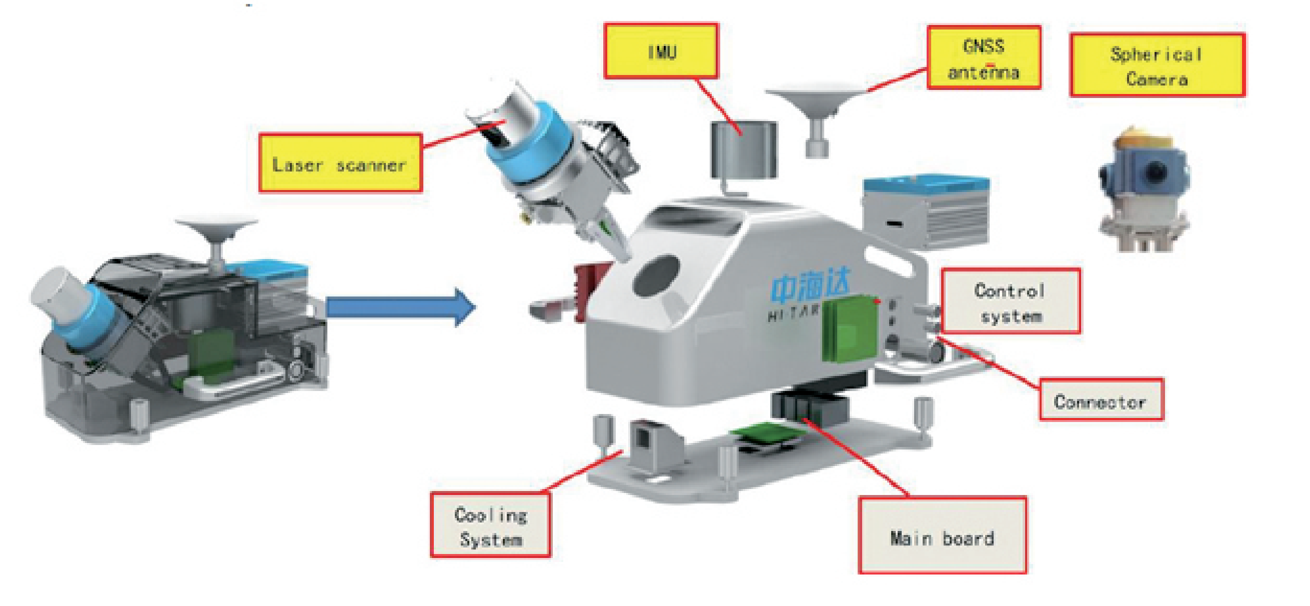
MAPS TODAY

Title-Code:-TELENG00772

This title has been verified by Registrar of Newspapers India, in terms of the provision to Section 6 of the PRB ACT 1867

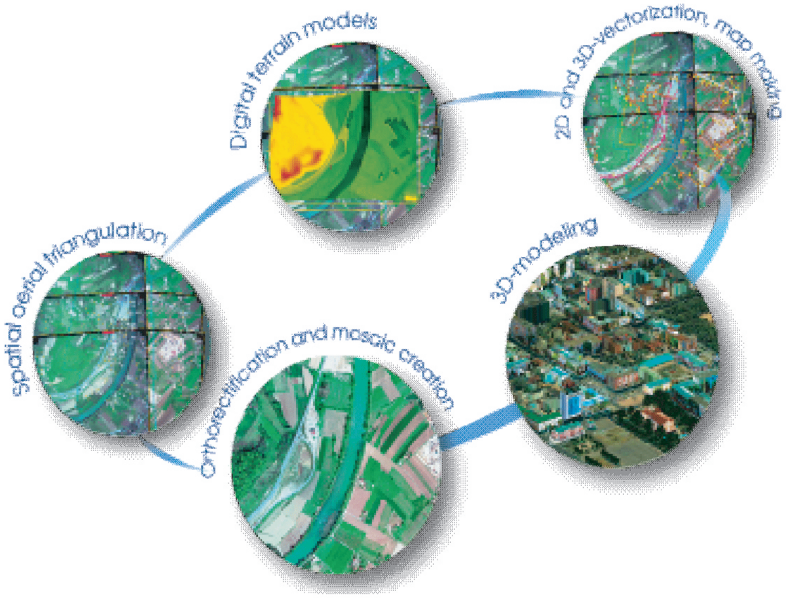
Volume 2 Issue 1 January - February 2020 Price Rs150

Mobile Mapping System (Details on page 15.)



Overview

RACURS, Russia



The PHOTOMOD software family comprises a wide range of products for the remote sensing data photogrammetric processing. This state-of-the-art software allows the extraction of geometrically accurate spatial information from almost all commercially available types of imagery, whether obtained by film or digital cameras, UAS, high resolution satellite scanners.

PHOTOMOD's flexible modular architecture and powerful import/export tools permit a variety of configurations: **Complete Digital Photogrammetric Workstation** (standalone configuration), high productivity distributed network environment for accomplishing large projects, complementary workplaces that can be used along with third-party systems to increase the overall productivity during the most time-consuming and labor-intensive operations like feature extraction and DTM creation.

Today PHOTOMOD is the most popular digital photogrammetric software in Russia and is also used in 70 countries all over the world. PHOTOMOD is the only digital photogrammetric system with the Russian Federation Ministry of Defense certificate and also the main digital photogrammetric software for the Federal Space agency of the Russian Federation (ROSCOSMOS) and Russian Federal Service for State Registration, Cadastre and Cartography (ROSREESTR)

General questions: info@racurs.ru

MAPS TODAY

January - February 2020

Publisher's address
6-3-1117, 602, Maruthi Sadan Apartments, Begumpet, Hyderabad-500 016, Telangana, INDIA
Tel: +91-40-66667776 Tel. & Fax: +91-40-66667333 E-mail: mapstodaygis@gmail.com / www.geopediasociety.com

CONTENT

***Institutional Subscription Rates for* MAPS TODAY**

(w.e.f 1 September 2019)

Period	Actual rate	Special rate
2 Years (12 issues)	Rs. 1200/-	Rs. 1100/-
4 Years (24 issues)	**Rs. 2200/-**	**Rs. 2100/-**

"Individual subscription is 50 % of the above rates"

Account Name: **Maps Today**
Account No. **3332500101669501**
Bank Name: **Karnataka Bank Ltd**
Branch: Umanagar, Hyderabad - 500018
IFSC: **KARB0000333**
MICR Code: **500052008**
For any more information please email to : mapstodaygis@gmail.com
Amount may also be sent by Cheque / Draft in favour of Maps Today payable at any Bank in Hyderabad
Maps Today, 6-3-1117, 602,
Maruthi Sadan Apartments,
Keertilal Jewellers Lane,
Begumpet, Hyderabad-500 016,
Telangana, INDIA

Editorial

Unmanned Aerial Vehicles have emerged as popular, efficient and economical platforms for capturing 3D spatial data, particularly for small areas. India Leads in Import of Unmanned Aerial Vehicles having imported 180 since 1998.Read six abstracts included in this issue. An abstract is about Optimising drone flight planning for better efficiency. One more review article on the subject also is included. In short focus is on 3D image based surveying and mapping

Read the article on GIS trends and online GIS courses. Information about 3D scanners indicates the trend of developing 3D outputs. Several agencies are offering 3D imagery data using satellite imgery.One such news item about 3D imagery with accuracy of 1:25,000 scale is included.

News items include use of GIS by Telangana Police for crime, traffic etc.

Property transactions Information in Spain is continuously exchanged electronically between citizens, professionals and the various institutions involved, enabling access to up-to-date information and minimize litigations. Read about this and question the government in India why ownership details are not updated when registration takes place with high stamp duty.

Await news on programmes on National Survey Day on 10 April 2020 in India.

One Page Calendar 2020

Dates					JUNE	SEP DEC	JAN APR JULY	OCT	MAY	FRB AUG	MAR NOV
1	8	15	22	29	Mon	Tue	Wed	Thu	Fri	Sat	Sun
2	9	16	23	30	Tue	Wed	Thu	Fri	Sat	Sun	Mon
3	10	17	24	31	Wed	Thu	Fri	Sat	Sun	Mon	Tue
4	11	18	25		Thu	Fri	Sat	Sun	Mon	Tue	Wed
5	12	19	26		Fri	Sat	Sun	Mon	Tue	Wed	Thu
6	13	20	27		Sat	Sun	Mon	Tue	Wed	Thu	Fri
7	14	21	28		Sun	Mon	Tue	Wed	Thu	Fri	Sat

Views of the authors of articles may not be shared by editors and members of Maps Today.

Declaration:

Printed by Maj Dr G. Shiva Kiran
Published by Maj Dr G. Shiva Kiran on behalf of Geo Map Society
Printed at 6-3-1117, 602, Maruthi Sadan Apartments, Keertilal Jewellers Lane,Begumpet, Hyderabad-500 016, Telangana, INDIA
Published from 6-3-1117, 602, Maruthi Sadan Apartments, Keertilal Jewellers Lane,Begumpet, Hyderabad-500 016, Telangana, INDIA

---- *Editor* ***G.S. Kumar***

Top GIS Technologies in 2020 & Beyond

December 16, 2019

Geographic Information Science and Technology (GIST) includes a versatile range of tools and techniques for capturing, analyzing and leveraging spatial information. With each passing year, advances in Geographic Information Systems (GIS) reveal exciting possibilities for urban planning, retail, space exploration, and more. Experts make the most of these opportunities by staying up to date as new ways of optimizing and employing GIS technology emerge.

With extensive locational data, government agencies and private businesses can deliver services more efficiently and strategize sustainable development

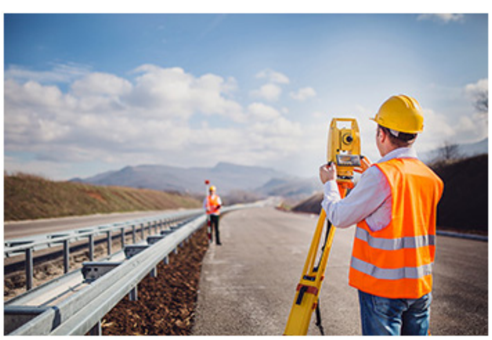
By implementing robust GIS software applications, professionals can capture and visualize valuable geospatial intelligence. That's why it's vital for GIST experts to possess the combination of theoretical knowledge and hands-on training

Here are some of the ways GIS technology is used to meet complex challenges, including a preview of some of the fascinating changes ahead:

Open Source GIS Mapping Software Empowers Innovation

Open-source GIS mapping software gives users access to powerful tools for creating maps and adding elements such as text, images and video. Particularly in conjunction with initiatives such as OpenStreetMap or the Open Geospatial Data Project, these applications offer endless possibilities for collecting and visualizing spatial information and customizing maps.

Users create projects to:



- Highlight the demographics of a region
- Trace the availability of natural resources over time
- Chart crop growth and capture any evidence of disease
- Demonstrate how changes in environmental conditions affect the preservation of a historical site

The flexibility to assemble maps for diverse purposes has a growing impact in daily life, influencing progress in smart city infrastructure. With extensive locational data, government agencies and private businesses can deliver services more efficiently and strategize sustainable development. Customized maps may be applied to augmented reality projects that provide workers with helpful details tied to a specific location.

Meanwhile, open-source mapping has a huge role in the burgeoning world of navigation systems and automated vehicles. When setting routes, these systems account for a widening range of factors, such as traffic conditions updated in real time and individual preferences. GIS is essential to improving performance in self-driving cars and guiding drivers to their destinations as quickly, comfortably and safely as possible

Fresh Insights From Geospatial Analytics

The rise of big data and analytics has been one of the most significant shifts for businesses over recent years. Across industries, organizations are constantly seeking chances to turn an ever-increasing volume of data into a competitive edge, and many have found that GIST adds value to these efforts. Geospatial analytics applies geographic information to enable wiser decision-making and agile problem solving.

With GIS data, analytics specialists can create visualizations, identify meaningful trends and make predictions, generating reports that flush out valuable context for strategy. Decision-makers gain increased visibility from synthesizing spatial information with findings from enterprise resource planning (ERP) systems. They can clearly see how crucial data about their organizations is attached to specific times and places.

Geospatial analytics clarifies complicated relationships and points out ways to streamline processes. Businesses and government agencies can:

- Make more informed choices about building or expanding facilities and stores
- Track when devices and equipment with Internet of Things (IoT) sensors enter or leave a work area
- Create apps for retail customers that enrich their in-store experiences (e.g. retail beacon technology)
- Speed up logistics and reduce costs by running various routing scenarios
- Find patterns of criminal activity within a region
- Minimize risks from hazardous location-based events like powerful storms

UAVs thus have a major role to play in making geographic information more readily available for open-source mapping and customizable to fit the priorities of businesses, governments, independent researchers and hobbyists

Bringing Together GIS and Drones

Organizations and consumers employ unmanned aerial vehicles (UAVs) for an ever-expanding list of applications, from entertainment to agriculture, often relying on navigation supported by GIS. For instance, experiments with making deliveries by drone have unlocked possibilities for getting food and other products to customers with unprecedented speed. Other companies are deploying the aircraft to collect information from IoT sensors that monitor industrial sites, hazardous travel conditions, volatile weather patterns or the wellbeing of crops and send real-time updates.

Meanwhile, drones also improve the information that is available for mapping and manipulation with GIS tools. A great deal of spatial data comes from satellite imagery and readings taken by manned aircraft, but drones are a cost-effective means of gathering extensive details on a smaller scale. UAVs thus have a major role to play in making geographic information more readily available for open-source mapping and customizable to fit the priorities of businesses, governments, independent researchers and hobbyists.▪

What's Next For GIST?

For professionals with expertise in spatial technology and problem solving, the future looks rich in possibilities. In the years ahead, GIST will likely become an even more prevalent aspect of our daily lives, thanks in large part to the widespread adoption of smart technology and the IoT. As sensors capable of sharing spatial-temporal information appear everywhere from industrial equipment to coffeemakers, the volume of spatial data will grow exponentially.

Meanwhile, consumers and businesses will demand greater functionality and integration from spatial software applications. Ride sharing services and navigation apps have shown the public the power of apps that work with GPS and mapping platforms to give them real-time updates. These types of features could have growing uses for enterprises and governments as well when harnessed for purposes such as tracking assets and growing the reach of marketing campaigns.

The proliferation of spatial data and market for software means organizations will have a mounting need for professionals familiar with every layer of the GIS Technology stack. Data specialists will need to optimize their processes for collecting, cleaning and formatting spatial information. GIS software developers must also understand the full scope of the data resources they have available for creating spatial-powered apps to put that information to work.

About USC's Online GIS Graduate Programs

The University of Southern California offers a comprehensive selection of online GIS programs, including GIST master's degrees and graduate certificates. This gives our students the ultimate flexibility in tailoring their education for their career goals. Click on the programs below to learn about our leading geographic information science education.

Online GIS Master's Degrees

- Master of Science in Geographic Information Science and Technology
- Master of Science in Human Security and Geospatial Intelligence

Online GIS Graduate Certificates

- Graduate Certificate in Geographic Information Science and Technology
- Graduate Certificate in Geospatial Intelligence
- Graduate Certificate in Geospatial Leadership
- Graduate Certificate in Remote Sensing for Earth Observation

REQUEST BROCHURE

Download a free brochure. If you have any additional questions, please call **877-650-9054** to speak to an enrollment advisor.

UAV based mapping applications

1. Accuracy Assessment of Low Cost UAV Based City Modelling for Urban Planning

https://www.researchgate.net/journal/1330-3651_Tehnicki_Vjesnik; · December 2018

Ramazan Cuneyt ErenogluOya; Çanakkale Onsekiz Mart Üniversitesi[Niyazi Arslan[Cukurova University

E-mail: o_turkdonmez@comu.edu.tr; narslan@cu.edu.tr

In the field of spatial data, particularly in urban areas, collecting of 3D geographical data in real-time has become critical. For example, monitoring built-up areas, updating development plan and detecting illegal buildings can be performed using the feature extraction from the UAV based produced 3D model

The unmanned aerial vehicle has emerged as a cheaper alternative to conventional aerial carrier platform

As the main method of data capture for topographical surveying and boundary mapping, UAV photogrammetry can especially replace GPS/GNSS surveying. Aerial images taken on UAV and using low cost software can be used to produce accuracy of photogrammetric products for most of the engineering purposes. In short, ground-based photogrammetry is useful especially for extracting geometric details of the buildings.

The unmanned aerial vehicle has emerged as a cheaper alternative to conventional aerial carrier platform. The proposed procedure can be summarized as follows: (a) Camera calibration scheme (b) UAV-based data acquisition (c) UAV imagery triangulation (d) Production of the data cloud (e) Integration of UAV point data to GPS/GNSS geo-reference and adjust the point cloud data (f) Modelling of DTM (g) Texturing model from aerial imagery (h) Quality control using GPS/GNSS, CORS and terrestrial surveys.

A brief summary of the used platform and other equipment is given below:

- UAV: Mikrocopter Octocopter XL 8 multi-rotor control platform with gyroscope and GNSS antenna, MK3538 - black brushless motors, IR camera trigger, MK SLR2 camera gimbal, video transmission system.
- Sensor System: Canon EOS-M Mirrorless Digital Camera, 18.0 megapixels, CMOS sensor (22.3 × 14.9 mm), 18-55 mm lens, time lapse software.
- GPS/GNSS Receiver: Satlab SL500 dual-frequency instrument has a manufacturer's stated accuracy specification of ±1 cm +1 ppm RMS horizontal, and ±2 cm + 1 ppm RMS vertical.
- Total station: Kolida KTS-442 RLC

Camera calibration is also important as it provides information about the used camera that improves accuracy for the modelling studies. It is a process of determining the characteristics of a camera so it can be used as a measurement device. This determination needs to be created only once and it is used for consecutive project. For this study, the calibration of the Canon EOS-M digital camera was performed using AgisoftPhotoscan in camera calibration module based on several images of a calibration grid. The calibration status report was obtained, and inserted in the software. A major effort was devoted towards setting up a pilot project with the aim to collect very high resolution aerial imagery over the Canakkale Onsekiz Mart University (COMU) campus area, Canakkale, NW Turkey (2015)

The location of all the points was selected to appear in aerial images.

For a successful flight operation, it is very critical to be aware of potential problems on UAV. For safe flight, the GPS onboard, rudder, elevator and main frame, digital camera, camera mount, propeller, electronic speed controller and remote controller should be checked before the flight. A suitable location is provided for launching operation after all tests have been performed. For flight planning step, the working area and suitable locations for starting and landing were chosen. The distance between 4 parallel neighbouring flight lines was planned with 40 m which equates strip and across-strip overlaps of about 80% and 60%, respectively. Note that the autonomous flight mission was preferred to capture images by digital camera in this study. The flying duration was approximately 18 minutes.

Note that operational time depends on additional loading weights and the weather conditions.

For the modelling area (400 × 500 m), 152 images were taken at a flying height of 100 metre in total with a pixel size of 2.3 cm depending on the flying height and the size of mapping area. The processing of UAV images has had its own challenges in the last decade. Inertial Measurement Unit (IMU) and Ground Control Points

(GCP) are required as input to obtain processed UAV images. Precise time-tagging of the camera shutter precisely within the GPS time-scale is the prerequisite for annotating the acquired imagery with the position and attitude information derived from the on-board GPS/ GNSS and Inertial Measurement Unit (IMU). After calibration, this allows to use the direct sensor orientation in the processing

For ground control points during the field campaign, the targeted ground control points were established to align 3D models and to control the UAV photogrammetry. The location of all the points was selected to appear in aerial images. The GNSS receivers were utilized to position at the centre of the targets, and 30 ground control points were surveyed terrestrially by RTK GPS/GNSS and CORS surveys for the global referencing in WGS84. For each GCP, 10 observation epochs were collected and the average value of 10 epochs was recorded as the surveyed coordinate of the related GCP. Consequently, the achievable accuracy was realized as a few centimetres for the GCP coordinates. Note that the corrections of the VRS approach were considered for the CORS surveys. As a rover antenna, the SATLAB SL 500 type GNSS receiver was used. The correction of rover receiver was sent via GSM. This large number of points will provide a redundant registration in the processing software. The UAV images were processed using gisoftPhotoscan Professional Software in order to produce 3D digital terrain model. This software uses a combination of Structure-from-Motion (SfM) and Multi-View-Stereo (MVS). It is a computer vision technique that automatically constructs 3D models using images. The GCPs were flagged to each image and the images were aligned in an absolute 3D space. The result is a reconstruction of the image and all matched feature points are accurately positioned in the 3D coordinate system.

The 3D mesh and triangular models were constructed by the triangulation of the point cloud. For 3D model, the mean values of the errors in X components between RTK/ GNSS and CORS surveys are “0.0050 m and “0.0055 m, respectively. The mean values of the errors in Y components between RTK/GNSS and CORS surveys are “0.0004 m and “0.0053 m, respectively

The evaluation of the dataset proved that the variations were a few centimetres for horizontal components, and were up to 9 centimetres for the height component. In such a case, it verifies that both the horizontal and height coordinates of the total station have higher accuracy than UAV-assisted 3D model.

The total cost of the experiments is approximately 2,500 USD

2. Unmanned aerial vehicle in cadastral applications

Madeleine Manyoky Sep 2012

..............the required level of accuracy for cadastral surveying was reached. The advantage of UAV systems lies in their high flexibility and efficiency in capturing the surface of an area from a low flight altitude. In addition, further information such as orthoimages, elevation models and 3D objects can easily be gained from UAV images. Altogether, this project endorses the benefit of using UAVs in cadastral applications and the new opportunities they provide for cadastral surveying. Altogether, this project endorses the benefit of using UAVs in cadastral applications and the new opportunities they provide for cadastral surveying.

Disaster monitoring and management by the unmanned aerial vehicle technology

Tien-Yin Chou; M.-L. Yeh, Y.-C. Chen; Y.-H. ChenJan Jan 2010

In the local small densely populated Taiwan, the recent spates of serious natural disasters have caused loss of lives and property. The study used the UAV technology to get the real-time aerial photos

............after the process of Image Rectification, we could get the estimated data of new collapsed lands to become the useful references of emergency rescue. On the other hand, digital photogrammetry can apply on the camera inside and outside position parameters to produce the Digital Elevation Model (DEM) data of 5m resolution. The DEM data can simulate the latest terrain environment and provide reference for disaster recovery in the future.

3. A Planning Environment for the Design of Future Cities

Gerhard Schmitt Jan 2012

Traditional methods of planning and managing large cities have reached their limits and need a radical re-thinking.............. The combination of interactive design and computation will demonstrate the effects and side effects of urban-rural planning or re-development. We build our design research approach on dynamics and scale: viewing cities and settlements as entities with dynamic urban metabolisms, we propose to apply stocks and flows simulations to the building scale (small, S-Scale), to the urban scale (medium, M-Scale), and to the territorial scale (large, L-Scale). Our long-term goal is the sustainable urban-rural system. Planning and implementation examples from Switzerland and ETH Zurich Science City serve as test cases, with the intent to use the findings for developments in other parts of the world.

4. **Cadastral audit and assessments using unmanned aerial systems**

K. Cunningham; G. Walker; E. Stahlke; R. Wilson Sep 2012

Ground surveys and remote sensing are integral to establishing fair and equitable property valuations necessary for real property taxation. The International Association of Assessing Officers (IAAO) has embraced aerial and street-view imaging as part of its standards related to property tax assessments and audits.

Traditional methods of photogrammetry have also given way to new equipment and sensors

New technologies, including unmanned aerial systems (UAS) paired with imaging sensors, will become more common as local governments work to ensure their cadastre and tax rolls are both accurate and complete. Trends in mapping technology have seen an evolution in platforms from large, expensive manned aircraft to very small, inexpensive UAS. Traditional methods of photogrammetry have also given way to new equipment and sensors: digital cameras, infrared imagers, light detection and ranging (LiDAR) laser scanners, and now synthetic aperture radar (SAR). At the University of Alaska Fairbanks (UAF), we work extensively with unmanned aerial systems equipped with each of these newer sensors. UAF has significant experience flying unmanned systems in the US National Airspace, having begun in 1969 with scientific rockets and expanded to unmanned aircraft in 2003. Ongoing field experience allows UAF to partner effectively with outside organizations to test and develop leading-edge research in UAS and remote sensing. This presentation will discuss our research related to various sensors and payloads for mapping. We will also share our experience with UAS and optical systems for creating some of the first cadastral surveys in rural Alaska.

5. **Unmanned aerial systems for photogrammetry and remote sensing: A review**

Ismael Colomina; Pere Molina

ISPRS J PHOTOGRAMM; Jun 2014

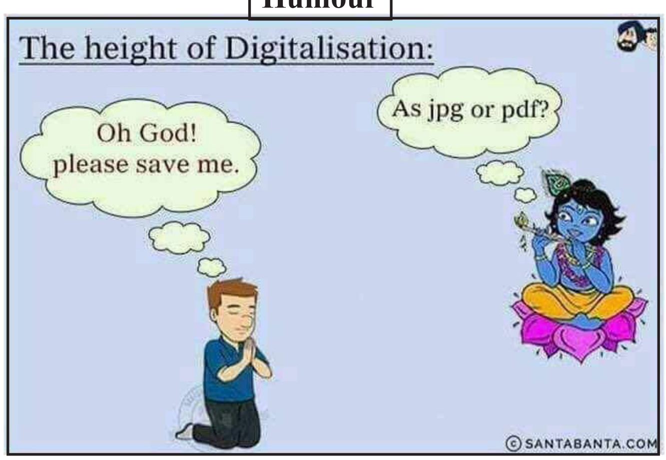
In the last five years, UAV and other disciplines have developed technology systems that challenge the current aeronautical regulatory framework and their own traditional acquisition and processing methods. Naivety and ingenuity have combined off-the-shelf, low-cost equipment with sophisticated computer vision, robotics and geomatic engineering. The results are cm-level resolution and accuracy products that can be generated even with cameras costing a few-hundred euros. In this review article, following a brief historic background and regulatory status analysis, we review the recent unmanned aircraft, sensing, navigation, orientation and general data processing developments for UAS photogrammetry and remote sensing with emphasis on the nano-micro-mini UAS segment.

2. **Monitoring and Computation of the Volumes of Stockpiles of Bulk Material by Means of UAV Photogrammetry.**

Grazia Tucci; Antonio Gebbia; Alessandro Conti; Claudio Lubello June 2019

The monitoring and metric assessment of piles of natural or man-made materials plays a fundamental role in the production and management processes of multiple activities. Over time, the monitoring techniques have undergone an evolution linked to the progress of measure and data processing techniques; starting from classic topography to global navigation satellite system (GNSS) technologies up to ... the current survey systems like laser scanner and close-range photogrammetry. Last-generation 3D data management software allow for the processing of increasingly truer high-resolution 3D models. This study shows the results of a test for the monitoring and computing of stockpile volumes of material coming from the differentiated waste collection inserted in the recycling chain, performed by means of an unmanned aerial vehicle (UAV) photogrammetric survey and the generation of 3D models starting from point clouds. The test was carried out with two UAV flight sessions, with vertical and oblique camera configurations, and using a terrestrial laser scanner for measuring the ground control points and as ground truth for testing the two survey configurations. The computations of the volumes were carried out using two software and comparisons were made both with reference to the different survey configurations and to the computation software.

Humour



Low Cost 3D Scanners

Some of the best

https://www.3dnatives.com/en/top-10-low-cost-3d-scanners280320174/

Appearing at the end of the 1970s, laser triangulation technology paved the way for new technology capable of 3D scanning objects. Usually reserved for industrialists, this tool has gradually evolved over time, allowing us to easily find affordable 3D scanners to use for ourselves. These range from a 3D scanner created by Makerbot, to new scanners that can scan underwater. Check out some of the best low cost 3D scanners below.

We searched through various companies' 3D scanner offerings to create our list of the Top 13 3D scanners in our 2019 update. Most of these 3D scanners are under $1000, with some as low as $500. These range from scanners created by large US 3D printing companies to those created by small research teams. Check out our list below to find your ideal 3D scanner, and also check out our other rankings here.

1. The XYZprinting Scanner 2.0

The Taiwanese 3D printer manufacturer of 3D printers, XYZprinting launched a newer version, the 3D Scanner 2.0. It is relatively small and light with its 238 grams, offering the user a great mobility and ease of use. It includes 4 different scanning modes, allowing you to scan objects, a whole body, a head or a face. The maximum size of scanning is 100 x 100 x 200 cm and has a resolution ranging from 1 to 2.5 mm. It is available from 199 • (£160).

2. Sense 2 from 3D Systems

The Sense 2 from 3D Systems is an affordable 3D scanning solution for small and medium-sized objects. In fact, Sense 2 uses structured light technology, and includes two sensors, one for capturing the size of the object and the other for the colour. The depth sensor has a 640 x 480 px resolution and the texture has a resolution of 1920 x 1080 pixels. The starting price for this machine is $499.

3. Structure Sensor from Occipital

The Structure Sensor solution adds precise 3D vision to your mobile device, enabling 3D scanning among other features. The only equipment you will need for this 3D scanner to work is an iPad, then once you have downloaded the app Skanect Pro, it will work instantly.

The new version of this device is smaller than the last, 109mm x 18mm x 24mm, and weighs about 65 g. It is recommended to use it on a 0.3 m to 5m scanning range. Some other features on this device include indoor mapping and virtual reality gaming! The Structure Sensor retails for $527.

4. SOL 3D Scanner from Scan Dimension

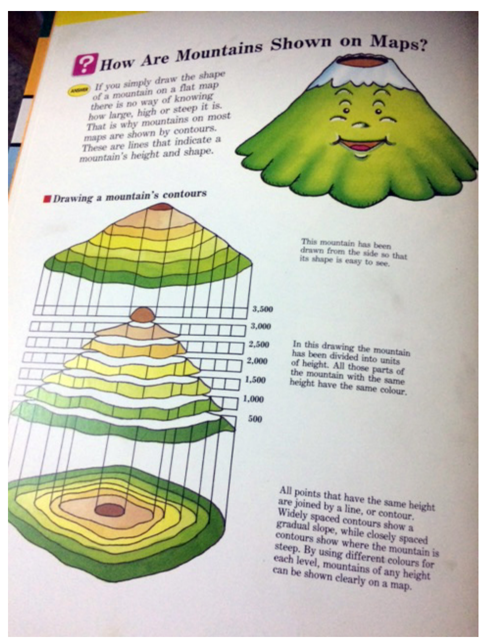
This scanner was developed by Scan Dimension, based in Denmark, and is essentially a hybrid solution. It uses a combination of laser triangulation and white light technology to 3D scan real-life objects. The SOL 3D scanner can provide a resolution of up to 0.1 mm. The 3D scanning process is automated and you can choose between a near and far scanning mode.

The SOL 3D scanner also includes software to simplify your entire workflow. In a few steps you will be sending your 3D model to your 3D printer. This is a solution meant for makers, hobbyists, educators and entrepreneurs who may not have the most experience with 3D scanning devices but still want to achieve great results. The SOL 3D scanner retails for $699

5. V2 from Matter & Form

The Matter and Form V2 3D scanner is a desktop 3D scanning solution powered by MFStudio software. Based on laser triangulation technology, the accuracy on this device can reach 0.1 mm, which is definitely impressive considering the price. It enables scanning an object with a maximum height of 25 cm and a diameter of 18 cm. The 3D scanner is available from $750.

Contouring of hill



GIS based Cadastral Cartography

Extensive use of The Inspire GML CADASTRAL PARCEL

Smart Cadastral Tools for Real Estate Registration

https://issuu.com/geomarespublishing/docs/gim-international-november-2017

The tools, systems and protocols as developed by the Spanish Directorate General for Cadastre are well accepted and widely used. A smart system of coordination between the Cadastre and the Property Rights Registry in Spain is now working and showing results. Agents working in the real estate market are now involved too. In Spain, the Cadastre and the Property Rights Registry are two separate institutions with differentiated mandates and competences, both working in the domain of land administration. The Spanish Law 13/2015 implements an effective coordination of transactions executed by both institutions. Today the real estate transactions are performed with increased legal certainty. While georeferenced spatial information of parcels is incorporated into the Property Rights Registry, cadastral mapping forms the basis of the graphic representation used. The cadastral data is updated simultaneously with the Property Rights Register.

A smart system of coordination between the Cadastre and the Property Rights Registry in Spain is now working and showing results

INSPIRE GML Format

The Cadastre, registries and notaries have worked together to design a technologically advanced model of institutional interaction for this coordination purpose. This model enables the application and use of georeferenced spatial information throughout all real estate transactions. The georeferencing of the parcels, expressed through the INSPIRE GML format of a cadastral parcel, is now widely used by all agents involved in property transactions in Spain. Information is continuously exchanged electronically between citizens, professionals and the various institutions involved. As a consequence, the Cadastre is aware and informed of any alterations to the real estate property recorded in a public deed or in any other object of registration, with a sufficient level of detail to carry out its unattended updating.

Object description

The object present in real estate transactions must be identified at the start of each transaction. This must then be known and agreed upon by all stakeholders. The information derived from the cadastral spatial database is then processed in order to be correctly transcribed into the public transaction document and to be incorporated into the Property Rights Registry. The technical solution developed by the Directorate General for Cadastre allows the list of coordinates as present in the INSPIRE GML format to be linked with its graphic visualisation without the need for specialised GIS tools. The cadastral cartography, and in particular the 'descriptive cadastral and graphic certification', has been chosen as the instrument to achieve the correct graphic description of the registered properties. This guarantees the coherence of the graphic information that is registered, ensures that there are no overlaps on neighbouring parcels or on neighbouring public land, and guarantees the graphic coordination with the Cadastre. The certified graphic information of the cadastral parcel is expressed in the INSPIRE GML cadastral parcel format

The system contributes to standardising the internal processes of all the stakeholders involved in the real estate sector

Representation of physical reality

In cases where the cadastral cartography does not sufficiently reflect the physical reality, procedures have been defined for updating the graphic data of the parcel involved through the use of alternative georeferenced graphic representations. These alternative representations are expressed again in the INSPIRE GML Cadastral Parcel format and can be generated from various computer applications. A simple internet search shows the plethora of tools available, appearing as free and open software tools, tools provided by professional institutions as well as tools from specialised commercial firms. Other options include free plug-ins for AutoCAD, QGIS or gvSIG as well as the tools presented on the Cadastre's website.

Validation

An alternative graphic representation must comply with certain technical conditions established in the relevant development resolutions. It must be represented in the cadastral cartography and the delimitation that already exists in the cadastral cartography must be respected. The accreditation of these conditions is verified by means of the 'validation service of alternative georeferenced graphical representations' on the Cadastre's website. This results in the 'graphic validation report'.

Latent demand

The key parts of the technical solution, the cadastral certification and the graphic validation report of the new, alternative georeferenced representation, can be obtained via a web service by citizens and professional users from the Cadastre's website. Over the course of 2016, more than seven million certificates and fifty thousand reports were issued, practically all of them electronically. Beyond the substitution effect of the face-to-face channel by the online channel, this shows the clear and ongoing emergence of a latent demand for cadastral information. Between the implementation of the Cadastre's website in 2003 and today, the number of cadastral certificates issued has multiplied by seven, and last year saw an increase of more than 10 percent (see Figure 5). It must be emphasised that only 15 percent of certificates are obtained by private citizens. The other 85 percent are being directly obtained by professional users – the notaries, registrars and authorities that need them. These are obtained not only interactively, but also by utilising the electronic web-based services enabling automatic data exchange between the information systems.

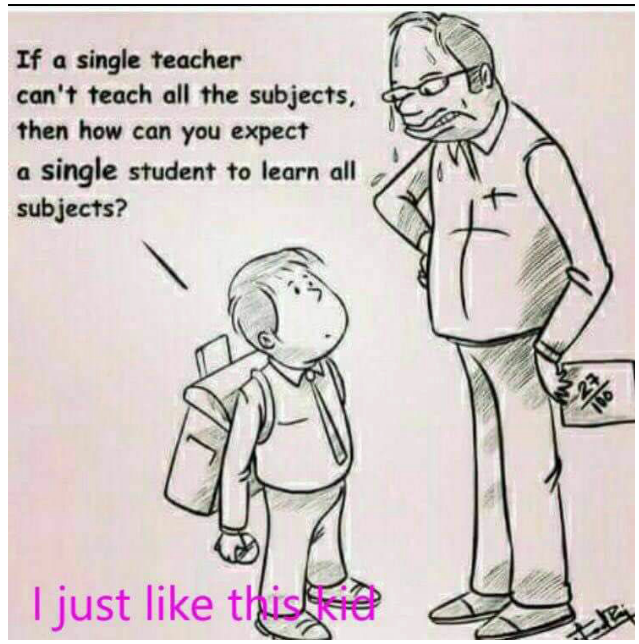
Authentic documents

The INSPIRE GML of the graphic situation of the cadastral parcel as certified by the Directorate General for Cadastre is embedded in the cadastral certification and the graphic validation report. The Directorate ensures the authenticity and integrity of its contents. This circumstance is achieved thanks to the fact that both products are electronic documents, signed using a secure 16-digit verification code. This code unequivocally identifies the document in the Directorate General for Cadastre's catalogue. The exchange between the various stakeholders requires only the 16-digit barcodesS. This avoids the need to physically exchange computer files, allows the visualisation of the new representation without GIS tools and enables the automated capture of its contents, thus preventing possible transcription errors.

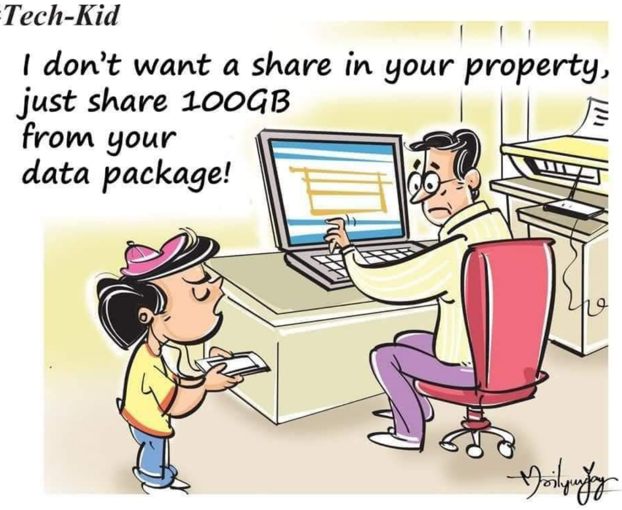
Concluding remarks

The introduction of this system has enabled strong progress in the coordination between the Cadastre and the Property Rights Registry. The system contributes to standardising the internal processes of all the stakeholders involved in the real estate sector. Interoperability between stakeholders' systems is enhanced and at the same time administrative procedures are simplified, costs are reduced and legal security is increased. Cadastral data has been incorporated and has been marked as coordinated in the Property Rights Registry, and the data related to delimitation, location and area is considered to be true for all legal purposes. This promotes transparency in real estate transactions by establishing an adequate procedure for generating spatial descriptions of real estate objects. This is principally based on cadastral cartography, and allows citizen participation by offering access for citizens to rectify and/or update the real estate object's description

Humour



#Tech-Kid



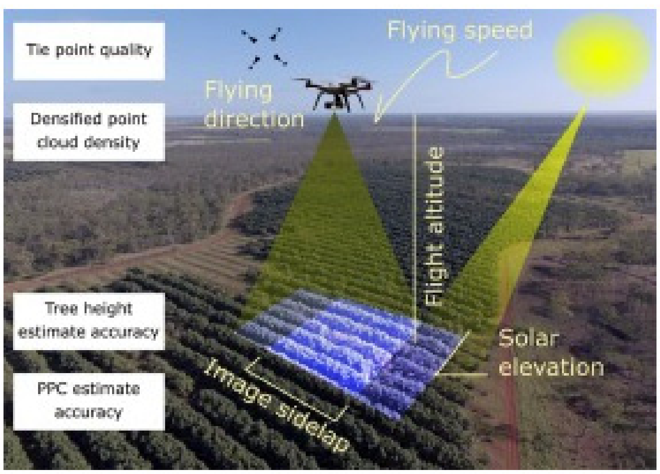
Abstract

Optimising drone flight planning for measuring horticultural tree crop structure

Yu-HsuanTu, StuartPhinn, KasperJohansen, AndrewRobson, DanWu

https://doi.org/10.1016/j.isprsjprs.2019.

In recent times, multi-spectral drone imagery has proved to be a useful tool for measuring tree crop canopy structure. In this context, establishing the most appropriate flight planning variable settings is an essential consideration due to their controls on the quality of the imagery and derived maps of tree and crop biophysical properties. During flight planning, variables including flight altitude, image overlap, flying direction, flying speed and solar elevation, require careful consideration in order to produce the most suitable drone imagery.



Previous studies have assessed the influence of individual variables on image quality, but the interaction of multiple variables has yet to be examined. This study assesses the influence of several flight variables on measures of data quality in each processing step, i.e. photo alignment, point cloud densification, 3D model building, and ortho-mosaicking. The analysis produced a drone flight planning and image processing workflow that delivers accurate measurements of tree crops, including the tie point quality, densified point cloud density, and the measurement accuracy of height and plant projective cover derived from individual trees within a commercial avocado orchard. Results showed that flying along the hedgerow, at high solar elevation and with low image pitch angles improved the data quality. Optimal flying speed needs to be set to achieve the required forward overlap. The impacts of each image acquisition variable are discussed in detail and protocols for flight planning optimisation for three scenarios with different drone settings are suggested. Establishing protocols that deliver optimal image acquisitions for the collection of drone data over horticultural tree crops, will create greater confidence in the accuracy of subsequent algorithms and resultant maps of biophysical properties.

Technology Trend

Source: https://www.ba-bamail.com/content.aspx?emailid=23711

If you cast your mind back 10 years, you'll probably realize how different your life was then. If you had a cell phone, most of your friends and neighbors probably didn't. You also likely didn't use social media or check your favorite websites every day. You didn't have instant access to the whole world lying right in your pocket. Yet the current rate of technological advances is so startlingly fast, that the next 10 years are expected to see exponential growth in activity.

Two such future changes are selected which are going to herald a total revolution in human affairs. Prepare to be shocked and amazed!

- **In 2 years, unlimited free data storage for 90% of humans**

It's believed that unlimited storage for all your files will (or could) be given to you free of charge, very soon, meaning you'll never need to delete anything ever again due to lack of space. Companies will be able to do this as the cost of hard drive gigabytes falls precipitately.

- **By 2022, 1 trillion sensors to be online**

Sensors are getting so cheap, and computers so powerful that soon there'll be hardly any reason for any electronic device (or otherwise) not to be wired to the internet. This'll mean that we'll be able to perceive our environment digitally as well as or perhaps even better than we can physically.

Telangana Police to use Space Technology to curb state crime

By Newsmeter Network Published on Jan 16, 2020

The police authorities have decided to use space technology for controlling crime and improve traffic situation in Telangana apart from reducing road accidents.

Speaking after interacting with Telangana State Remote Sensing Applications Centre (TRAC) Additional Director-General G. Sreenivas Reddy and other officials, Director-General of Police M. Mahendar Reddy said the police would sign a memorandum of understanding with the TRAC to use the technology.

Priority would be given to map crime prone areas, accident spots and steep curves through remote sensing. This apart, mapping of police station jurisdictional boundaries and linking it with revenue records would also be taken up. This move would enable people lodge a complaint at the police station concerned without any confusion about the jurisdiction. A request was also made to geo-map the areas where tipplers regularly consume alcohol.

These areas would be linked to the City Police Commissioner's office and the Superintendent of Police office in each district to take necessary action against those who are consuming liquor in open places. This initiative would also enable the police to reduce crime against women, he said.

Reddy also advised TRAC officials to geo-map open places in police stations, offices and buildings to use them effectively in future and protect them from being encroached. Linking the police department's offices with remote sensing applications would help to render better services.

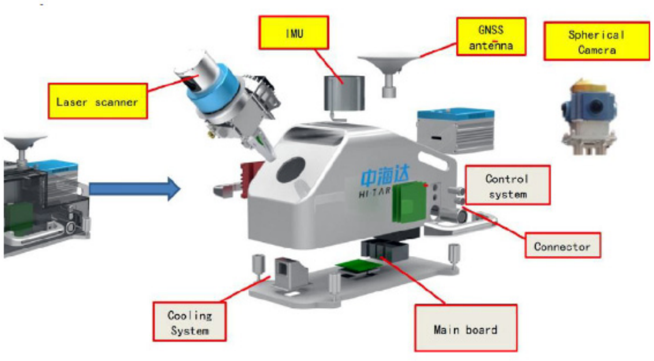
He asked the IT wing to prepare modalities to reach an agreement with the TRAC.

Mobile Mapping System for Cadastral Surveying

By Stefan Wei and Seven Zhao

https://geo-matching.com/content/mobile-mapping-system-for-cadastral-surveying

Cadastral surveying is quite an important task for all the countries and the governments. The cadastre records the detail location, coordinates, ownership, and a lot a valuable information, which means the location should be very precise. Based on the surveying technology, we are able to acquire the high-precision coordinates in a very reliable and efficient way. MMS (Mobile Mapping System) is one of the latest surveying technology to measure the object by millions of points per second with centimeter accuracy. This article introduces the application of MMS which been used in cadastral surveying, as well as the benefit and detail procedures.



MMS components

Background: Mobile Mapping Systems for Cadastral Surveying

Cadastral surveying is land management's most basic function, it can be applied across all the surfaces, gather all sorts of data needed for land management. With the help of both hardware and software, it can deliver location, mapping, distance in different types of formats.

At the moment, the most conventional method of Cadastral surveying is using the Total Stations and RTK GPS, it is time-consuming and inefficient in terms of human productivity. The end results of the traditional method are in 2D, whereas the new age is 3D. 3D data opens up to more possibilities and applications, providing a better platform for land management. LiDar is the latest method for 3D data collection, it achieves better data accuracy and higher proficiency, showcasing 3D data collection at its best.

What is LiDar?

LiDar stands for Light Detection and Ranging. It is an integration of GPS, IMU (Inertial Measurement Unit) and laser scanner, into one system. It achieves a more accurate 3D data with the IMU and GPS input. The main idea behind LiDar technology is, the scanner head emit lasers out, it gets reflected back into the scanner head. Once the system receives the reflected lasers, the location, distance ,and angular measurements are calculated in the span of milliseconds.

MMS is one of the methods that use LiDar technology. With the integration of spherical camera into the system, it can provide geo-coded images with the mass point cloud.

Installed on various types of vehicles, it scans and takes pictures while the car moves around the specific area, providing millions of points with distance, location and angular measurements to each individual point. And the point cloud can be applied for 3D modeling, Topographic landscape, Map street view and many other GIS applications.

1. Comparison of conventional surveying method and MMS method

We did a comparison work on both conventional surveying method and MMS method in a small town in Guangxi province, China. Using the conventional way of RTK GPS and MMS, concluding the results as follows;

a) By GPS RTK Receiver

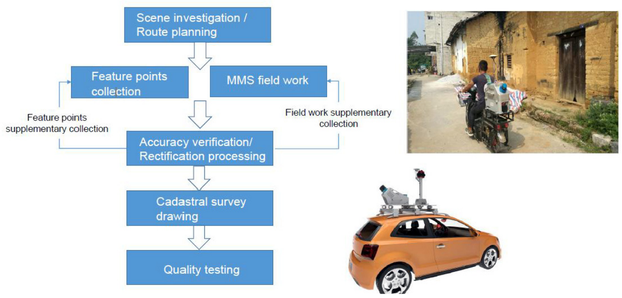
It takes 20 days to finish the whole surveying works in the field, and more than

10 days for drawing and generate the result, totally is 30 days.

The workflow of RTK GPS is very generic and well understood by many, so it will not be illustrated in this article.

b) By Mobile mapping system

Below figure 3 illustrates the workflow of MMS method.



MMS workflow

a) Route Planning

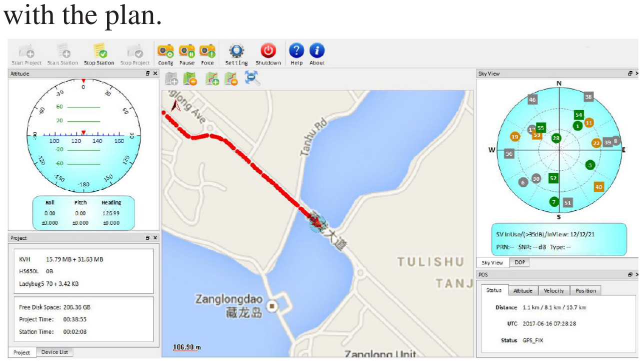
Route planning is essential as a first step, as different areas have different landscapes. A proper planning beforehand will decide what type of vehicle to be used, the sequence of the route to be taken, so the data will be collected in the most efficient way.

Figure 4 shows the route planning, with red circles indicating areas not accessible by car, therefore have to use a motorbike for the scans.

Route planning

b) Field Work

On the field, simplified software is used to manage the work, all sorts of information like the pictures, point cloud data and position will be stored automatically as well as the tracks shown on the handheld device. On the interface, you can check back on the area you have covered refer to the background Map, to ensure the work is in accordance with the plan.



We need your continuous support

Dear esteemed reader

I thank you for your valuable support and patronage in our long journey and being a part of GeoMap Society (GEMS), since 1990. Together in pursuit, today GEMS is able to focus and organise many activities, which include:

- GIS India (Now, bi-monthly, Maps Today, from 2018);
- GeoMap Quiz for School Students
- Events like GIS Day, National Survey Day, Seminars, Workshops, Outreach Programmes for Teachers & Professionals.
- Publishing of Books and Maps
- Conducting Panel Discussions, Lectures in Educational and other Organizations
- Networking with Universities, Geospatial Industry & Government

We continue with support from different organizations and well wishers like you. The support comes from subscriptions, sponsorship and donations.

I am communicating through this seeking your continued and kind support, like in the past, for 2020-2021, too. The contributions may be starting from Rs 10,000 or in multiples. The principal amount and its accurals will be utilised for the activities of GeoMap Society. I am furnishing the Name of the Bank and the Account details, as under.

Account Name:

GeoMap Society; Account No. 1787201000685

Bank Name:

Canara Bank; Branch: Somajiguda, Hyd-82

IFSC: CNRB0001787; MICR: 500015036

Good wishes to you & your Family

Yours sincerely

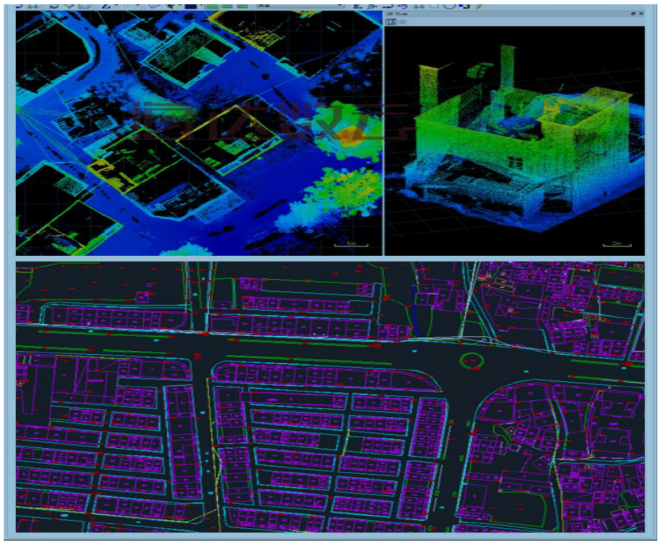
GS Kumar

(President GeoMap Society, Hyderabad)

Field data collecting

c) Post Processing

After the completion of fieldwork, the collected data will be processed with compatible software, integrate all the data like location coordinates, distances into numeric formats, virtual displays of real-life visuals.With a specific software for cadastral drawing, the point cloud data can be used for generating cadastral data automatically.



Point cloud and cadastre

In short, MMS method is much faster than RTK receivers in capturing the data on the field, it only takes 1 ~2 days to finish the field work and 5 more days to process the point cloud data. The output results are in 3D compared to the 2D by RTK, a shorter time taken, a more in-depth result. in short, MMS is the next to get method of Cadastral Surveying.

NO.	Task	Man-day(s)
1	Site visit	1 days/1 person
2	Route planning	2hours/1 person
3	Field work	2 days/2 people
4	Accuracy checking	1.5 days/2 people
5	Point cloud post processing	1.5 days/1 person
6	Cadastral drawing	2.5 days/2 people
Total		6 days/2 people
1 km²		

RTK: 60 People day/1 km2

MMS: 20 People day/1 km2

Efficiency comparison between RTK and MMS

Point NO.	Point cloud coordinates		Control point coordinates		Deviation	
	pX(m)	pY(m)	cX(m)	cY(m)	dX(m)	dY(m)
1	569464.59	2592353.79	569464.55	2592353.82	-0.04	0.03
3	569511.88	2592245.98	569511.89	2592246.00	0.01	0.03
5	569462.13	2592211.66	569462.12	2592211.68	-0.02	0.02
7-1	569437.68	2592191.60	569437.68	2592191.67	0.01	0.06
7-2	569437.70	2592191.68	569437.68	2592191.67	-0.02	-0.01
9	569398.03	2592179.35	569398.03	2592179.32	0.00	-0.03
13-1	569280.77	2592142.58	569280.73	2592142.60	-0.03	0.02
13-2	569280.77	2592142.58	569280.73	2592142.60	-0.03	0.02
19-1	569343.90	2592253.54	569343.89	2592253.60	-0.01	0.06
19-2	569343.90	2592253.54	569343.89	2592253.60	-0.01	0.06
21-1	569387.96	2592300.31	569387.99	2592300.28	0.03	-0.02
21-2	569387.96	2592300.31	569387.99	2592300.28	0.03	-0.02
25-1	569398.76	2592253.20	569398.76	2592253.17	0.00	-0.03
25-2	569398.77	2592253.16	569398.76	2592253.17	-0.01	0.01
27-1	569403.17	2592240.43	569403.19	2592240.43	0.02	0.01
27-2	569403.15	2592240.41	569403.19	2592240.43	0.04	0.02
29	569357.13	2592209.14	569357.14	2592209.17	0.01	0.03
33	569485.24	2592266.98	569485.23	2592266.99	-0.02	0.02
35	569428.49	2592504.79	569428.49	2592504.82	0.00	0.04
37	569447.98	2592416.81	569447.94	2592416.89	-0.05	0.08
39	569402.07	2592343.75	569402.03	2592343.78	-0.05	0.03
				Average	0.00	0.01
				Standard deviation	**0.02**	**0.03**

2. Conclusion

a) Cadastral surveying requires centimeter accuracy and MMS perfectly meet the needs.

b) The efficiency of MMS relieves the manpower workload, achieving better productivity per headcount.

c) MMS not only serves the purpose of Cadastral Survey, it can also be used for GIS and many other purposes.

BIOGRAPHICAL NOTES

Stefan Wei

Marketing Director in Hi-Target for more than 2 years, he was The Leader of Hi-Target After Sale Department for more than 4 years, and now is the head of product managers team. He has rich experiences in land survey, GIS data collecting and 3D laser solution promotion, support and marketing.

Seven Zhao

Product Manager in Hi-Target on Laser Scanner products specialized in land survey solution and marketing.

Obituary

Dear friends,

The following is a message received by me from Gini, daughter of Col. H. M. Dattatreya, to which I have replied. It is a very sad News. For your information.

GS Oberoi. <gurbakshsoberoi@yahoo.co.in>

After a brief but courageous battle with cancer, Hari Mohan Dattatreya passed away peacefully in his sleep this afternoon, the 25th. of January, at PGI Chandigarh hospital. He was 90. Gini.

Dear Gini,

So sad to hear about the demise of your dear father. He was a kind and pious man. Loved by all who knew him. He was like a brother to me. We spent lot of happy time together in Survey of India and after retirement.

May God give rest in heaven to his soul and strength to you all to bear this irreparable loss!

Yours in Grief,

GS Oberoi, E 64, Sector 21, Noida(UP). 201301.

gurbakshsoberoi@yahoo.co.in

Very sorry to hear.from GS Oberoi. Copy to SOI FriendsSP GoelSorry to inform you that Shri S.P. Goel has sent me a message on WhatsApp that Shri R.M.Tripathi has passed away in Lucknow. No other details are available with me.

Very sorry to hear the sad news. May God rest his soul in Peace and give strength to the bereaved family to bear this irreparable loss! GS Oberoi.

Shri R.M.Tripathi (centre)

Dear friends of SOI,

It is a very sad news. I have a lot of sweet memories spent with him to remember in SOI. I pray the almighty to rest the soul in peace,

and give sufficient strength to all the bereaved family members to bear with the irreparable loss.

G Namasivayam

Very sad news. May the Almighty rest him in peace. I have fond memories of my interactions with him.

A lovable officer with a smiling face.

USVs & Seafloor Mapping Technologies

Newsletter 20Geo-matching.com.html

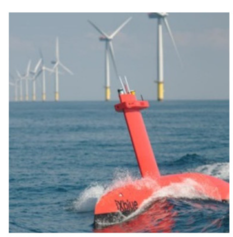
L3 ASV - C-Worker 5

C-Worker 5 is the ideal platform to support hydrographic survey work. Designed as a force multiplier to enable increased survey coverage and minimized weather risk through reduced survey duration.

dotOcean - Calypso Inflatable ASV

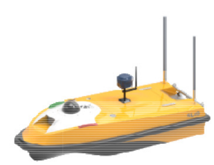
The Unmanned Survey Platform (USP) Calypso is an inflatable, full autonomous surface vehicle that can carry a wide range of sensors for hydrographic and environmental surveys.

iXblue - DriX



Launched in 2017 on the Ocean Science, Hydrography and Energy markets, DriX proved to be a real game changer and already conducted many successful operations ranging from subsea positioning to bathymetry missions.

OceanAlpha - USV SL40 USV



SL40 autonomous survey boat is a waterjet-propelled unmanned surface vessel (USV) for hydrographic and bathymetric survey. Measuring 1.6 meters long and 0.7 meters wide, SL40 weighs 35 kg and can carry 15 kg of survey instrumentation.

3D imaging sensor

Positioning Strategies and Accuracy:

https://geocue.com/products/trueview/

The laser scanner in a 3D imaging sensor (3DiS) provides the time a pulse is emitted, the angle with respect to the scanner and the range to the target. In order to deduce where in "object" space this pulse made contact (ground, tree, building, etc.), the position (X, Y, Z) and orientation (pitch, yaw, roll) of the sensor platform, with respect to time, must be known. A Position and Orientation System (POS) is a device that provides a high frequency set of raw measurement from which the position (X, Y, Z) and orientation (pitch, yaw, roll) of the system can be deduced in post-processing software. The hardware comprises a Global Navigation Satellite System (GNSS) antenna and receiver for position and a gyroscope to deduce angular rates of rotation. The POS also contains accelerometers to measure rates of linear velocity changes.

Post-processing software consumes these raw measurements and outputs a trajectory. This trajectory contains tuples of information that include the time, X, Y, Z, Pitch, Yaw, Roll and additional information that is used to solve for platform position. This trajectory is combined with laser range, angle timing data within True View Evo to "geocode" the point cloud.

Sensor Fusion, by Design

The True View® 410 is the industry's first integrated LIDAR/camera fusion platform designed from the ground up to generate high accuracy 3D colorized LIDAR point clouds. Featuring dual GeoCue Mapping Cameras, a Quanergy M8 Ultra laser scanner and Applanix Position and Orientation System (POS), the result is a true 3D imaging sensor (3DiS). With its wide 120° fused field of view, the True View 410 provides high efficiency 3D color mapping with vegetation penetration in a payload package of 2.2 kg.

Dual Cameras

Two GeoCue Mapping Cameras provide a 120° field of view, coincident with the laser scanner track. The 25° oblique mounting ensures the sides of objects are imaged, allowing a true 3D colorization of all LIDAR points.

LIDAR Scanner

The Quanergy M8 Ultra scanner provides range of up to 100m with three returns per outgoing pulse.

Google Processor

A Google® Coral TensorFlow Processing Unit provides exceptional power as the True View central controller. The CCU coordinates all on-board functions of the system.

Applanix Positioning

A sensor can be no more accurate than the position and orientation system. GeoCue incorporates the industry's most accurate and reliable POS – the Applanix APX series. APX post-processing is accessed via the included True View software, providing "pay-as-you-go" access to SmartBase and Trimble PP-RTX positioning services.

True Track® Flightlines

· Post-processing software uses positioning system information to perform roll compensation at the individual scan line level. This allows reduced overlap between flight lines, increasing platform flight efficiency.

True Time Synchronization

Fusing sensor data requires exceptional timing synchronization among the positioning system and all sensors. True View's System Synchronization Unit (a GeoCue designed Master Clock), ensures sensor coordination at the microsecond level.

Image gives an idea of traffic condition on road

UAV Photogrammetry and 3D Printing

NS Gayathri, GIS scientist, Hyderabad email: vsgayu@gmail.com

Introduction

Photogrammetry processing of stereo imagery from Unmanned Aerial Vehicles (UAV) has emerged as an efficient, economical and reliable technology. This paper covers some aspects of this emerging technology highlighting advantages and limitations.

Applications

Take the example of a model like a mountain or a house or a car. It is possible to take images using a digital camera or a mobile phone. Using a special software it is possible to generate 3D pictures. These can be printed for study / analysis. This is very useful to teach students in schools and colleges

For larger areas also UAV's are appropriate. The main advantage of UAV system acting as a photogrammetric sensor platform over more traditional manned airborne system is the high flexibility that allows image acquisition from unconventional viewpoints, the low cost in comparison with classical aerial photogrammetry and the high resolution images obtained.

Presently, it is a necessity for surveying small areas and in these cases, it is not economical to use normal large format aerial or metric cameras to acquire aerial photos, therefore, the use of UAV platforms can be very suitable. The availability of digital cameras has strongly enhanced the capabilities of UAVs. The use of digital non metric cameras together with the UAV could be used for multiple applications such as aerial surveys, GIS, wildfire mapping, stability of landslides, crops etc.

3D models for surveying & mapping

Using the information produced from UAV imagery, high-accurate 3D city models are generated. The analysis of XYZ data from 3D models using UAV photogrammetry revealed similar products as the terrestrial surveys which are commonly used for the development plans and city maps. The experimental results show the effectiveness of the UAV-based 3D city modelling. The assessed accuracy of the UAV photogrammetry proved that urban planners can use it as the main tool of data collection for boundary mapping, changes monitoring and topographical surveying instead of GPS/GNSS surveying.

Use of UAVs in surveying and aerial mapping revolutionized the approach of Remote Sensing and popularized the use of drones for various mapping applications. The basic procedure in producing an accurate map from UAV imagery consist of three steps which are, establishing ground control points mainly using GNSS method, perform the aerial survey and process the survey data with a suitable photogrammetric software. The three main components of a photogrammetric system, UAV, GNSS system and image processing software are the key cost factors influencing the overall feasibility of its application for a given task. In the case of survey grade components, the system would add up to a very high cost making it only viable for large scale projects which would justify their expenditure. Adoption of consumer grade photogrammetric system to achieve required levels of accuracy/ precision and assess its applicability thereby justifying the feasibility upon both cost and accuracy parameters.

In case of models, we just need to capture the object through a digital camera or mobile phone. We have to take the pictures from all angles by clicking 30-40 sequential photos. It is to be made sure that top to bottom of the object is covered . Focusing, Lighting have to be proper. Overexposed and underexposed areas are to be avoided. Plain, reflective, transparent surfaces and objects are to be avoided to ensure good quality 3D model. Then the photos are to be uploaded. There will be a tool in the software that will identify common features from photographs and convert them into a single 3D design. The model is uploaded and saved in cloud storage. One can edit or fix any errors. Unwanted areas can be removed.

Case Studies

A case study of UAV used a DJI Phantom 3 Professional while Ublox Neo M8P as the GNSS unit and

OpenDroneMap as the image processing software which is an open source software available for free. The accuracy and limitations of such a system is analyzed considering the benefits to the community as an affordable complete mapping solution.

Another case study details are:

- The study area has been marked with distinctive checkpoints in the form of triangles (0.5 × 0.5 × 0.2 m for accuracy of ortho photos.
- Flight plan for the territory was carried out before the aerial surveying
- Reference point coordinates and check-points reference point coordinates provided using GNSS in real-time kinematics (RTK)
- Aerial survey with Trimble UX5 UAV combined with digital camera SONY NEX-5R from 200m and 300 m altitude
- Orthophotomap generated using photogrammetric software Pix 4D.
- Accuracy verified with check points proved to be better than traditional methods

Concluding remarks

3D printing is transforming many conventional industries. For example, GE is able to replace a third of the parts on an aircraft engine using 3D printing and by fusing materials together they can reduce the overall number of parts. Honda created an electric vehicle entirely from 3D-printed segments. On-demand printed cars may be just around the corner. Even homes are being 3D printed at highly reasonable costs these days — although a bit rudimentary, the output can only get better. Application scenario is unlimited

Thus, photogrammetry has become so convenient , affordable, efficient and easier. One can create 3D model at home by just few clicks and explore new things, based on stereo imagery from various platforms like terrestrial, air and space. UAV based imagery is found to be more suitable for small areas. 3D printing has its own advantages, particularly for research, analysis development etc.

Digital 3D maps

About AW3D Standard (2.5m resolution)

https://www.nttdata.com/.../2019/july/ntt-data-and-restec-launch-aw3d-full-global-3d-map

This latest version of AW3D Standard digital 3D maps offers 2.5m resolution. The mapping process uses a floating-point format for height values to achieve highly accurate representations of terrain, including smooth expressions of topography. Compared to 5m resolution, 2.5m resolution offers:

- Fine expression of terrain undulations
- Expression of coastal landfills, narrow rivers and waterways
- Urban structures such as buildings and overpasses
- Flat structures such as roads

Katsuichi Sonoda, Senior Vice President and Head of NTT DATA's Social Infrastructure Solution Sector, said: "3D maps are a foundation in many different fields. This latest version of AW3D Standard, which is believed to be the world's highest-definition digital map covering the entire globe, presents views of the world with unprecedented clarity. We have been working to apply its datasets in broader fields, so we are confident that this latest version will find broad applications in diverse industries and government-level projects."

Kaname Ikeda, President of RESTEC said: "AW3D Standard (2.5m resolution) represents a significant step forward in the innovative use of Japan's cutting-edge space technology. This latest version will enable companies, organizations and governments to achieve the United Nation's Sustainable Development Goals (SDGs) for industry, innovation and infrastructure (Goal 9), sustainable cities (Goal 11), climate action (Goal 13) and goal partnership (Goal 17)."

Usage examples

AW3D Standard (2.5m resolution) supports very accurate simulations and analyses for urban planning and natural-disaster prediction. Offering accuracy equivalent to a map scale of 1/25,000, AW3D Standard (2.5m resolution) is suitable for use as core map information by national governments.

Drone Regulations

https://www.pwc.in/consulting/financial-services/fintech/fintech-insights/data-on-wings-a-close-look-at-drones-in-india.html

Regulatory impact is currently one of the most important factors affecting the pace of adoption of drone-powered solutions by business and government entities. Drone regulations have changed in recent years from being treated as a niche hobby to becoming part of regular aviation operations, to a point where national authorities have started developing special regulatory frameworks to address the most urgent issues.

The first country to implement all necessary sets of regulations was Poland in 2013. Thanks to the combined efforts of the civilian aviation authorities, the UAV community and insurance companies, Poland allows both visual-line-of-sight (VLOS) and beyond-visual-line-of-sight (BVLOS) operations of commercial drones in a secure and user-friendly way.

At the global level, the International Civil Aviation Organization (ICAO), a specialised agency of the United Nations, prepares the standards and recommended practices for national and international air navigation to ensure safe and orderly growth. Of the 191 ICAO members, 63 have some regulations for drones already in place; 9 states have pending regulations and 5 have temporarily banned the use of drones.

India Leads in Import of Unmanned Aerial Vehicles

by Gunjan Bagla

http://www.theindiaexpert.com/india-leads-in-import-of-unmanned-aerial-vehicles

Based on data related to imports/exports of drones between 1985 and 2014, India tops the list of drone-importing nations with 22.5 percent of the world's unmanned aerial vehicle (UAV) imports says a report on *SiliconIndia News*. These pilot-less aerial vehicles are used for reconnaissance, surveillance, intelligence gathering and aerial combat missions.

The data has from the **Stockholm International Peace Research Institute**, shows that Israel is the leading exporter , having shipped 783 drones since 1980, accounting for 61 percent of all drones sold. The **U.S**., with a 24 percent of UAV exports, ranks second, followed by **Canada** with 6.4 percent.

India's first UAV delivery came from **Israel's** IAI in 1998. Of India's 176 UAVs, 108 are *Searcher* reconnaissance aircraft (called Meyromit in Israel) s and remaining 68 are medium-altitude long-endurance *Herons.* American companies are eager to enter India's lucrative UAV market.

Humour

Campus placement

During admissions of his kid into a professional course a parent asked the college watchman,

"Is this a good college?"

Watch man:

"Probably the best. I did my engineering here & got campus placement."

National Survey Day

Friday 10 April 2020

Seminar on

Image based Surveying & Mapping

Quiz for Students

At Telanga State Centre of Instn. of Engrs, Khairatabad, Hyderabad

For details send mail to :
geomapsociety@gmail.com

Geometric Evaluation of Mobile-Phone Camera Images for 3D Information

Ferruh Yilmazturk [1] and Ali Ersin Gurbak[2]

[1]Geomatics Engineering, Engineering Faculty, Aksaray University, Aksaray 68100, Turkey

[2]The State Hydraulic Works, XII. Region Directorate, Kayseri 38010, Turkey

https://istanbultek.academia.edu/Departments/Geomatics_Engineering/Documents

This study aimed to investigate the usability of smartphone camera images in 3D positioning applications with photogrammetric techniques. These investigations were performed in two stages. In the first stage, the cameras of five smartphones and a digital compact camera were calibrated using a calibration reference object, with signalized points having known three-dimensional (3D) coordinates. In the calibration process, the self-calibration bundle adjustment method was used. To evaluate the metric performances, the geometric accuracy tests in the image and object spaces were performed and the test results were compared.

In the second stage, a 3D mesh model of a historical cylindrical structure (height = 8 m and diameter = 5 m) was generated using Structure-from-Motion and Multi-View-Stereo (SfM-MVS) approach. The images were captured using the Galaxy S4 smartphone camera, which produced the best result in the geometric accuracy tests for smartphone cameras.

This study aimed to investigate the usability of smartphone camera images in 3D positioning applications with photogrammetric techniques

The results demonstrated that smartphone cameras can be easily used as image acquisition tools for multiple photogrammetric applications.

1. Introduction

In the early 1980s, the advent of digital cameras had a striking and positive impact on close-range photogrammetry, immediately expanding the scope of applications and providing facilities for full measurement automation. The development of digital cameras has provided a substantial acceleration in the processing steps for offline measurement tasks. In addition, subpixel image operators such as centering or template matching provided a level of image measurement accuracy that was routinely better than 0.1 pixel

Digital cameras can be divided into two categories with respect to their metric properties: comparatively low-cost, low-resolution, amateur digital cameras, and comparatively expensive, professional digital cameras with high resolution.

Professional cameras have a wide range of features, such as good lens quality, a robust structure, a large sensor with high resolution and sensitivity, and the ability to switch lenses, while amateur cameras may contain any of these features. The main difference between compact and professional cameras is the lower geometric stability of amateur cameras. Among the different amateur cameras, smartphone cameras are the most interesting option because mobiles phones are light, portable, inexpensive, and fully equipped with high-resolution digital cameras

The camera calibration is a process required to extract accurate and reliable 3D information from images. Various algorithms have been proposed for camera calibration in the area of photogrammetry and computer vision. The developed algorithms are generally based on the perspective camera model. In the early 1970s, the self-calibration approach was initially developed by Brown and has been routinely used as an efficient technique in photogrammetry.

The results demonstrated that smartphone cameras can be easily used as image acquisition tools for multiple photogrammetric applications.

Smartphone cameras are used for capturing and decoding the barcodes of devices. After decoding, an encoded URL, which automatically directs the users to the source website for further information, is obtained

One of the first applications in the field of photogrammetry using mobile-phone cameras was presented in the work by Akca and Gruen. They investigated the geometric and radiometric evaluation of the low-resolution mobile-phone cameras. Furthermore, Azhar and Ahmad carried out the same tests for a low-resolution mobile-phone camera.

With the advent of high-resolution mobile-phone cameras in the 2010s, these devices have begun to be used as imaging tools in photogrammetric tasks. A few studies have focused on the use of smartphone camera images for pure photogrammetric processes, e.g., in the work of

El-Ashmawy et al. [2]. The authors used mobile-phone camera images to photogrammetrically determine the displacements of signalized points on a beam under loading.

3D reconstruction procedures using the smartphones have initiated research in this field [11–13]. Recently, image-based 3D reconstruction techniques based on the combination of computer vision and photogrammetric algorithms have become a robust and efficient solution [14]. The basic concept of these methods is to apply an automatic image orientation by SFM and then a dense image matching. The measured point cloud is then converted into a triangular mesh or textured surface which represents the object surface shape. Depending on the computational load and the desired reliability level, the 3D reconstruction process can be performed on a mobile phone directly or on a cloud-based server or on a PC using the appropriate software. In the PC and server-based solutions, the mobile phone is used only as an imaging device to capture images of the scene of interest. There are a wide variety of open-source solutions (Visual SfM, Bundler, etc.) and free web-based services (e.g., Photosynth, 123DCatch, etc.) to implement the SfM-MVS approaches [15]. Although these methods provide automation and convenient services for users in data processing, they do not ensure accuracy and robustness in the final results, lacking georeferencing process and spatial data creation. On the commercial side, many effective software packages have also emerged on the market (e.g., Pix4d, Agisoft PhotoScan), providing a 3D reconstruction of objects from image data [14, 16]. In the literature, there are a few studies using these software packages for the processing of smartphone camera images. In one of these studies, Kim et al. [17] investigated the possibilities of using smartphone cameras in photogrammetric UAV systems. In another study, Micheletti et al. [18] explored the possibility of obtaining high-resolution topographic and terrain data using a set of low-resolution smartphone camera images. The solution was implemented on a smartphone, on a server, and also with a commercial software package.

The geometric accuracy tests of high-resolution smartphone camera images and 3D object reconstruction capabilities have not been sufficiently researched in literature. Herein, the usability of smartphone cameras in photogrammetric applications has been investigated. For this purpose, the geometric accuracy tests for five smartphone cameras and one compact camera have been performed using a 3D reference field, followed by a comparison of the test results. In the second stage, a 3D model of a historical structure has been reconstructed based on SfM-MVS approaches using smartphone camera (Galaxy S4) images and geometric accuracy tests have been performed on the model. This produced better results in terms of geometric accuracy.

Finally, the test results are summarized.

2. Geometric Performance Tests

2.1. Cameras

Today, for purchasing a smartphone, users have an option to choose from a wide variety of brands and models. In our research, we studied five smartphones, which were widely used during the period of the study, and one digital compact camera.

2.2. Comparison of Cameras

In total, 25 images of the calibration reference object with 80 targets comprising a white dot on a black background (Figure 1) from approximately the same locations were captured using the compact camera and each smartphone camera. 3D coordinates of the marked points installed on a transparent glass plate (60 × 60 cm) at different heights were measured previously with high accuracy. The images were taken from a distance of <“70 cm. To avoid correlations between the parameters of interior orientation (IO), exterior orientation, and the coordinates of the object point, the cameras of the smartphones were rotated 90° to the left and right around the optical axis in eight positions while capturing the images.

For photogrammetric evaluation, the Australis photogrammetric software package (version 6.06; Photometrix, 2012) was used. It can perform least-squares adjustments of photogrammetric bundles with photogrammetric-only data. Alternatively, it uses combined adjustments with either known camera parameters or by self-calibration. The self-calibrating bundle adjustment method used herein is the most versatile and accurate photogrammetric positioning and calibration method. The mathematical model of this method is based on the following collinearity condition, which is implicit in the perspective transformation between the image and object spaces [19, 20]:with, where x and y are the image coordinates of the point

The most common set of APs employed to compensate for systematic errors in digital cameras is the 8-term “physical” model originally formulated by Brown [4]. This model includes the 3D position of the perspective center in image space (principal distance and principal point), as well as the three coefficients of radial and two of decentering distortion. The model can be extended by two further parameters to account for affinity and shear within the sensor system.

In the self-calibrating bundle adjustment for multiple comparisons, 10 points from a total of 80 test field points with known 3D coordinates were used as the control point and the 3D coordinates of the remaining points (checkpoints) were calculated. To evaluate the effect on the positioning accuracy of the APs, we also performed photogrammetric bundle adjustment without using APs for each smartphone camera. Using free-network bundle adjustment for each camera, another camera calibration procedure was performed. In this case, the control points were not used and were included in the adjustment process as checkpoints.

Results of bundle adjustsments.

According to the results of the bundle adjustment with external constraints using 10 control points, the triangulation misclosures (RMS of image coordinate residuals) used as precision indicators for internal accuracy was computed as 0.27 ìm for Galaxy S4, whereas this value for the three other smartphone cameras and the Canon compact camera was determined to be in the range 0.49–0.63 ìm. The relative precision was determined as 1/40000 for Galaxy S4. Relative precision is the ratio of the mean target coordinate precision to the largest span of the target array. For other cameras, this ratio was in the range from 1/18000 to 1/25000.

Without using APs, we calculated the accuracy in the image space for all smartphone cameras. These values were in the range 2.26–11.02 pixel. A comparison of bundle adjustments with and without APs showed that the accuracy in the image space improved by a factor of 15.

Variation of Gaussian radial distortions.

The lowest values for radial distortion (<“9 ìm at the corners) were obtained for Galaxy S3, whereas the highest value was obtained for Canon IXUS 960 IS (<“180 ìm at the corners). The obtained decentering lens distortion value was less than 1 ìm for the cameras, except for Sony Xperia S. This value for Sony Xperia S was calculated as 3 ìm at the corners. The calculated principal point locations and their standard deviations show that.the highest values for the principal point position were obtained for Galaxy S4 and Canon IXUS 960 ISTable 3

Image-Based 3D Modeling Tests

The integration of photogrammetric methods and computer vision algorithms is leading to attractive procedures which have increasingly automated the whole image-based 3D modeling process [24]. Recently, automatic solutions based on SfM-MVS techniques have been extensively used in image-based 3D reconstruction tasks [16, 25, 26]. The process principally involves image orientation and dense model reconstruction with a high level of automation.

3.1. Structure from Motion

Structure from motion can be described as the determination of orientation parameters and 3D scene's model at the same time. Traditionally, the SfM pipeline consists of two main stages. First, a set of point correspondences between image sequences is detected as a consequence of feature detection and image matching. Second, the SfM is operated to determine the orientation parameters and scene structure [27].

xxxxxxxxxxxxxxxxxxxxxxxxxx

After matching features for an image pair, the fundamental matrix is robustly estimated for the pair using RANSAC with the eight-point algorithm [30, 31]. After finding a set of geometrically consistent matches between each image pair, the matches are organized into tracks, where a track is a connected set of matching key points across multiple images [32, 33].

The second stage of the pipeline comprises determining a set of camera parameters and a 3D position for each track. The recovered parameters should be coherent, in that the reprojection error is minimized. This minimization problem is considered as a nonlinear least-squares problem and solved using bundle adjustment [33].

3.2. Dense Scene Reconstruction

SfM is capable to construct a sparse geometric structure consisting of the 3D positions of matched image features. While this is adequate for some applications such as the image-based visualizations, the reconstruction of a highly detailed and accurate 3D model demands producing a dense point cloud, which requires to apply dense image matching methods between oriented images [27, 34].

xxxxxxxxxxxxxxxxxxxxxxxx

The last steps of the 3D reconstruction process consist of meshing and texturing. Various approaches can be used to derive a photorealistic 3D model from a dense point. Remondino and El-Hakim [36] expressed that polygonal meshing is generally the most efficient solution to accurately represent the results of 3D measurements, providing an optimal surface description. One of the most popular polygonal 2D mesh algorithms is the Delaunay triangulation method. In general, these methods require a starting point such as the visual hull model, a calculation of additional information such as a vertex normal, and a sufficient number of points [34].

3.3. 3D Modeling and Performance Testing

A second application was implemented to examine the potential use of mobile-phone images for 3D modeling applications. In this application, 3D modeling of a historical cylindrical structure (height = 8 m and diameter = 5 m) was first performed based on SfM-MVS techniques using the images captured using Galaxy S4, and then accuracy tests were conducted on the 3D model.

xxxxxxxxxxxxxxxxxxxxxxxxx

For 3D modeling, a closed five-point polygon network was first created and measured the coordinates of the 96 signalized points on the historic cupola using a reflectorless total station with high accuracy. In addition to the signalized points, 280 natural points, clearly identified and well distributed on the cupola, were also measured. Herein, we took 69 overlapping images of the cupola. The images were captured from a distance of 5–20 m. The average shooting distance was <“8 m. The ground resolution at this shooting distance was an average of 2.06 mm/pixel.

Twenty-eight of these points were used as ground control points (GCPs), while the remaining sixty-eight points were used as the checkpoints

The Agisoft PhotoScan Professional software package (version 1.4.3; Agisoft, 2018) was used to generate a 3D photorealistic model of the historical structure based on SfM and MVS algorithms. The workflow of the software for 3D modeling comprised four primary steps: (1) align photos, (2) optimization, (3) build dense point cloud, and (4) surface reconstruction (3D polygonal model).

The align photos process consists of detecting the common tie points in the images, matching them on the images, and then the photoalignment process. In our study, the photoalignment accuracy was selected as “high” (the software package uses photos in their original size). To optimize the performance, the number of matching points for each image was limited to the default value of 4000. The outputs of the photoalignment process are the camera position and orientation parameters for each image, camera calibration parameters, and a sparse point cloud model.

For the optimization step, firstly, 3D coordinates of the marked points were added to the input data set. Twenty-eight of these points were used as ground control points (GCPs), while the remaining sixty-eight points were used as the checkpoint. The coordinates of the marks were manually associated with the corresponding marker center. This procedure georeferenced the sparse point cloud model. Nonlinear deformations of the model can be eliminated by optimizing the calculated sparse point cloud and camera parameters based on the known control point coordinates. Throughout this optimization procedure, the software updated estimated point coordinates and camera parameters minimizing the sum of reprojection error and reference coordinate misalignment error.

The third step involved the generation of a dense point cloud using the estimated camera positions and the images. The software calculated the depth map for each image and combined into a final dense point cloud. To obtain a more detailed and accurate geometry, the reconstruction quality was set to “high.”

The final step in the process was the reconstruction of the 3D polygonal model representing the surface of the object based on the dense point cloud. The surface type was selected as “arbitrary,” which was suitable for modeling any object. The user could also determine the maximum number of polygons in the final mesh. This parameter was set to “high” to optimize the number of polygons for a mesh with the corresponding level of detail [37].

From the optimization step, the average precision of the coordinates of the control points was calculated as 0.59 mm and 0.71 mm for the in-plane (*x*-*z*) and out-of-plane (*y*) components, respectively. The empirical accuracy in the object space calculated from the checkpoints was found to be 1.04 mm and 1.33 mm for the in-plane and out-of-plane components, respectively. The RMS of reprojection error (residuals of image coordinates) was 0.54 pixels for all tie points.

The SfM-MVS process produced a 3D dense point cloud containing 21.8 million points (with an average density of 17 points/cm^2). This point cloud was triangulated to create a mesh model with 4.3 million faces and 2.18 million vertices

To assess the final positional accuracy of the geometric model, 68 signalized checkpoint coordinates were measured within the 3D point cloud. These measurements were performed by measuring the closest points to the center of the targets.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Each surface deviation depiction is followed by a graph showing the deviation distance frequency of the occurrence along with the mean distance and standard deviation (*ó*) of the measured checkpoints [38]. It is worth noting that the comparison resulted in Gaussian-like distributions. The average mean distance between the 3D mesh model and the checkpoints was 0.12 mm, whereas the standard deviation of the checkpoints was 3.83 mm.

3.4. Automatic Camera Calibration

Currently, a convenient, stand-alone targetless camera calibration is achievable via a process that combines SfM methods with rigorous photogrammetric orientation and self-calibration [39]. An attempt was made to evaluate the performance of the targetless camera calibration method based on the SFM algorithm on Galaxy S4 camera images. A total of 40 images of the cupola were used in the study and camera calibration parameters were calculated automatically in Agisoft PhotoScan software. For comparison with the targetless approach, the camera calibration parameters were recalculated in the Australis software using the same images and signalized points having known 3D coordinates. Twenty-five of the signalized points were used as ground control points, while the remaining 50 points were used as the checkpoint.

Regarding the internal accuracy indicators, as expected, there was a two-fold discrepancy between the accuracy of the image coordinate measurement in both cases, with the RMS values being 0.33 pixel for the target-based case and 0.67 pixels for the targetless case. The accuracy tests were also performed by using checkpoints for the target-based case and as a result of the improvement in image coordinate measurement accuracy, the relative object point accuracy was determined as l :
11000 in-plane and 0.012% of average depth.

4. Conclusions

We investigated the usability of mobile-phone camera images in photogrammetric applications in two stages. In the first stage, five different mobile-phone cameras and a digital compact camera were compared in terms of their accuracy and precision. For this purpose, both self-calibration with the control points and free-network bundle adjustments were performed for each camera.

With external constraints using 10 control points, the accuracy of the image space was calculated to be <“1/4 pixel for Galaxy S4. For other cameras, this value was in the range 1/2–1/2.9 pixel. The relative accuracy in the object space for Galaxy S4 was l : 25000 in-plane and 0.004% of average depth, whereas these ratios for other cameras ranged from l : 10000 to l : 13000 in-plane and from 0.01% to 0.006% of average depth.

The 3D object point accuracy was less than 0.1 mm for all cameras. The best results in all evaluations were obtained for the Galaxy S4 smartphone camera. For the mobile-phone cameras used in the study, we think that the principal influence on accuracy is the resolution of the camera sensor and the pixel size. Luhman et al. [1] stated that values consistent with anticipated accuracy of image coordinate measurement are in the range of 0.03–0.1 pixels for automatically measured targets, and the quality of the camera calibration will provide a relative accuracy of 1 : 50000 with the precondition of a strong multi-image geometry.

There was about twofold discrepancy between the accuracy values obtained for the Galaxy S4 and recommended for digital cameras in both image and object space. On the other hand, in an earlier study using test field data, Akca and Gruen [9] demonstrated that relative accuracies of 1 : 8000 in-plane and 0.03% of average depth can be achieved with low-resolution mobile-phone cameras. Therefore, it can be said that there is an appreciable improvement in relative accuracy as a result of developments in image resolution and mobile-phone technology.

In the second stage, we used the SfM-MVS techniques to reconstruct the 3D model of the historical Sircali cupola using the images captured using the Galaxy S4 smartphone camera, which yielded the best performance in the geometric accuracy tests. After aerotriangulation block adjustment, relative accuracy values were determined as 1 : 7500 and 1 : 6000 for the in-plane and out-of-plane components, respectively.

In SfM-based approaches, there are two main problems associated with measurement applications. Firstly, imperatives of avoiding wide base-lines means that a weaker network geometry results. Secondly, descriptor-based feature point matching leads to the lower accuracy image measurement [39]. The disparity in accuracy is likely related to these disadvantages of the sfm approach, the lower image scale, and the manual image measurements of targets. Indeed, as also stated by Fraser and Shortis [40], the accuracy of vision metrology systems based on digital cameras is dependent on the image resolution, image scale, image measurement precision, and a number of other factors, such as network design. The problems of the sfm approach were also seen in the automatic calibration process. Although the compatibility between the target-based and targetless cases was high for the camera calibration parameters, there was about twofold discrepancy between the accuracy of the image coordinate measurements.

The final positional accuracy tests of the geometric model showed a reasonable accuracy (mm level) of the dense point cloud and the resulting mesh model. The data evaluation phase demonstrates that it is possible to obtain high-quality results from numerous images captured by smartphone cameras using appropriate software solutions. Furthermore, the generated 3D model demonstrated the feasibility of the SfM-MVS approaches in low-budget digitization or documentation projects.

Consequently, with an appropriate imaging configuration, calibration, and data processing software performance, these devices can be used in multiple photogrammetric measurement applications demanding high accuracy. This option is being explored because mobile-phone cameras have good resolution and are economical and flexible. In addition, in line with the technological advancements, the quality and performance of mobile-phone cameras will develop further along with their built-in image processing functions. Therefore, it will be possible to obtain high-quality results for 3D modeling applications in which these devices are used alone as both photogrammetric data acquisition and processing tools for at least small projects.

(For full paper, send email to mapstodaygis@gmail.com)

EVENTS

Environmental Science and Development	March 4-5 2020	Poland	info@academicsworld.org
Cartography Symposium	March 6, 2020	OR USA	https://psuasprs.wixsite.com/pdxcartography2020
FOSSGIS	March 11 -14, 2020	Germany	https://www.fossgis-konferenz.de/2020/
R S and Geoinformation of Environment	March 16 -18, 2020	Cyprus	http://www.cyprusremotesensing.com/rscy2020/
Geo Week	23 - 25 March 2020	Washington USA	https://www.lidarmap.org/geoweek/
Geospatial & Surveying	6 to 8 April 2020	Malaysia	http://ageos.i-idea.org/
Geospatial World Forum 2020	April 7-9 2020	The Netherlands	https://www.geoconnexion.com/events
RS and Geoinformation on Environment	16 - 18, March 2020	Mesa Cyprus	www.cyprusremotesensing.com/rscy2020/
Civil and Environmental Engineering	April 14-15 2020	Dubai	info@academicsera.com
Future of Mining	March 23 - 24, 2020	Sydney, Australia	https://australia.future-of-mining.com/
Lidar Mapping Forum	March 23 - 24, 2020	Washington	/www.lidarmap.org/
Mountain Cartography Workshop	April 14 - 18, 2020	CO USA	www.shadedrelief.com
Environmental Science and Development	April 15-16 2020	New Delhi	info@academicsworld.org
MidAmerica GIS Symposium	April 20-23, 2020	NE USA	https://www.magicgis.org/
AgriTech 2020	May 6-7 2020	The Netherlands	https://www.geoconnexion.com/events/
GIS Trg , Applns Mgt 2020	May 7-9 2020	Czech Republic	www.gistam.org
FIG Working Week 2020 - "Smart surveyors for land and water management	10-14 May2020	Amsterdam	http://www.fig.net/fig2020/
INSPIRE 2020	12 - 15 May 2020	Croatia	https://geoinformatics.com/events-geo/
Environmental Science and Development	May 14-15 2020	Dubai	info@academicsworld.org
Big Data in Management	May 15-17 2020	Manchester UK	www.icbdm.net
Digital Image Processing	May 19-22 2020	Japan	http://www.icdip.org/
Food and Agricultural Engineering	May 28-29 2020	Toronto	info@academicsworld.org
Environmental Science and Development	May 29-30 2020	New Delhi	info@academicsworld.org
Natural Science and Environment	June 1-2 2020	Dubai	info@theiier.org
FME International User Conference	16-19 June 2020	Vancouver, Canada	https://fmeuc.com/
FOSS4G	24-29, August 2020	Calgary Canada	http://2020.foss4g.org/
Blockchain and Internet of Things	8-10 July 2020	Singapore	/www.biotc.net
Geological and Environmental Sustainability	September 10-11, 2020	Dubai	https://earthscience.conferenceseries.com/events-list
International Conference on GIS	September 15 - 18, 2020	Poland	https://www.giscience.org/
GeoSmart India	6-8October 2020	Hyderabad	https://geosmartindia.net/
Geosciences and RS	October 19-20, 2018	Ottawa,Canada	https://www.omicsonline.org/conferences-list/gis
GIS Day Seminar	Nov 18-19 2020	Hyderabad	geomapsociet@gmail.com
GIS and Remote Sensing	November 23-24, 2020	Barcelona, Spain	https://gis-remotesensing.environmentalconferences.org/

For more information on events visit https://conferencealerts.com/topic-listing.

Information about events has been compiled from different sources. Readers are advised to check correctness from the organisers

HiScan-C Mobile Mapping System