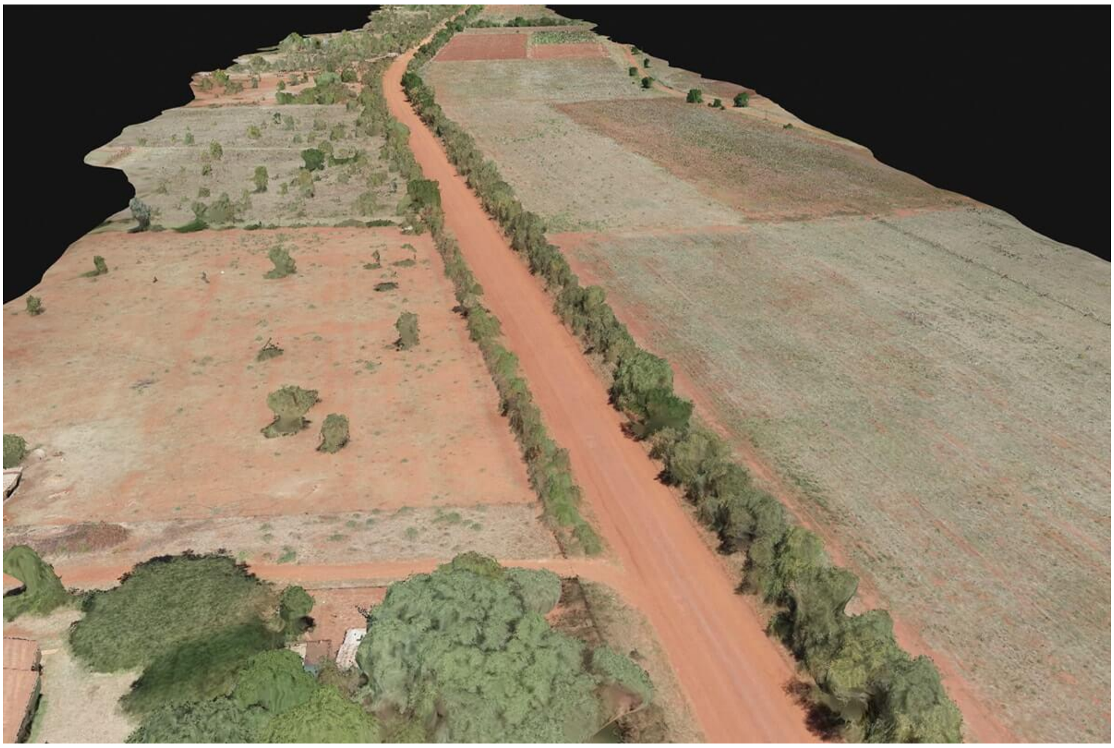


Figure (2-7) : survey of an african road before construction planning

These images also provide the foundation for detailed models of site topography for pre-construction engineering studies. The generated data can also be transferred to any CAD or BIM software so that engineers can immediately start working from a 3D model.

As data collection by drones is easily repeatable at low cost, images can be taken at regular intervals and overlaid on the original blueprints to assess whether the construction work is moving according to plan specifications**.**

3-Precise measurements

High resolution orthophotos enable surveyors to perform highly-accurate distance and surface measurements.

Figure (2-8) : volume measurement of a landfill in the Bahamas

4-Stockpile volumetric measurements

With 3D mapping software, it is also possible to obtain volumetric measurements from the very same images. This fast and inexpensive method of volume measurement is particularly useful to calculate stocks in mines and quarries for inventory or monitoring purposes.

With a drone, surveyors can capture many more topographic data points, hence more accurate volume measurements. They can also do this in a much safer way than if they had to manually capture the data by going up and down a stockpile. Since drones are capturing the data from above, operations on site won't be interrupted. The short acquisition time enables capturing a site snapshot at a specific point in time.

5-Slope monitoring

With automated GIS analysis, it is possible to extract slope measurements from DTMs and DSMs generated by drone imagery. Knowing the steepness of the ground's surface, the areas can be classified and used for slope monitoring purposes, including landslide mitigation and prevention.

With orthomosaics taken at different times, it is possible to detect changes in earth movement and to measure its velocity. This data can help predict landslides and prevent potential damage to roads, railways and bridges

6-Urban planning

The development of increasingly dense and complex urban areas requires intensive planning and therefore time-consuming and expensive data collection. Thanks to drones, urban planners can collect large amounts of up-to-date data in a short period of time and with far less staff. The images produced in this way allow planners to examine the existing social and environmental conditions of the sites and consider the impact of different scenarios.

Figure (2-9) :zoning map overlayed on an aerial map of a mixed urban and leisure area .

Thanks to 3D models, buildings can also be easily overlayed onto their environment, giving planners and citizens an experimental perspective of a complex development project. 3D models also allow analysis and visualization of cast shadows and outlooks/views.

Maps produced with a WingtraOne drone and Esri's ArcGIS Urban.

2.9 Accurate of drone survey

The performance and type of drone, the quality of its components, the camera resolution, the height at which the drone flies, the vegetation, and the method and technology used to geolocate the aerial images can heavily influence the accuracy of drone survey mapping. At this point, it is possible to reach an absolute accuracy down to 1 cm (0.4 in) and 0.7 cm/px (0.3 in/px) GSD under optimal conditions with a high-end surveying drone such as the WingtraOne.

2.10 drone survey Procedure

1. Check before you leave the office

Check the local regulations and make sure that you are allowed to fly your drone at the planned location. Also, make sure that the weather is suitable, meaning no rain, fog, snowfall or strong winds. Check that the battery of your drone and connected devices such as tablets are fully charged and that the memory card of your drone camera has sufficient empty space to capture the entire project.

2. Plan your flight

You can create the survey flight plan with the drone flight planning app on the tablet. For this, just tap and drag the points around the area you want to survey, or import a KML file. Make sure you account for tall objects within the flight plan, as well as altitude differences. If needed, you can adjust flight settings such as altitude, ground sampling distance (GSD), flight direction and images overlap.

3. Set up your flight in the field

During this step, you basically unpack and assemble the drone and make sure that it is ready to take-off in safe conditions. Following the interactive check-list, you will one-by-one check every parameter, like the calibration of the airspeed sensor and making sure the camera lid is removed.

4. Fly and collect images

After pushing the take-off button, the drone autonomously takes off, captures images and lands back where it started. In this step, the operator essentially makes sure that nobody approaches the drone during take-off or landing and that the weather conditions stay optimal for the survey mission.

5. Geotag your images

After one or several flights, import the images into WingtraHub software to geotag them s. Geo-tagging assigns geographical position (X, Y, Z) information to the images either in a separate CSV file or in the images' meta-data.

2.11 Drone survey data processing

While surveying with drones, images of the ground are taken from multiple vantage points. Through processing these images, a photogrammetry software can then create orthomosaics and 3D models, from which it can measure accurate distance, as well as surfaces and volumes of physical objects.

1-Data outputs from the drone

Images taken by the drone are usually saved on a memory card (such as SD card), just like for any other camera. Depending on the technology used by the drone, the images are already geo-tagged or can be imported in a geo-tagging software, such as WingtraHub. According to the size of the survey site, you probably have between a few hundred images and a few thousand, and each image contains geographical information (X, Y, Z).

2-Importing into a photogrammetry software

After importing or uploading the geo-tagged images in a photogrammetry software such as Drondeploy, delair.ai, 3DR Sitescan or Pix4D, images will be stitched together to create 2D or 3D models of the surveyed site. Image processing can be a lengthy process depending on the number of images and the performance of your computer. Some photogrammetry software are desktop-based, thus requiring robust hardware. Other software is cloud-based, employing powerful servers instead of your local computer to process the data.

CHAPTER 3

Photogrammetry

3.1 Definition of Photogrammetry

3.2. Types of photogrammetry

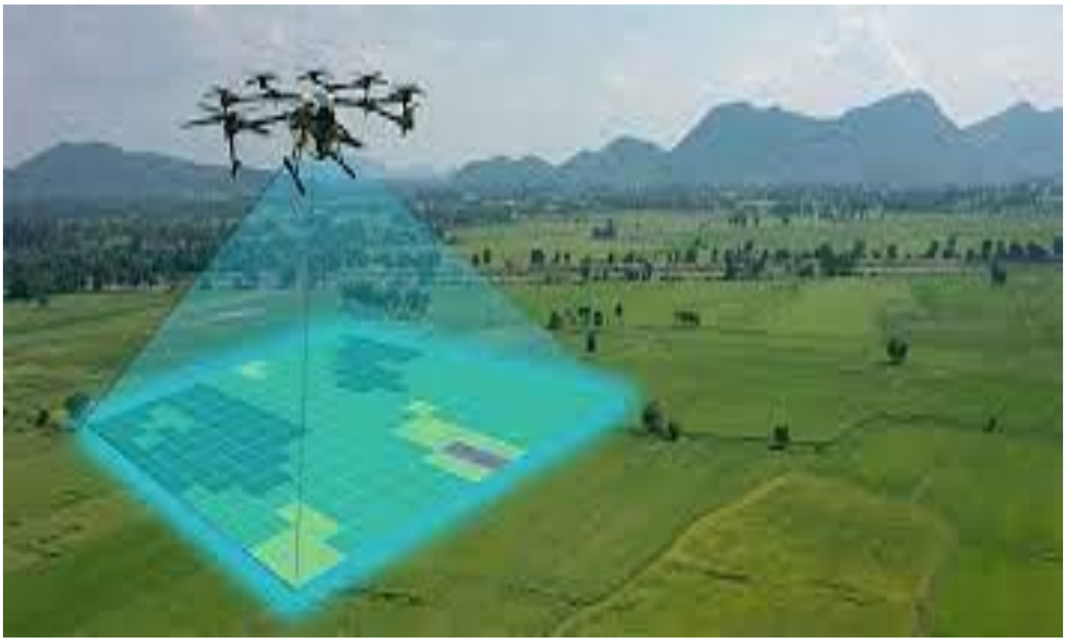
3.3. Types of photos

3.4 Uses of photogrammetry

3.5Very High-Resolution Images

3.6 Close Range photogrammetry

3.7 Agisoft Photoscan



3.1 Definition of Photogrammetry

Photogrammetry has been defined by the American Society for Photogrammetry and Remote Sensing as the art, science, and technology of obtaining reliable information about physical objects and the environment through processes of recording, measuring, and interpreting photographic images and patterns of recorded.

3.2. Types of photogrammetry

For centuries, photogrammetry has played a critical role in our understanding of faraway objects and the Earth's surface. Its uses have expanded over the years and have led to a powerful range of game-changing technologies in industries like construction, engineering, medicine and much more.

Photogrammetry gathers measurements and data about an object by analyzing the change in position from two different images. It uses things like perspective, advanced processing software and photo analysis to get the job done, but it can happen on the ground or from the air. In this guide, we'll explain the different types of photogrammetry and how it can be used.

1-AERIAL PHOTOGRAMMETRY

Taking aerial photos is one of the most common approaches to mapping out an area. In this process, a camera is mounted on an aircraft and pointed toward the ground with a vertical or near-vertical axis. As the plane follows its flight path, the camera takes multiple overlapping photos, which are then processed in something called a stereo plotter.

The stereo plotter is an instrument that helps determine elevations by comparing two different photos and conducting the necessary calculations. With the help of photogrammetry software, we can process this information and create digital models out of it.

Aerial photography, generally flown from an airplane, is still widely used in the creation of topographic maps worldwide; they are also a relatively inexpensive and accessible data source. Photography can provide black-and-white, color, or color-IR data in either film or digital form. All photographs are captured with some inherent geometric distortion; however, those distortions can be corrected to produce an orthophoto. The USGS makes available digital orthophoto quadrangles that correspond to USGS 7.5-min topographic sheets, and is a good repository for downloading US archival photography (and other remotely sensed datasets). Because aerial photography predates satellite imagery, it represents a valuable source of historic landscape data. Land-use studies often rely on panchromatic aerial photographs for compiling land-use histories. Another advantage to aerial photography is that oftentimes it is flown at relatively low altitudes, thereby capturing fine detail, such as buildings, stands of trees, roads, bodies of water etc., which renders it highly useful for visual interpretation.

2-TERRESTRIAL PHOTOGRAMMETRY

These images are taken from a fixed position on the ground with a camera's axis parallel to the Earth. Data about the camera's position, such as its coordinates, are collected at the time the photo is taken. The instruments used for terrestrial photography are often theodolites, though regular cameras are sometimes used as well. Terrestrial photogrammetry for surveying typically requires fewer resources and skilled technicians to accomplish, but it may take longer to cover a large portion of land.

3-SPACE PHOTOGRAMMETRY

Moving out to a larger scale, space-based photogrammetry occurs with cameras either fixed on Earth, in an artificial satellite or positioned on the moon or another planet. In fact, photogrammetry was touted as a key part of space exploration even in the '60s, and technological advancements have made it even more relevant. It can tell us about cloud patterns, create accurate maps of Earth and gather data about faraway planets.

While we can classify photogrammetry based on the location of the camera, we can also break things down by the type of photogrammetry being conducted. These types vary based on the kind of data being gathered.

Two forms of photogrammetry that you're likely to encounter are:

Interpretive: Interpretive photogrammetry is all about identifying objects and gathering significant factors from an image with careful and systematic analysis. Photo interpreters gather information about their subjects, such as characteristics and features, by analyzing and evaluating the photos carefully. The job may involve remote sensing technologies. Remote sensing combines photo interpretation with data from remote sensing instruments, like cameras on satellites or aircraft and sonar systems on ships.

Metric: In metric photogrammetry, the goal is to find measurements. A researcher may pull specific data and measurements from a photo with the help of other information about the scene.

3.3. Types of photos

Since aerial photogrammetry is one of the most common methods, let's take a look at how those photos get classified.

Typically, aerial photos will fall under one of two categories:

Vertical photographs: These images occur when the camera axis is vertical. So, if you put the camera in an airplane, its lens would point down to the ground for a birds-eye view.

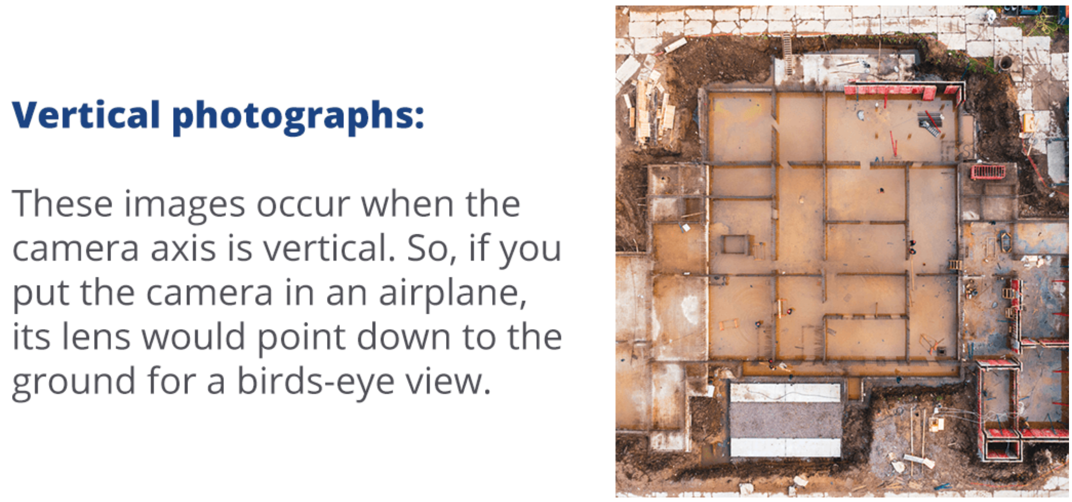


Figure (3- 1) : Vertical photo

Tilted photographs: Though the axis may be nearly vertical, tilts in the aircraft can cause an image to be unintentionally tilted in one direction. Within the category of tilted photographs, we have oblique photos, in which you can see the horizon line, and low-oblique photos, in which there is no apparent horizon. The classification depends on the level of tilt of the camera off of its vertical axis.

The lens of the camera can also offer a range of coverage. For instance, an ultra-wide-angle lens captures a larger field of view than a normal-angle lens. It would gather more of an image in its sights but could create distortion at its edges, depending on the lens and camera design.

When collecting aerial photos, operators capture many images in succession. These images need to overlap with each other, so the image processing software can identify the changes and understand where specific objects are placed. When it can capture those common items, it can more effectively stitch the photos together or gather data about their positions.

3.4 USES OF PHOTOGRAMMETRY

The ways that photogrammetry comes to life can vary widely by collection method, data gathered, industry use and compatible technologies.

Some of the products that come from the process include orthomosaics, digital surface models and digital terrain models. An orthomosaic is essentially a birds-eye view of a terrain that adjusts for distortion and can span wide landscapes. Digital surface models and digital terrain models represent surface levels and elevation. Surface models include buildings and trees, while the terrain model gets rid of all of these features, showing the height of the bare earth.

The most common use for photogrammetry is creating maps out of aerial photos. It is cost-effective and accurate, allowing planning entities like architects, local governments and construction workers to make clear, informed decisions about their projects without spending months scouring the landscape. It is also very detailed and can provide an exceptional level of information about an area.

Photogrammetry makes its mark in an array of industries, from medical research to film and entertainment. Here are some of the places you can find it:

1. LAND SURVEYING

We’ve already discussed the applications of photogrammetry in civil surveying, the results of which are used by many entities, including construction crews, governments, building planners and architects. All of the data gathered from photogrammetry inform them about everything from necessary safety measures to potential project results.

2. ENGINEERING

In the world of engineering, drone photography helps to evaluate sites for construction, as well as create perspective images and 3D renderings. Engineers can produce images of project results or previews, as well as analyze their current progress.

3. REAL ESTATE

In the digital age, where 80% to 81% of millennials find their homes on mobile devices, creating attractive, accurate listings can significantly improve the buying experience and their understanding of the purchase. Viewers can see the home from all angles and get a clear idea of what they're looking at.

4. MILITARY INTELLIGENCE

Photogrammetry also plays a role in data gathering for military programs. Accurate geo-locational models with low processing times are necessary for understanding a landscape. Aerial imagery and photogrammetric technology can work together to create accurate 3D maps quickly without any human input.

5. MEDICINE

While you might not think to put the medical field in the same category as land surveying, the 3D models that come from photogrammetric technology come in handy for a variety of health-related uses. It can also work alongside remote sensing technology to help develop diagnoses without invasive procedures.

6. FILM AND ENTERTAINMENT

Photogrammetry can play a big role in set design and world-building for a variety of films and video games. 3D modeling can bring unique objects to fruition in a virtual world, like cityscapes for action sequences and accurate historical elements, such as statues and buildings. One popular franchise that uses photogrammetry is the "Battlefield" games, which have an art style that works well with these 3D renderings and recreations.

In addition to world-building, photogrammetry can also assist with designing special effects and real sets.

7. FORENSICS

Photogrammetry also plays a part in crime investigation. It can help to document and measure precise data about a crime scene and determine what was physically possible. There are also many photogrammetric experts that can assist in the courtroom.

8. CONSTRUCTION AND MINING

Project engineers and contractors can use accurate 3D models to monitor and plan their worksites. The information from a photogrammetric model can help create a smart worksite with sensors and safety features that improve the environment. These models work in tandem with connected vehicles.

9. SPORTS

Analyzing athlete movements can help coaches and researchers understand more about their activities. They can develop virtual training systems and learn about the physical effort that players expend by tracking their body movements. Topographical maps also come in handy for outdoor athletes, like hikers, mountain climbers, skiers and snowboarders. Mapping remote areas is often easier with the help of photogrammetric technology.

10. AGRICULTURE AND FORESTRY

In agriculture, aerial photos can offer insights into soil quality, irrigation scheduling, nutrition and pests. Farmers can adjust their planting schedules or adjust irrigation and fertilizers with this information. They can also use photogrammetry when assessing growth and crop damage after storms or floods.

Researching and managing forests becomes significantly easier with the help of photogrammetry. It can produce models to analyze various aspects of a forest, like timber volume and height, to better understand the development of a forest.

3.6 CLOSE RANGE PHOTOGRAMMETRY

Introduction

Terrestrial photogrammetry is an important branch of the science of photogrammetry. It deals with photographs taken with cameras located on the surface of the earth.

The term close-range photogrammetry is generally used for terrestrial photographs having object distances up to about **300** m.

Terrestrial photography may be:

• Static: photos of stationary objects. Stereopairs can be obtained by using a single camera and making exposures at both ends of a baseline.

• Or dynamic: photos of moving objects. Two cameras located at the ends of a baseline must make simultaneous exposures.

Applications of Close Range photogrammetry

• Surveying

• Industry(e.g. aircraft manufacture)

• Archeology

• Medicine

• ……..etc

Terrestrial Cameras

Two general classifications:

• Metric: for photogrammetric applications. They have fiducial marks. They are completely calibrated before use. Their calibration values for focal length, principal-point coordinates, and lens distortions can be applied with confidence over long periods.

• Non-metric: manufactured for amateur or professional photograph) where pictorial quality is important but geometric accuracy requirements are generally not considered paramount.

A phototheodolite is an instrument that incorporates a metric camera with a surveyor's theodolite. With this instrument, precise establishment of the direction of the optical axis can be made.

A stereometric camera system consists of two identical metric cameras which are mounted at the ends of a bar of known length. The optical axes of the cameras are oriented perpendicular to the bar and parallel with each other. The length of the bar provides a known baseline length between the cameras, which is important for controlling scale.

Horizantal and Oblique Terrestrial Photos:

Classification of terrestrial photos depending on the orientation of the camera :

• **Horizontal**: if the camera axis is horizontal when the exposure is made. , the plane of the photo is vertical. So if metric camera is used the x-axis is horizontal and the the y-axis is vertical.

• **Oblique**: the camera axis is inclined either up or down in an angle θ from horizontal. If θ is upward is called elevation angle. If its downward it called depressing angle.

3.7 Agisoft Photoscan

Program description

Agisoft Metashape Professional is software that maximizes the possibilities of photogrammetry. It incorporates machine learning technologies for analysis and post-processing to deliver the highest accuracy results. Agisoft Metashape is a standalone software product that photogrammetrically processes digital images and generates 3D spatial data that can used in geographic information system (GIS) applications, in cultural heritage documentation, for visual effects production, and for indirect measurements of objects of various scales.

Metashape makes it possible to:

process images obtained with RGB or multispectral cameras, including multi-camera systems,

convert photographs:

1-in to dense point clouds,

2-in to textured polygonal models,

3-in to georeferenced orthophotomaps,

4-in to digital elevation / terrain models (DEM / DTM).

Post-processing allows to remove shadows and texture distortions from the surface of models, calculate vegetation indices, compose prescription files for agricultural activities, automatically classify dense point clouds, etc.

The ability to export to all external post-processing packages makes Agisoft Metashape Professional a versatile photogrammetric tool.

Use Metashape for aerial photos:

Point clouds

similar quality as laser scans

Highly detailed

surfaces in TIN or GRID models

Texturised 3D models

based on original images

Orthophotos

with 1:500 precision

The core of Metashape is digital photogrammetry methods supported by modern computer vision algorithms.

Metashape knows what to offer to professionals. You can control the quality of the obtained results by using reports, fine-tune the workspace for specific tasks and use advanced features such as stereo mode or Python scripts.

A professional photogrammetric system can be easily operated by a novice: the intuitive interface is very easy to learn. You can get highly accurate results without even having specialized knowledge and training in photogrammetry.

Agisoft Works:

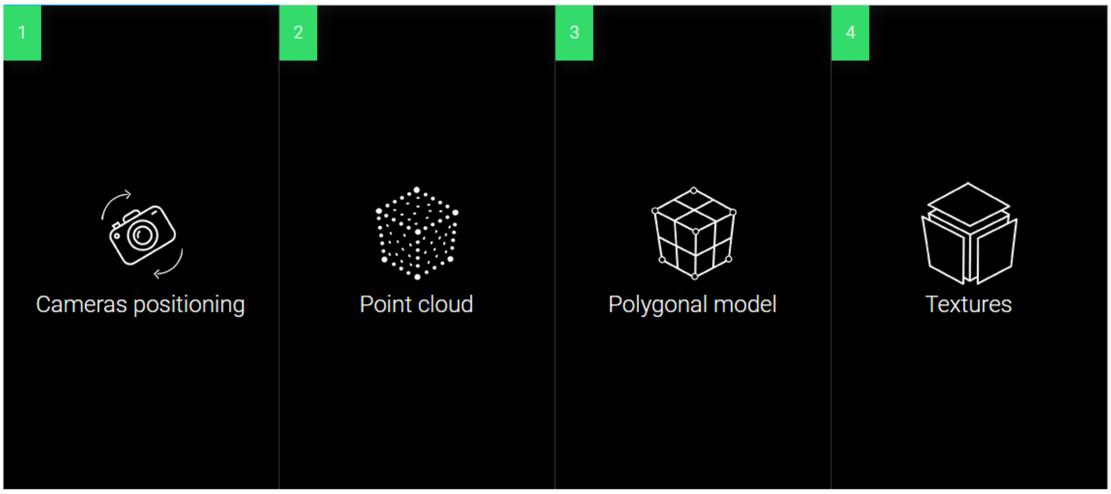


Figure (3- 3) : Agisoft Works

To find common points, Metashape uses an algorithm that first finds 'special' points in individual photographs. Then, on the basis of unique identifiers — descriptors — the points are identified. If a point is recognized in two or more frames, it becomes a match.

This is followed by frame alignment, or phototriangulation. This process is implemented with the use of the Bundle Block Adjustment algorithm, which is based on the least squares method. Bundle Block Adjustment is an interpretation of the Bundle Method, the most rigorous method for solving phototriangulation. The calculation can include the coordinates of the anchor points and the projection of markers on the frame. All parameters can be given weights — the scale of their participation in the calculation.

A dense cloud is built on the basis of depth maps. The Semi-Global Matching algorithm is used to create them. The essence of the algorithm is that for each pixel of the left image of a stereo pair there is a corresponding pixel on the right image. Each pixel in the left image is compared to a subset of pixels in the right image with the corresponding ordinate. Next, a parallelepiped is formed for the entire image, where one 'line' of cells corresponds to each pixel, and one longitudinal section of the cube corresponds to a row of pixels in the image. The elements of the cube are the values of the matching criterion, which are analyzed to find the minimum values for each pixel.

In addition, links between neighboring pixels in eight directions around a given pixel are analyzed. As a result, for each pixel of the left image, the corresponding value of the longitudinal parallax is found and, as a consequence, the spatial coordinates of the points of the dense model.

Some tips to ensure successful preparation of the 3D model:

1_If you can, maintain a perpendicular location relative to the object while you take photos.

2-Make sure that there are no moving objects in the background when you take the photos.

3-If you can, take photos in a location where lighting is consistent and doesn't cast shadows.

Agisoft Photoscan

Depending on which drone and camera you are using, the procedure in Photoscan/ Metashape differs. Therefore this instruction is divided in different sections depending on the function of each sensor/drone. The Agisoft manual is well written and give you a deeper understanding about the workflow described below.

The guide goes through how you create an ortho photo and 3D point cloud from images taken with a drone.

STEPS:

1-Import photos, location and accuracy

2-Image quality

3-Align photos

4-Ground control points (GCP)

5-Dense point-cloud and ortho photo

EXPORTING ORTHO PHOTO

Place Markers

Markers are used to optimize camera positions and orientation data, which allows for better model reconstruction results. To generate accurately georeferenced orthophoto at least 10 – 15 ground control points (GCPs) should be distributed evenly within the area of interest.

Photogrammetric control or ground control consists of any points whose positions are known in an object- space reference coordinate system and whose images can be positively identified in the photographs.

Photogrammetric control can be:

- Full control: X, Y, Z ground coordinates is known.

- Horizontal control: X, Y ground coordinates are only known.

- Vertical control: Z (elevations) is known.

Requirements of ground control:

- They should be sharp.

- They should be in favorable locations.

For Horizontal control, their horizontal positions on the photographs must be precisely measured; images of horizontal control points must be very sharp and well defined. Horizontal control are intersections of sidewalks, intersections of roads, manhole covers, small lone bushes, isolated rocks, corners of buildings, fence corners, power poles, points on bridges, intersections of small trails or watercourses, etc.

Images for vertical control need not be as sharp and well defined horizontally. Points selected should be well defined vertically. Best vertical control points are small, flat or slightly crowned areas. The small areas should have some natural features nearby, such as trees or rocks, which help to strengthen stereoscopic depth perception. Large, open areas such as the tops of grassy hills or open fields should be avoided.

Number and Location of Ground Control

Space resection problem: for determining the position and orientation of a tilted photo, a minimum of three XYZ control points is required. The images of the control points should ideally form a large, nearly equilateral triangle. Although three control points are the required minimum for space resection, redundant control is recommended to increase the accuracy of the Photogrammetric solution and to help detecting mistakes.

Object space coordinates of ground control points, which may be either imageidentifiable features, are generally determined via some type of field survey technique such as GPS.

It is important that the object space coordinates be based on a three-dimensional Cartesian system which has straight, mutually perpendicular axes.

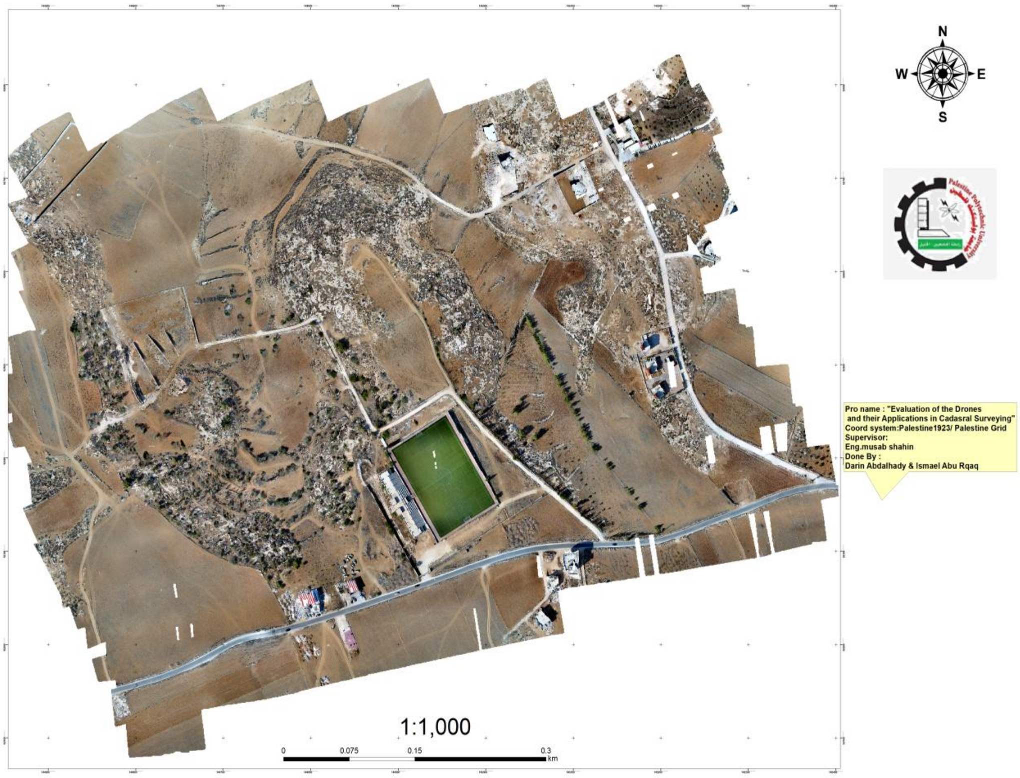


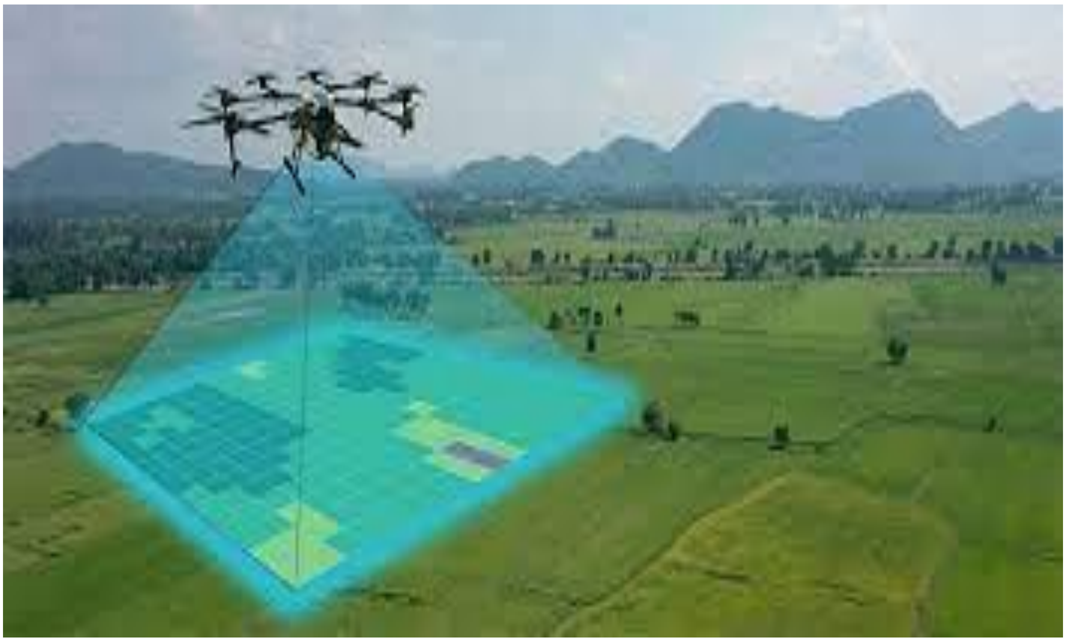
Figure (3- 4) : orthophpto of the study area frome agisoft

CHAPTER 4

Land Settlement and Photogrammetry

4.1 Land Registry and Settlement in Palestine

4.2 Digital Photogrammetry for Land Registration



4.1 Land Registry and Settlement in Palestine

Over the past years, the Palestinian National Authority (PNA) has given special attention to the issue of land settlement (prior to titling), introducing many administrative and structural modifications as well as legal amendments. Towards speeding up the process of legally and officially settle property rights for all land in Palestine, in April, 2016 the PNA transferred land settlement powers from the Land Authority to the Land and Water Settlement Commission.

There is no consensus as to whether land settlement has positive impact on investment in housing and property improvement projects; hence, investments hinge on the financial resources of those having title to the land. Moreover, investment for such purposes does not require a title deed, not when parties depend on social and customary arrangements to effectively secure tenure.

Land settlement that is legally protected promotes long-term investments in land and soil, since formal land registration reduces the risk of arbitrary expropriation, minimizes disputes over land and borders, and improves owners' expectations about the future benefits of the land. However, the positive impact may be peripheral if property rights are exclusively secured by social and customary arrangements.

Land settlement catalyzes the land market by reducing risks associated with land ownership disputes. Land settlement is thus likely to improve market efficiency and increase return on sales. However, high land settlement and registration fees may curtail benefits, which may cause owners to abandon settlement. Several studies point out the importance of settlement and registration as a means for improving access to credit. However, this access is also related to other credit conditions such as income, ability to repay, bank liquidity, loan type, etc.

Land settlement and registration broadens the tax base, increases public revenue and improves collection efficiency for local government units. Naturally, land settlement provides a database of all land owners, the parcels in their possession, as well as infrastructure on those parcels (buildings, etc). Where settlement increases the value of the land– and thus its appraisal– tax revenues from registered land equally increase.

Typically, land settlement and registration encourage more construction and investment outside urban (city and village) centers, which requires provision of infrastructure and public services (water, electricity and sanitation). However, previous literature found no correlation between land registration and tangible results regarding the provision of public services and investment in infrastructure. This is due to a number of reasons, particularly the ability of individuals and families to access public services and infrastructure even when official title to the land does not exist. The provision of public services and infrastructure requires large investments that may not be available to developing countries.

Respondents from local government bodies unanimously reported that land settlement has contributed to resolving disputes between parties and protected land against fraud, theft, leakage and confiscation by the Israeli occupation. Respondents also said land settlement has stimulated investment; helped local government bodies organize roads and develop effective urban planning; and increased local government bodies' opportunities to acquire land for public facilities, which would mean more projects and prosperity. On the other hand, respondents reported that land settlement has protected women's right to inheritance and as well protected the property of absentees. They also agree that by expanding the tax base and providing a database for tax collection, land settlement would mean additional financial resources to the central government, and local government units alike.

On the challenges associated with increased land settlement and registration, respondents from local government bodies cited concerns about owners of nonregistered land, taxes and fees associated with settlement and registration, as well as reluctance of some male owners to allow women their share of inheritance, which made some desist from the settlement project. Respondents also indicated that the pace of progress in the project is very slow due to land disputes and poor economic conditions, not to mention other impeding factors. In the area surveyed for this study, some owners refuse to cooperate during land surveying, some are expatriates, and some tracts of land are kept undivided between heirs (joint ownership). Other challenges interviewees cited involve problems associated with the boundaries defined of land parcels, the refusal of the residents to cede parts of their land for the construction of access roads, the delays in the settlement process as some transactions need special purchase permits (e.g. if the purchaser is an East Jerusalem resident or a Palestinian of Israeli nationality), and the fact that some tracts are in Area C (under Israeli control) or tracts by the Apartheid Wall.

Ther is some complaints from local bodies over slow procedures and lack of cooperation with surveyors. Of particular concern were procedural problems, such as incorrect recording of owners' names or land area, the loss of title deeds by some residents (who might have been unaware of how important these deeds are), with replacement of lost documents taking a lot of time, effort and money. There was also a range of other challenges: the absence of a clear legal system, designed specifically for the current conditions in Palestine; the inability of the Settlement Commission to decide on some outstanding cases and therefore transferring land that it could not settle to the state treasury (weakening owners and tenants' confidence in the settlement system); insufficient number of judges; ineffective court procedures; the large scale of the settlement project; and the financial burden (registration fees) that owners have to pay, which vary by local government body, who do not follow clear standards for charging.

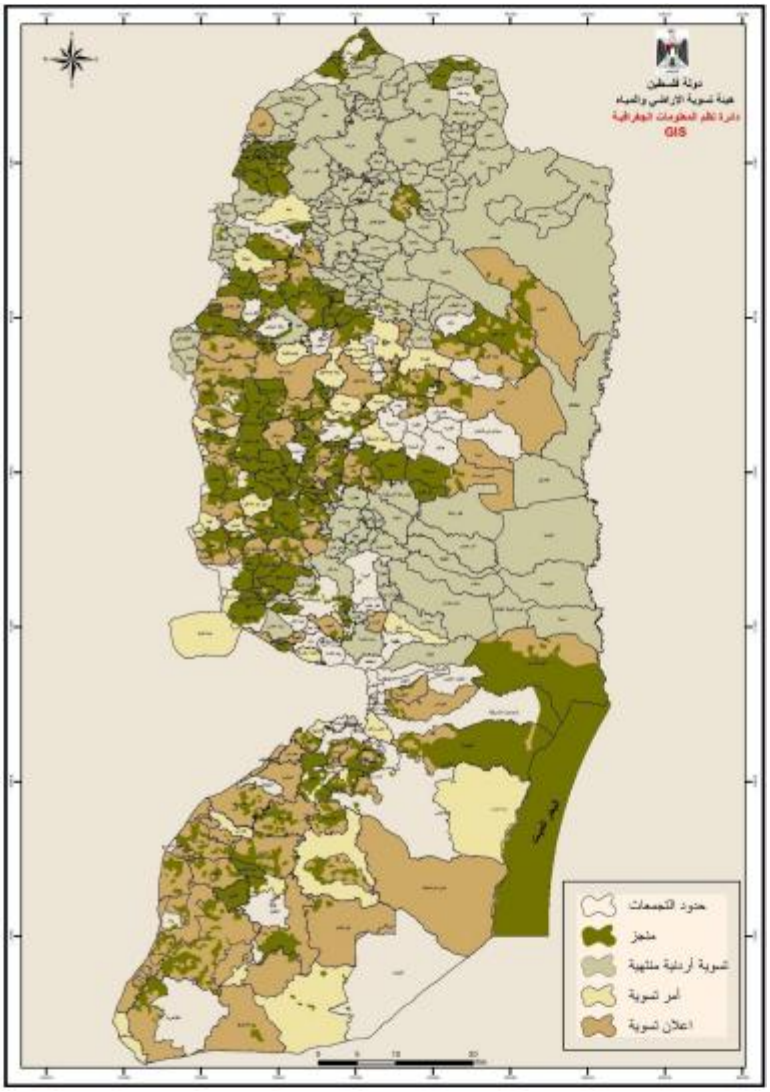


Figure (4- 1) : Map of settlement achievements in the West Bank governorates in 2020

The number of cooperation agreements until the end of 2020 between the Land and Water Settlement Authority and local authorities reached 215 cooperation agreements, distributed as follows:

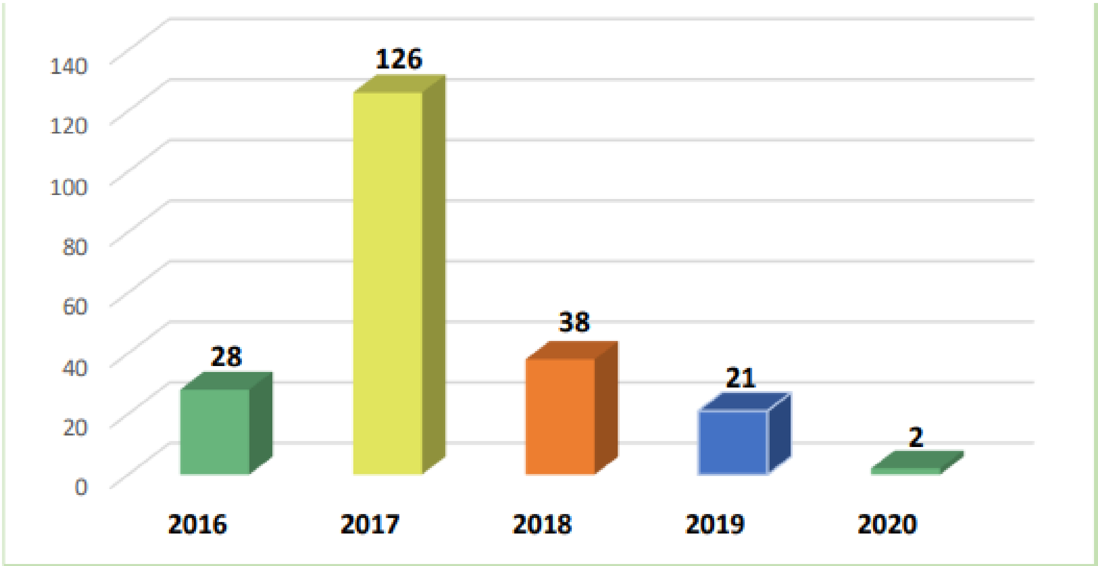


Figure (4- 2) : Number of cooperation agreements by years

And The number of settlement announcements reached 147 settlement announcements until the end of 2020, and they were distributed as follows:

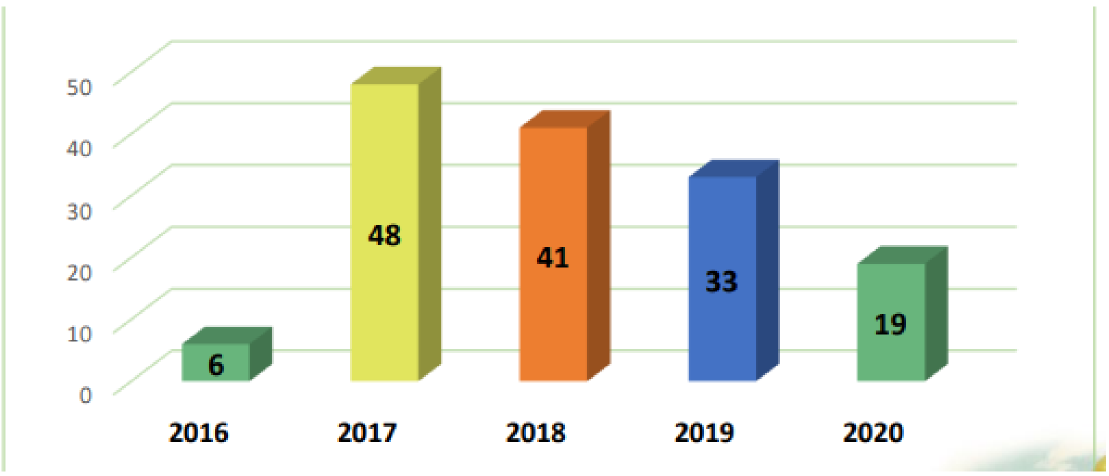


Figure (4- 3) : Number of settlement announcements agreements by years

settlement procedures

Initially determining the area in which the settlement will be carried out by the Land and Water Settlement Department.

-Issuance of a settlement order, based on Article No. (5) of the Land and Water Settlement Law, specifying the settlement area.

-Announcing the settlement, whereby the residents of the area are notified of the date of commencement of work in the areas specified in the settlement order.

-Announcing the settlement to inform the residents of the area of the date of commencement of work on the settlement order.

After the settlement is announced:

• The Land and Water Settlement Commission begins by dividing the declared area into basins and neighborhoods with names familiar to the people of the area.

• The Supreme Judicial Council appoints a settlement judge.

• Some of the official authorities concerned are informed of the settlement work.

• Registration departments stop conducting any transaction in the areas where the settlement is announced.

• The settlement teams (survey) carry out surveying and defining boundaries.

Documents required from land owners

Documents required from land owners, if any:

• Deduction from property tax.

• Inventory of inheritance, an argument for exit.

• Sale or purchase contracts, investment contracts or documents, secretion contracts or documents.

• Insurance or mortgage bonds, agency or agencies related to land, water, real estate or apartments.

• Any papers or other documents that prove the claim of ownership right.

Settlement in the study area:

A settlement was made in this area and the area was divided into 57 pieces , Field measurements, calculations and demarcation were carried out by the Ad-Dhahiriya Land Settlement Office, It was audited by the Geographic Information Systems Department - Land and Water Settlement Authority, Settlement Officer: Muhammad Al-Sous, where all non-descriptive points are RM, Where all the nondescript boundaries are unobtrusive on the nature ,Selection from 1/8/2018 to 20/8/2018.

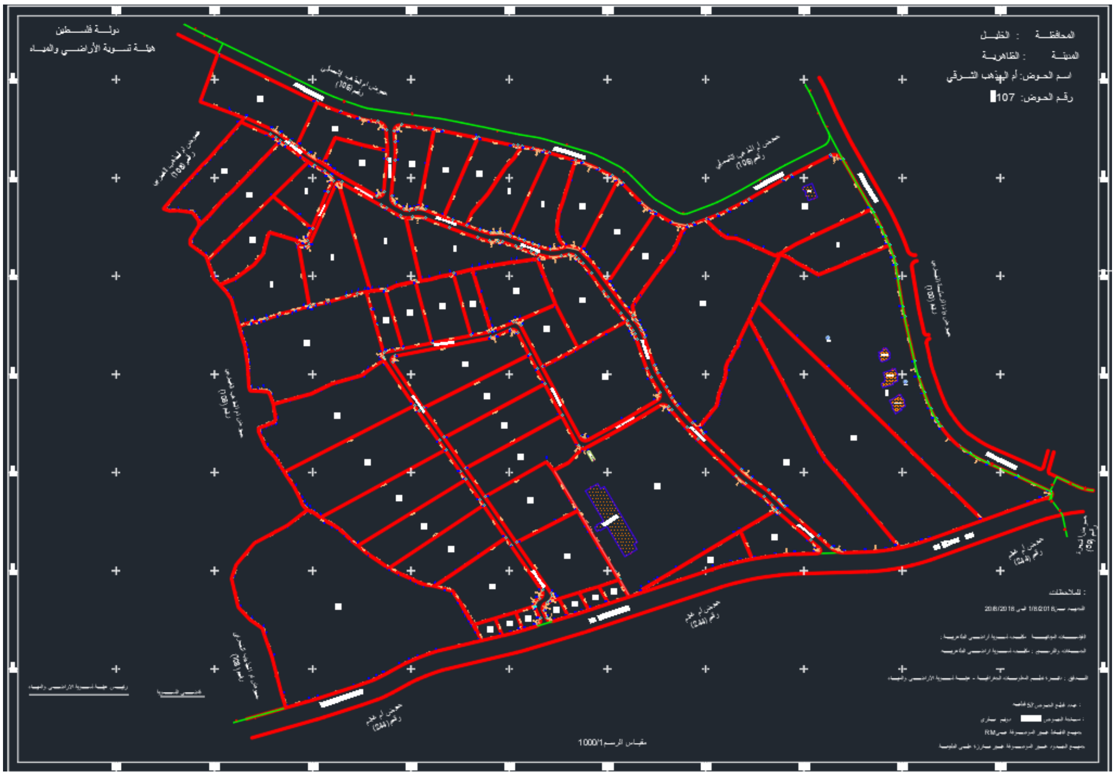


Figure (4- 4) : field survey plan

4.2 Digital Photogrammetry for Land Registration

At simple level, cadastral surveys are concerned with setting out and recording the turningpoints or corners along property boundaries. A variety of techniques may be used, each having its own inherent accuracy and cost. The necessary and sufficient accuracy that is needed for any survey depends on the purposes for which that survey is conducted. Almost all generally known techniques in surveying can be employed for the purpose of cadastral survey. These include both field survey techniques and photogrammetry.

While photogrammetry has been extensively used for topographic mapping, it has contributed less to cadastral surveying. Photogrammetric methods are in the cadastral context, mass production techniques that are only cost-effective if sufficient boundary points or lines need to be measured and also ideally suited to the compilation of base maps and to the recording of physical features of the landscape that are visible from the air. In optimal circumstances, for example where there are rice lands with embankments around their edge, terraced hill lands or land enclosed with well-marked hedges or walls, the photographs may be able to supply all the field detail needed for the cadastre.

On the other hand, the legal boundaries of parcels cannot be determined from the photographs without extensive checking on the ground. Generally more work will be required to supplement the photographs in the case of cadastral maps than in the case of most topographical mapping. In all cadastral surveys undertaken by photogrammetry there is a need for follow-up ground surveys to check the actual location of legal boundaries that may not be visible on the photography or may have been wrongly identified.

In the developing countries, for example, an effective and inexpensive means to create a cadastre is to produce large scale orthophotos and have the neighbors agree on the identified and pricked boundary locations in the images by their signature in the so called "photoadjudication process".

On the contrary, in the case where a wide range of areas are not entirely registered yet or are required to be newly or renewly registered for land information management rather than determining private land ownership. Land registration through the satellite photogrammetric technique could be an alternative solution in cost-effective and the time-saving way.

Although the art of surveying and preparation of maps has been practiced from the ancient times, the methods for demarcating land boundaries have been evolved after the man has develop to sense the land property. The earliest surveys were carried out mainly for the purpose of recording the boundaries of land plots. The spatial component of land including accurate delineations of land boundaries was found to be important for administrators and rulers. This eventually has lead to evolve the cadastral survey. Cadastralsurvey along with its map is basically the parcel based land information showing the demarcation of every parcel boundaries. In addition, it includes land tenure, land use, land value and all other attributes of land which are needed for land administration. Many tools and techniques have been applied in the past in the !eld of cadastral survey from chain surveying to plane table surveying (with plain alidade/telescope alidade). For the last few decades various techniques have been evolved in the cadastral surveys such as digital cadastre using Total Stations and Global Positional Systems(GPS)instruments, digital aerial photography, and cadastral mapping using high resolution satellite images.

After the introduction of photogrammetry in the mapping processes, approaches in cadastral surveys as well have been changed dramatically. Photogrammetry was !rst invented in 1851 by Laussedat, and has continued to develop overthe last 160 years. Over time, the development of photogrammetry has passed through the phases of plane table photogrammetry, analog photogrammetry, analytical photogrammetry, and has now entered the phase of digital photogrammetry (Konecny, 1994). After the development of aeroplanes in the early twentieth century, aerial photogrammetry technique has been applied in the !eld of mapping as well as in cadastral surveying.

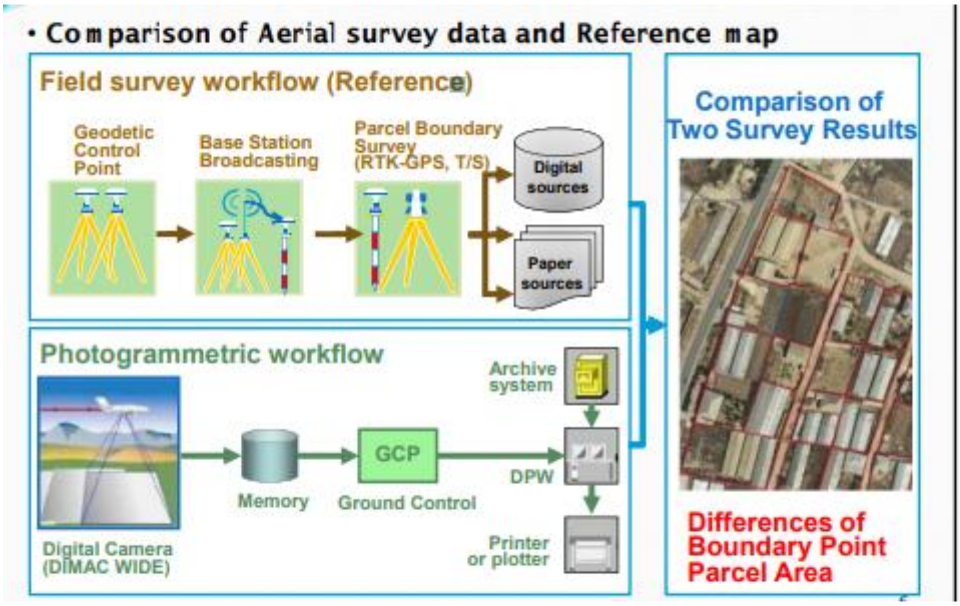


Figure (4-5) :comparison of aerial survey data and reference map

A total process of practical work is basically categorized into 4 stages: Preparation, Image processing, Digital mapping, and Land information management system application as shown in the Figure (4-6).

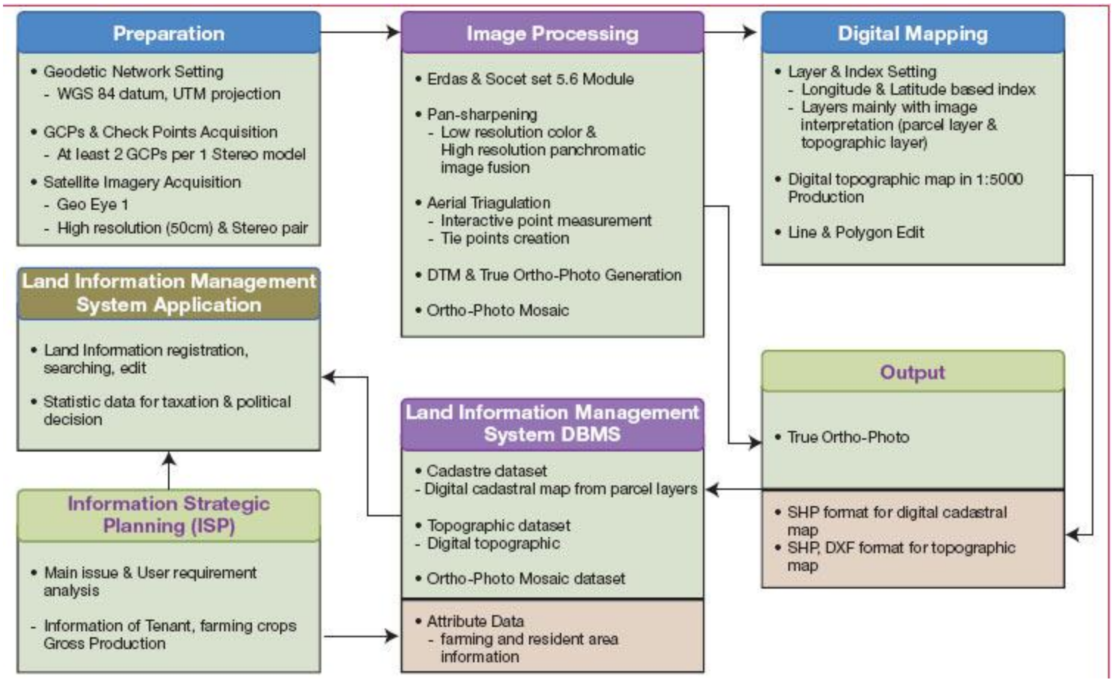


Figure (4-6) : Flow chart of practical work

Cadastral Feature Stereocompilation

As a result of photogrammetric aerial triangulation, exterior orientations of aerial images have been calculated (Xo, Yo, Zo, Omega, Phi, Kapa). Stereo models have been created using these EO values.

In this project the map which stereocompiled every cadastral features in test field defines as a draft cadastral map. Cadastral features, for example, firstly terrestrial structure demarcating the parcel similar to building, streets, trees common fence and wall, hedge.

The details fall below the trees which were come across during the stereo interpretation were completed with field surveys. Missing information for those details also completed such as building name, street type, Acquired text information and survey results have been merged with the map in the edit workstations.

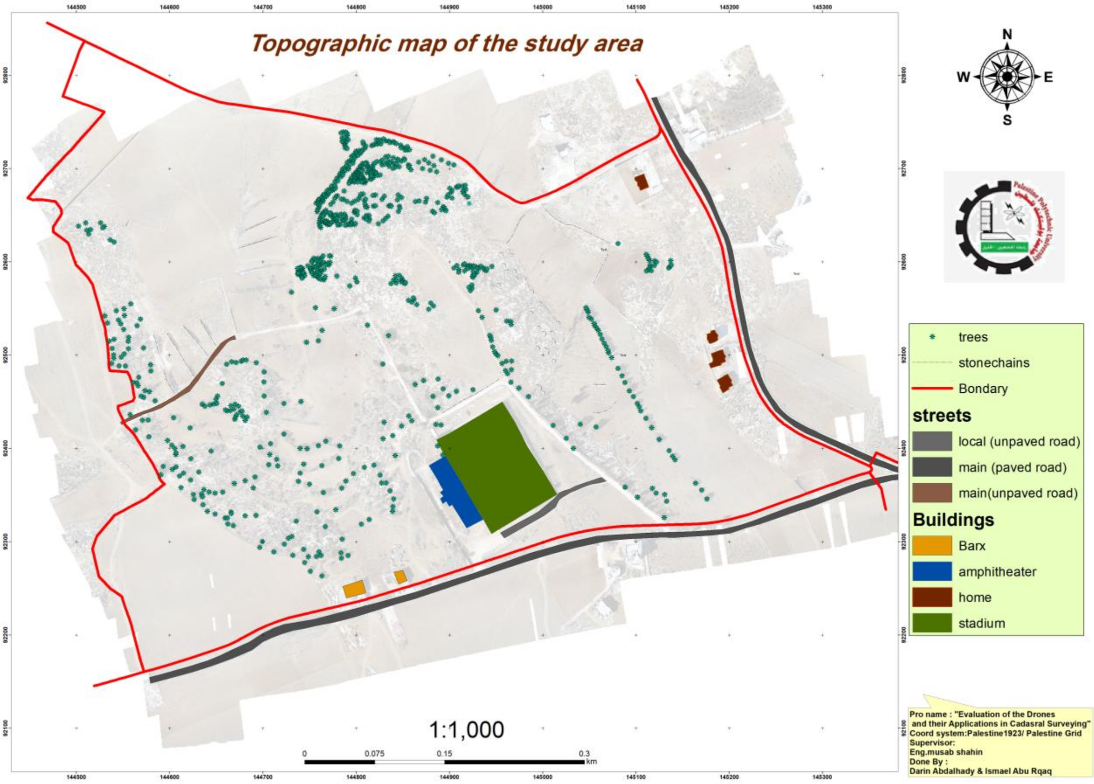
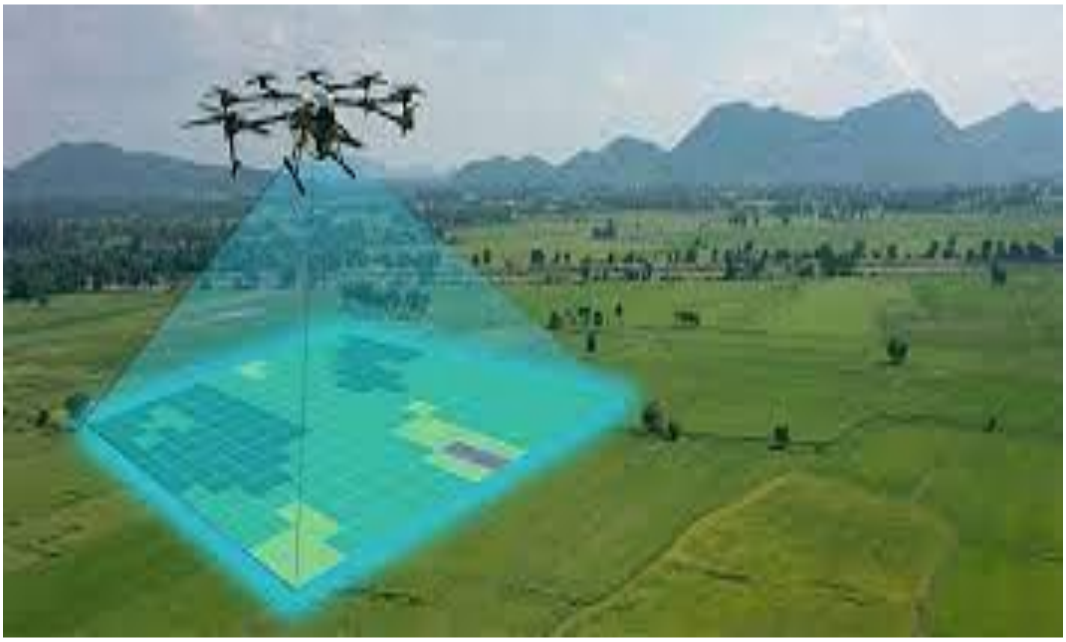


Figure (4-7) : Topographic map of study area

CHAPTER 5

RESULTS AND CONCLUSION



5.1INTRODUCTION

After completing the project and dealing with problems that had been faced during the work on it, it is necessary to summarize the results that were reached and to give some recommendations that will be helpful for students who will work on such projects.

5.2 Results

The following are results that had been reached during the work on this project :

Ground Control Points:

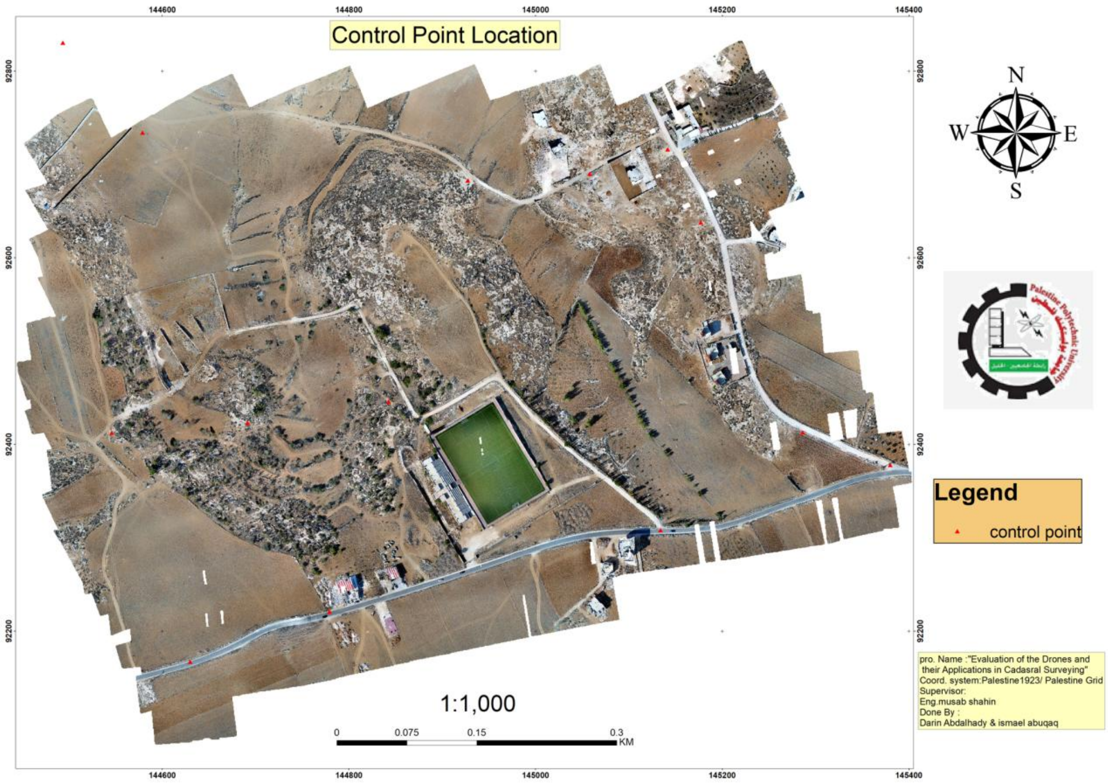


Figure (5-1) : GCP locations and error estimates

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape. Estimated GCP locations are marked with a dot or crossing

Accuracy:

Table(5- 1) : Control points RMSE.

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
1	3.62348	-2.76104	-2.2592	5.08497	3.277 (3)
4	-2.43364	2.07386	-0.652995	3.26342	1.213 (3)
5	-0.517565	0.975141	-0.0662321	1.10597	0.657 (2)
7	-0.928808	-1.41494	-4.92172	5.20463	3.571 (4)
8	1.58051	3.60274	7.75675	8.69741	6.572 (4)
9	2.26528	-0.619398	-2.95	3.77063	3.063 (5)
10					
11	2.61505	3.66458	-0.284272	4.51092	4.159 (4)
3	-2.39161	1.80205	-0.31497	3.01104	0.957 (4)
6	0.463766	-1.20171	-0.343747	1.33318	0.809 (5)
2	-4.30649	-6.16379	2.28963	7.86006	4.046 (4)
Total	**2.4317**	**2.90437**	**3.22751**	**4.97648**	**3.441**

Table(5- 2) : Control points RMSE total.

Count	X error(cm)	Y error(cm)	Z error(cm)	XYerror(cm)	Total (cm)
10	2.4317	2.90437	3.22751	3.78794	4.97648

We used the check points to calculate the difference in coordinates in X ,Y and Z:

Where we made a steak out of the three points on the ground, and after monitoring them, we linked them to the ortho photo. In addition to made PointDance Cloud on the the Agisoft, then creating a surface using the civil 3d program. This is in order to make a comparison between the coordinate values.

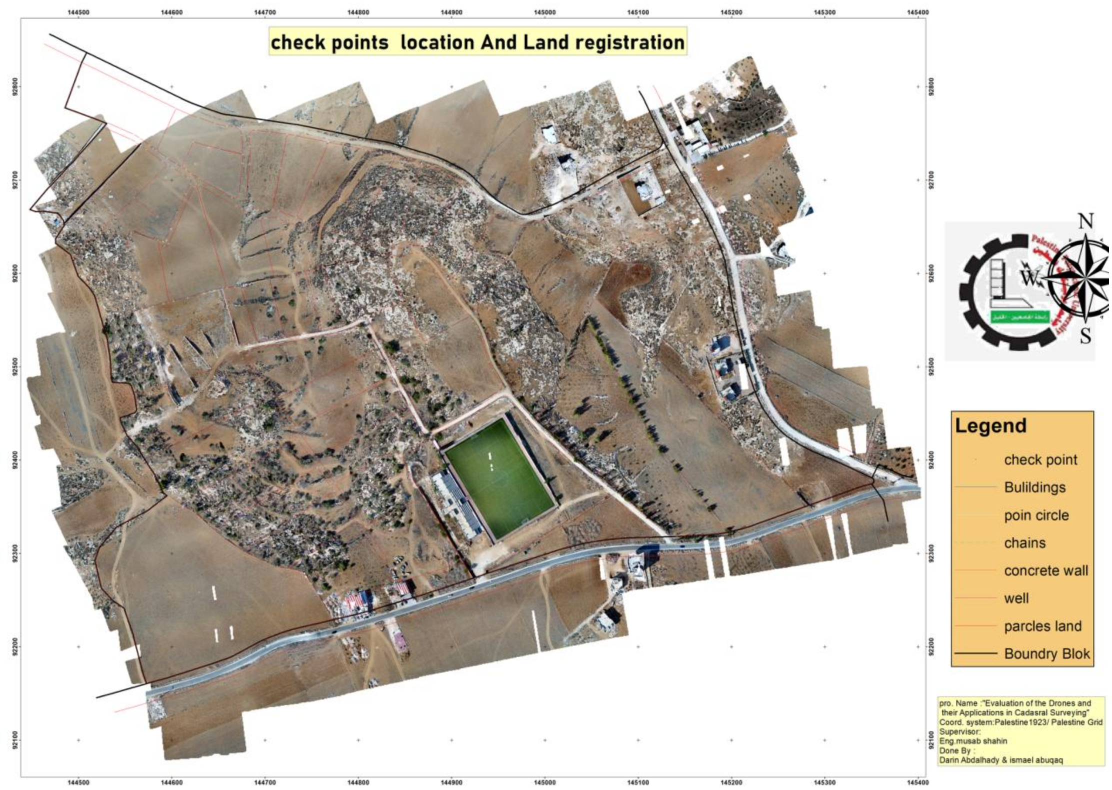


Figure (5-2) : check points location and land registration

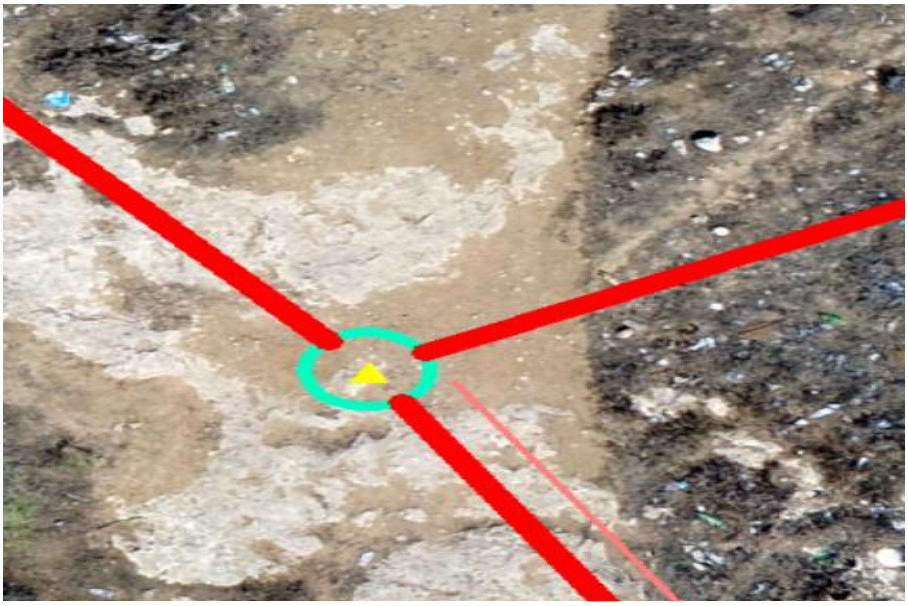


Figure (5-3) : Check points and their locations on the ortho photo

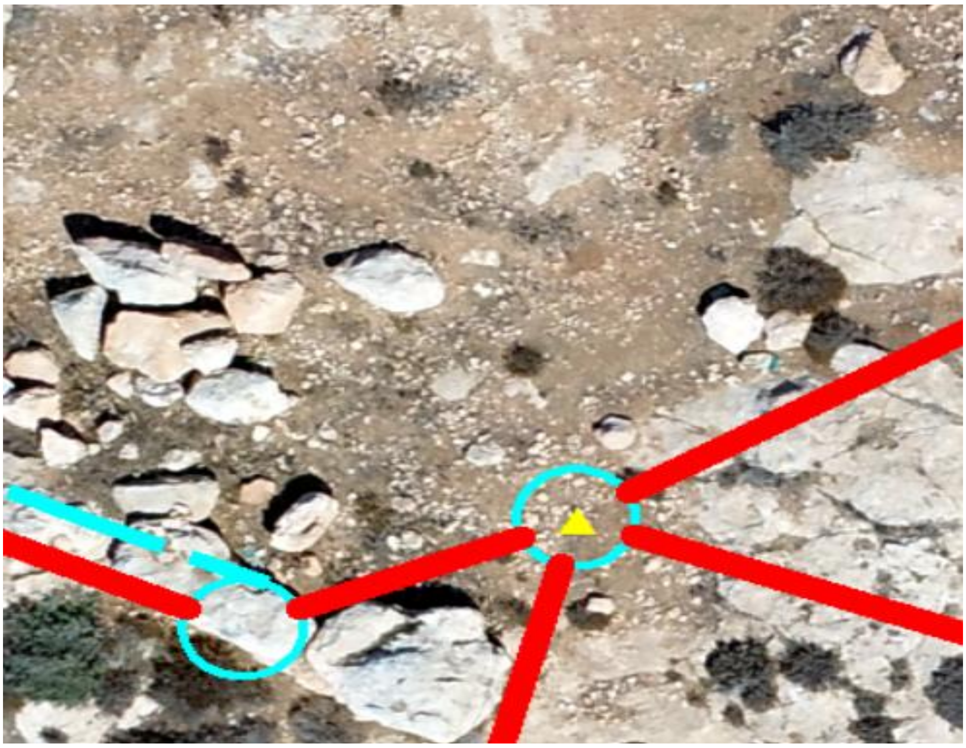


Figure (5-3) : Check points and their locations on the ortho photo

Then we got these results:

Table(5- 3) :. Measured error in X coordinates

Point	X(autocad)	X(monitor)	X(Surface)	dalta S&au	dalta S&M
1	145127.84	145127.86	145127.846	-0.006	0.014
2	145075.118	145075.122	145075.15	-0.032	-0.028
3	144845.067	144845.076	144845.032	0.035	0.044

RMSE in X : 0.012

Note:

X(autocad): From the settlement plane for the area.

X(monitor): From Monitoring using GPS.

X(surface): Y(surface): Coordinates from the surface that was built from the DenisPoint Cloud from Agisoft.

dalta S&au: The difference between surface and AutoCAD coordinates.

dalta S&M: The difference between surface and montoring coordinates.

Table(5- 4) :. Measured error in Y coordinates

point	Y(autocad_	Y(monitor)	Y(Surface)	dalta S&au	dalta S&M
1	92649.35	92649.3	92649.335	0.016	-0.035
2	92622.41	92622.355	92622.369	0.036	-0.014
3	92402.11	92402.052	92402.103	0.007	-0.051

RMSE in Y : -0.03

Note:

Y(autocad): From the settlement plane for the area.

Y(monitor): From Monitoring using GPS.

Y(surface): Coordinates from the surface that was built from the DenisPoint Cloud from Agisoft.

dalta S&au: The difference between surface and AutoCAD coordinates.

dalta S&M: The difference between surface and montoring coordinates.

After building the Point Dens Cloud ,

1-Creating points on the surface of the Dens Point Cloud,

2-then we exported the points from the Aggie Soft,

3-then inserted them on the CIVIL 3D and then built the surface

4-then made a contour network for the area To calculate the difference in Z coordinates:

Table(5- 5) :. Measured error in Z coordinates

Zs	Zm	dalta S&M
628.12	628.52	-0.4
617.751	617.11	0.641
627.3	627.72	-0.42
622.512	622.22	0.292
623.732	623.54	0.192
616.47	616.63	-0.16
607.32	607.88	-0.56
620.02	619.55	0.47
620.961	620.47	0.491
616.84	616.72	0.12
605.45	605.57	-0.12

RMSE in Z : 0.049636

Therefore, from these results, ortho can be used to make a contour map and use it in designing roads and calculating quantities

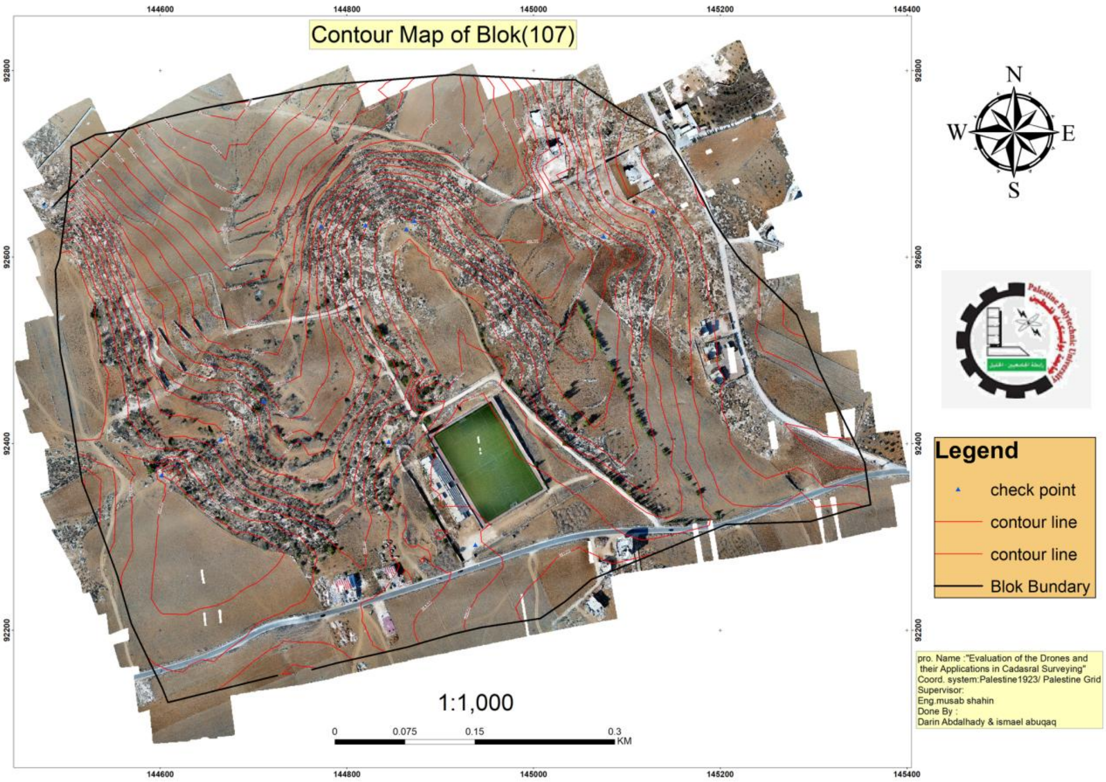


Figure (5-4) : Contour network for the study area

Digital Elevation Model:

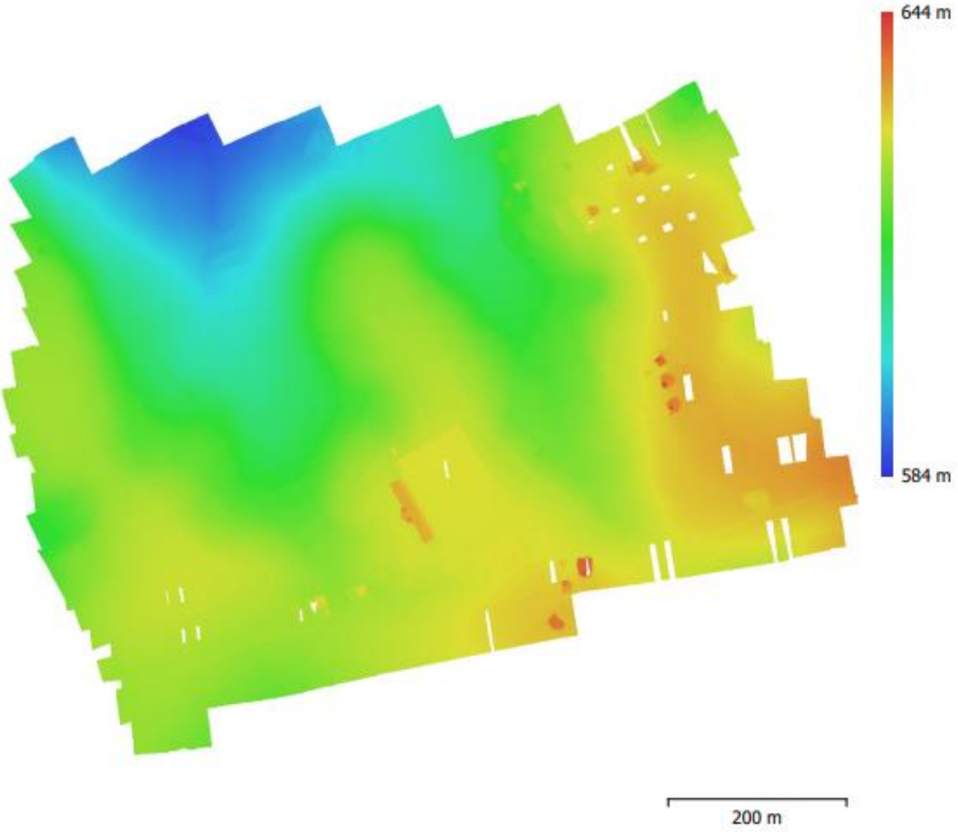


Figure (5-5) : Reconstructed digital elevation model.

Table(5- 6) : Digital Elevation Model:Parameters:

Resolution:	67.8 cm/pix
Point density	2.17 points/m²

DEM

Table(5- 7) : DEM parameters

Size	1,991 x 1,453
Coordinate system	Palestine1923/ Palestine Grid (EPSG::28191)
Source data	Sparse cloud
Interpolation	Enabled
Processing time	19 seconds
Memory usage	93.99 MB
Date created	2021:12:07 08:33:35
Software version	1.7.6.13315
File size	4.31 MB

5.3 Conclusion

This project describes identification of land parcel boundaries using digital photogrammetric method. Then parcel boundary can be extracted by on Digital Photogrammetric Workstation (DPW) as through line map compilation procedure. For the comparison of photogrammetric result with field survey.

Through this project, we reached the following conclusion:

1-we can identificat of land parcel boundaries using digital photogrammetric method Where we get an accuracy of 2 cm.

2- It is possible to make digitizising for buildings with high accuracy and higher than the accuracy of the GPS because the GPS does not work near the buildings and their accuracy worsens near buildings, bridges, and trees..

3- Digital photogrammetric can be used to check settlement work and check borders.

4- We were able to obtain the elevations that can be used in the design of roads or contour networks.

5.4 Recommendations

This project has an important role in expanding the understanding of Survey projects and works Defining boundaries and lands settlement. So after completing this project, some recommendations should be mentioned that may help students who will work on such projects after us,To achieve the best accuracy.

1- Photographing the area in one stage only
2- Choose a suitable flight altitude.
3- Distribution of control points to cover all study area.
4- When monitoring check points to determine the two-dimensional accuracy (x,y), points that can be determined with high accuracy are monitored on Othrophoto, such as settlement monitoring points (AI or RC).
5- When monitoring points to check the accuracy of heights, the points are monitored on flat areas to obtain the required accuracy.
6- When making a surface, it is preferable to make it from ortho, because it takes all points without exception, unlike the ground survey plane, which can not include all areas.

References:

1-DeWitt, B., Wolf, P., & Wilkinson,. Elements of Photogrammetry with Application in GIS. October 22, 2013.

2-Minchin, M.. In troduction to Surveying. 2003.

3-(wingtra.com/drone-mapping-applications/surveying-gis)

4-(lwsc.ps/index.php)

5- Ahn, K., & Song, Y.. Digital Photogrammetry for Land Registration in Developing Countries. Marrakech, Morocco. (18-22 May 2011)

ANAXES:

Agisoft Results

The following is an analysis done using Agisoft.

Survey Data:

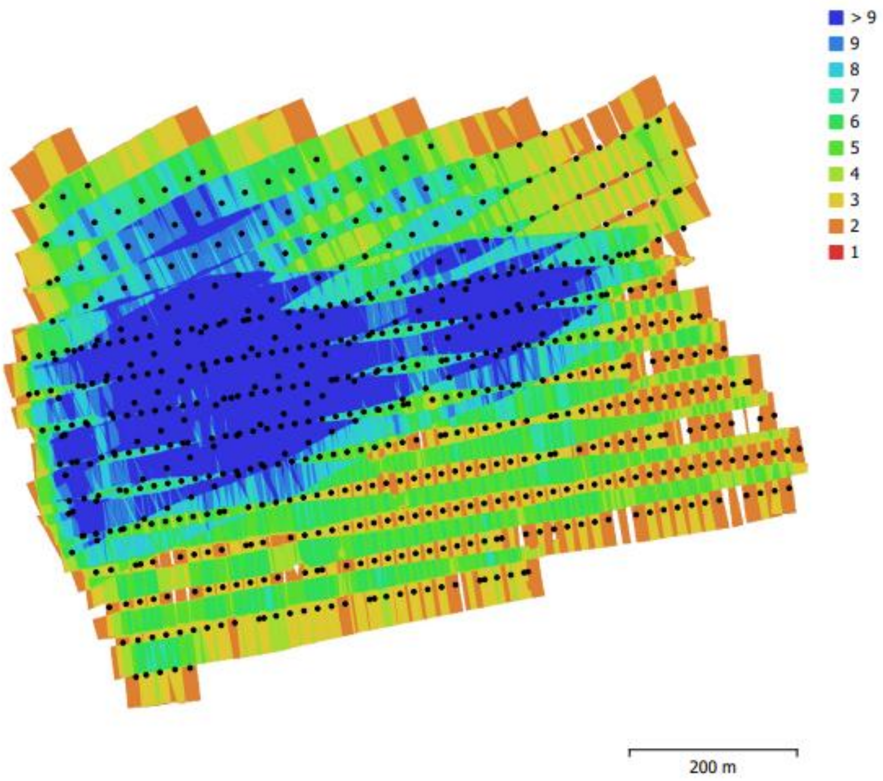


Figure (5-4) : Camera locations and image overlap.

Table(5- 8) : Cameras.

Number of images	615
Flying altitude	59.3 m
Ground resolution	1.75 cm/pix
Coverage area	0.49 km²
Camera stations	614
Tie points	774,860
Projections	2,463,424
Reprojection error	0.466 pix
Camera model	FC6310(8.8mm)
Resolution	5472*3648
Focal length	8.8mm
Pixel size	2.41 *2.41 mecro metar
Precalibrated	No

Camera Calibration:

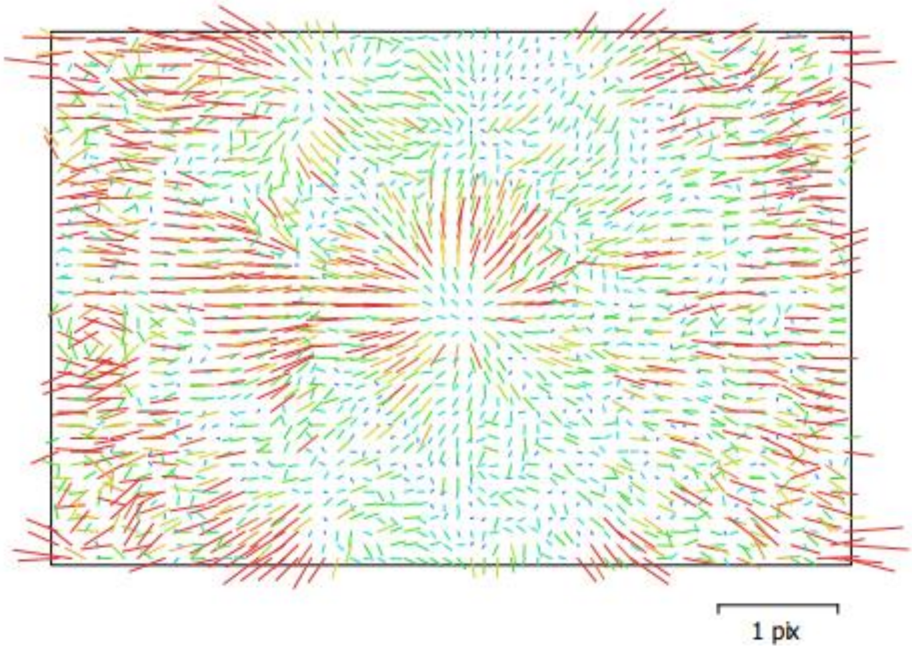


Figure (5-5) : Image residuals for FC6310 (8.8mm).

Table(5-9) : Calibration coefficients and correlation matrix.

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
F	3383.55	1.1	1.00	0.27	0.67	0.13	-0.21	0.32	-0.15	0.00
Cx	-17.5051	0.032		1.00	0.19	0.04	-0.06	0.09	0.31	0.02
Cy	9.03775	0.039			1.00	0.09	-0.15	0.22	-0.10	0.29
K1	0.00298986	1.8e-05				1.00	-0.96	0.90	-0.03	-0.00
K2	-0.00594859	4.4e-05					1.00	-0.98	0.05	0.00
K3	0.00460227	3.3e-05						1.00	-0.06	-0.00
P1	-0.000758557	1.5e-06							1.00	0.02
P2	-5.14271e-05	1.6e-06								1.00

Camera Locations:

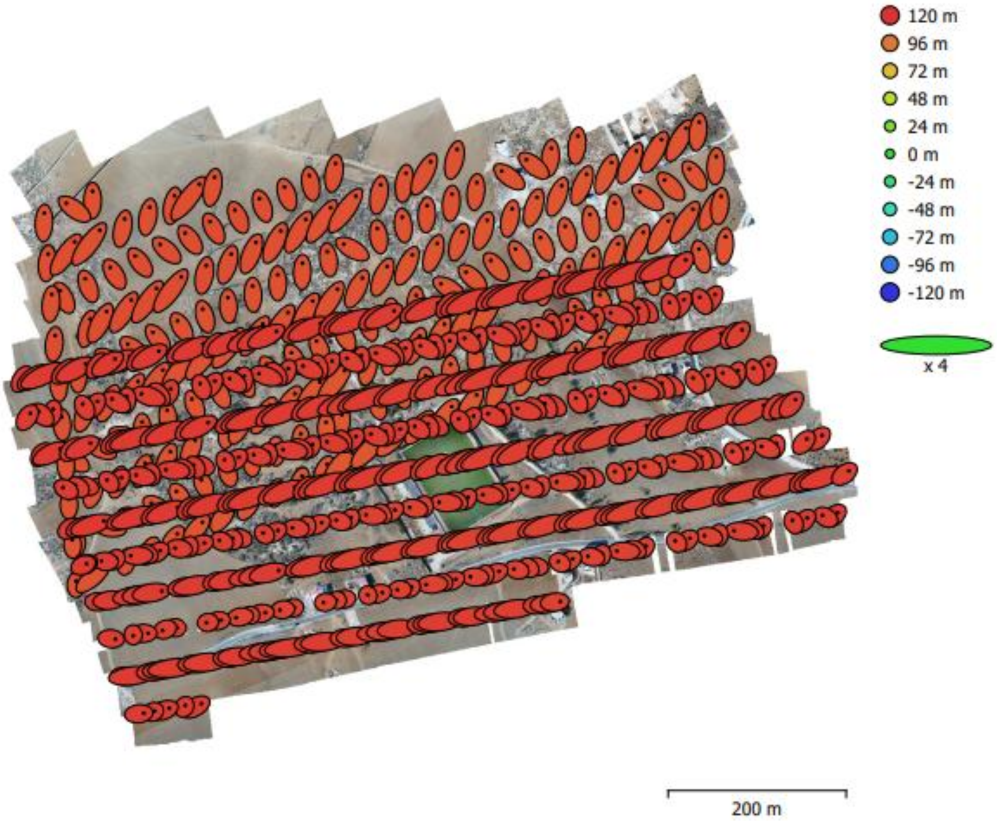


Figure (5-6) : Camera locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
Estimated camera locations are marked with a black dot.

Table(5- 10) : Average camera location error

X error (m)	Y error (m)	Z error (m)	Total error (m)
3.91261	3.3306	113.847	113.962

.

NOTE : X - Easting, Y - Northing, Z – Altitude

General

Table(5- 11) :General Processing Parameters:

Cameras	615
Aligned cameras	614
Markers	11
Point	67
Coordinate system	Palestine1923/ Palestine Grid (EPSG::28191)
Rotation angles	Yaw, Pitch, Roll

Table(5- 12) : Point Cloud Parameters:

Points	774,860 of 804,509
RMS reprojection error	0.182954 (0.465597 pix)
Max reprojection error	0.556566 (28.8373 pix)
Mean key point size	2.41612 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	3.23016

Alignment

Table(5-13) :Alignment parameters

Accuracy	High
Generic preselection	Yes
Reference preselection	Source
Key point limit	40,000
Key point limit per Mpx	1,000
Tie point limit	4,000
Exclude stationary tie points	Yes
Guided image matching	No
Adaptive camera model fitting	No
Matching time	1 hours 27 minutes
Matching memory usage	608.32 MB
Alignment time	9 minutes 23 seconds
Alignment memory usage	265.36 MB
Date created	2021:12:02 09:43:20
File size	59.77 MB
Depth Maps Count	614

Depth maps generation

Table(5-14) : Depth maps generation parameters

Quality	High
Filtering mode	Mild
Max neighbors	40
Processing time	13 hours 37 minutes
Memory usage	4.69 GB
Date created	2021:12:06 09:06:54
Software version	1.7.6.13315
File size	24.79 MB
Texture	3 bands, uint8

Reconstruction

Table(5-15) : Reconstruction parameters

Source data	Depth maps
Tile size	256
Face count	High
Enable ghosting filter	No
Processing time	1 hours 53 minutes
Memory usage	1.68 GB
Date created	2021:12:06 11:00:31
Software version	1.7.6.13315
File size	1.04

Orthomosaic

Table(5- 16) : Orthomosaic parameters

Size	54,713 x 43,027
Coordinate system	Palestine1923 /Palestine Grid (EPSG::28191)
Colors	3 bands, uint8
Blending mode	Mosaic
Surface	DEM
Enable hole filling	Yes
Enable ghosting filter	No
Processing time	49 minutes 2 seconds
Memory usage	3.82 GB
Date created	2021:12:07 09:12:04
Software version	1.7.6.13315
File size	13.86 GB

System

Table(5- 17) : SYSTEM parameters

Software name	Agisoft Metashape Professional
Software version	1.7.6 build 13315
OS Windows	64 bit

RAM	7.88 GB
CPU	Intel(R) Core(TM) i7-8565U CPU @ 1.80GHz
GPU(s)	Radeon (TM) 520 (Hainan)