

MAPS TO DAY

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Volume 2 Issue 8 October 2020



Hyderabad clogged. (P Surendra)



Scan-to-BIM deploys 3D laser scanners on location to build a precise point cloud dataset and model, operating at speed and scale according to the needs of the job

Volume 2 Issue 8 October 2020

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Editorial

Drone has emerged as an efficient and economical platform for acquiring and processing digital images of earth. Focus of this issue is on drones. It may be a surprise for many that Drone is available in India for less than Rs 10,000.

Readers will like the report on the webinar hosted by GeoMap Society (GEMS) on “Understanding land records”. Demarcation of mutually acceptable boundary between adjacent owners seems to be the issue in surveying properties.

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INTRODUCTION TO UNMANNED AERIAL VEHICLES

ISBN : 978 93 89802 45 0

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P K GARG

Professor

Geomatics Engineering Group,
Department of Civil Engineering
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Uttarakhand, India and
Former Vice Chancellor



About the Book:

Drones/Unmanned Aerial Vehicles (UAVs) are aerial devices that can fly with a human remotely controlling them, or fly autonomously without any human intervention. The increasingly use of drones/UAVs has created a rapid evolution of payload hardware and software, multispectral, thermal and

hyperspectral sensors, and environmental sensors. However, before UAVs can be used for such real-world applications, it is necessary to understand the types of drones/UAVs, their components, sensors employed, operational methods and software needed to analyse the data and application requirements. The book is divided into eight chapters to take the reader from the foundations of UAV to active research topics in this fast developing arena. Each chapter is written in a simple language with several illustrations and tabular data to provide better understanding of the topic. Since the technology is gaining popularity world-wide, the students will find the book very useful to update their knowledge for UAV based data collection approaches.

The main key feature of this book is that it concisely covers the principles of UAV, its types and missions, hardware and software components employed in UAV, data collection methods, UAV regulatory system, applications in various fields and future research areas. The structure and character of images, and spatial & point cloud data datasets are crucial to understand their effective analysis in various applications, and develop innovative approaches. The book covers the course contents requirement of UG (civil engineering) and PG (geoinformatics) as well as computer science, mechanical engineering, electronics and communication engineering, information technology, geography, environmental science, earth science, students and research scholars, and those who have curiosity to learn about drone/UAV.

Since UAV is a multi-disciplinary tool having applications in civil engineering, resources management, disaster & rescue service, oil & gas monitoring, forestry, agriculture, goods delivery, health system, crowd management, traffic regulation, media & journalism, urban planning, infrastructure monitoring, 3D mapping, surveillance,

search & rescue, businesses etc. So the book also intends to be very useful for those who are working in UAV-based application areas.

About the Author:

Prof. P K Garg, is currently serving as Professor in Geomatics Engineering Group, Civil Engineering Department at Indian Institute of Technology (IIT) Roorkee, Uttarakhand, India. He completed B.Tech. (Civil Engineering) in 1980 and M.Tech. (Civil Engineering) in 1982 both from the University of Roorkee (now IIT Roorkee).

He is a recipient of Commonwealth Scholarship Award for doing Ph.D. from University of Bristol (UK), and Commonwealth Fellowship Award to carry out post-doctoral research work at University of Reading (UK).

He joined the Department of Civil Engineering at IIT Roorkee in 1982, and became Head of the Department in 2015, and then Vice Chancellor, Uttarakhand Technical University, Dehradun from 2015-2018. Prof. Garg has published more than 310 technical papers, undertaken 27 research projects and provided technical services to 94 consultancy projects on various aspects of Civil Engineering.

He has authored & edited three textbooks and produced two technical films on Story of Mapping. He has guided 71 M.Tech. and 27 Ph.D. Thesis.

He is a life member of 24 professional societies, out of which he is a Fellow member

Report - GeoMap Society webinar held on 09 Oct 2020

Understanding Land Records,

Key Speaker

Shri VK Agarwal, IAS (retd), Former Commr, AP Land Survey, Records & Settlement

GeoMap Society has initiated the, "Discussion Forum" using the Webinar platform. The forum will enable, 'Presentations & Discussions' by eminent and experienced persons in academic, geospatial industry, government, practitioners and policy makers. The initiation to this activity has come from Prof I V Muralikrishna. And strongly supported by Dr V Raghava swamy. This activity is supported by Centre for Applied Research (CARG), Indian National Cartographic Association (INCA), Hyderabad Chapter & Innovation, Co-Innovation Research in Geoinformatics (ICORG),Hyderabad.

The first talk in the series was delivered by Maj Gen Dr R Siva Kumar on, 'Maps & GIS Applications for National Development' on 11 September, 2020. It was decided to hold such events on every second Friday of the month at 6 pm.

The second event was held on Friday, **09 Oct 2020**. The key speaker was Shri VK Agarwal, IAS (retd), Former Commr, AP Land Survey, Records & Settlement. Prof IVM welcomed the participants. Mr. GSKumar, appreciated that the topic title and the speaker are very apt. Even after 70 years we are still trying to understand and resolve issues related to land records. Dr VRS informed that he will not be able to participate.

Salient points from the presentation and discussions are : .

Shri VK Agarwal
(points from his PP presentation)

1. Originally parcel mapping was for revenue purposes, which is no more relevant now. But certain practices introduced at that time continue.
2. In AP and Telengana, focus is on Property extent and productivity evaluation
3. Land holder register is a mother register.

4. Investor is responsible for ownership authenticity as per 1793 law.
5. Legal ownership is a matter of concern. Advocate gives an opinion. He/she writes " In my opinion, based on the documents before me....." Different advocates can give different opinions. it s not conclusive.
6. I give an example of my own. I purchased a flat with Bank loan. In course of time, loan amount was paid back. I applied for bank loan afresh, for my son's education abroad. It was rejected by three different banks on the grounds of defective title..
7. Clear Title will improve the economy of the country. I have seen in Sweden, it is easy to raise up to 70 % of the value of the property as loan.
8. Making Register of Title functional will improve the situation.
9. There are three functions in a property deal- Stamps Act, Registration Act and Transfer of ownership Rules.
10. During the time of Mr. Manmohan Singh as PM, Wadhwa report on land records was generated which recommended absolute ownership on registration (Torren's system)
11. Modernisation programme involves computerisation of grossly out-dated records. This cannot be considered progress.
12. Identification of ownership boundary on ground is an issue

Mr. MS Swamy Panelist

During 1994-95, resurveys covering about 7000 sq km was taken up using photogrammetry. Photogrammetric map plots were taken for ground verification. What was planned to be done in 6 months took two years. Main problem/issue was finalizing mutually acceptable boundaries on ground. This approach of settlement though time taking, reduces litigations.

Mr. Ch Subba Rao, Panelist

1. I was involved with many experiments. Gujarat also experimented. Some claims that every inch of land will be surveyed. are Impractical.
2. Surveying is not the solution. Surveying can be a problem as experienced in Visakhapatnam.. Surveying selectively may be an alternative. Surveying for the sake of surveying is not correct.
3. In Jubilee hills, demarcation of government lands is an issue.
4. Another issue is correlating with old surveys
5. Survey to be made compulsory before registration

Mr. KK Pappan

I have the experience of cadastral surveys in Gujarat, Telangana and other States. It is not practical to standardize a particular method of survey. Terrain-based approach.is the right method.

Maj Gen R. Siva Kumar (USA)

Latest surveys are more reliable. But farmers' acceptance is important. Other issues like datum, projection, coordinate system, etc have also to be considered.

Mr. GS Kumar

Thanked the key note speaker and other participants. He also thanked Prof IVM for good conduct of the event. He also thanked Dr Swarna Subba Rao, Dr Sasi & his wife, and a few others for joining as observers.

Cadastral survey updating and Title issues are deep-rooted and .complex. But we are moving forward. Our experiences are helping to move towards improved approaches.

Prof IVM

He expessed happiness and satisfaction for the lively discussion on the important issues related to Land Records. He commented we may continue discussion on this based on some Acts being passed shortly in the country.of 8 societies.

Urban 3D Modelling

Advanced Urban 3D Modelling and Visualization - 18/09/2020

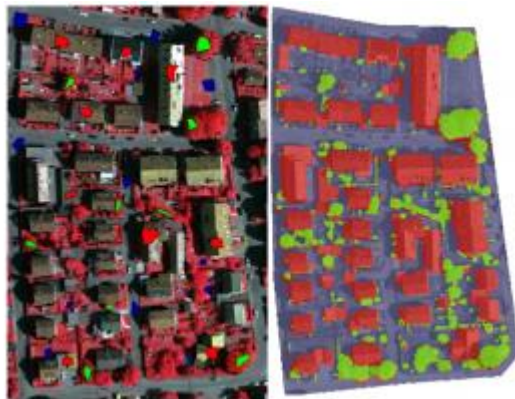
A Generic Workflow for Automatic Building Detection and 3D Modelling

Evangelos Maltezos, [Charalabos](#)

[Ioannidis](#), [Anastasios](#)

[Doulamis](#), [Konstantinos Karantzalos](#),

Nikolaos Doulamis



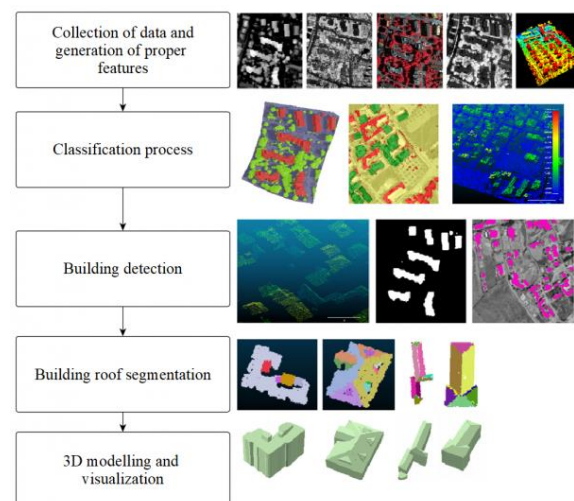
The automatic detection, data extraction, 3D modelling and visualization of buildings in urban areas using remote sensing data is an essential task in various applications such as cadastre, urban and rural planning, change detection, mapping, updating geographic information systems, monitoring, housing value and navigation. Even today, this task still remains challenging due to the inherent artefacts (e.g. shadows) in the remote sensing data used, as well as the differences in viewpoints, surrounding environment, complex shape and size of the buildings. This article outlines a generic workflow using modern technologies.

Besides the recent developments in image processing, advances in computer vision have promoted automated methods able to generate precise 3D models from overlapped multiple 2D imagery data derived from aerial platforms. Such methods apply a dense image matching (DIM) algorithm which extracts a textured

dense 3D point cloud of a region or an object of interest. DIM is an affordable process compared to other approaches that use other types of sensorial data such as Lidar. In this area, numerous robust stereo image matching algorithms have been developed, each of which has its own advantages and limitations.

A generic workflow for building detection and 3D modelling includes the following steps:

- i) collection of data and generation of proper features,
- ii) classification process,
- iii) building detection,
- iv) building roof segmentation,
- and v) 3D modelling and visualization.

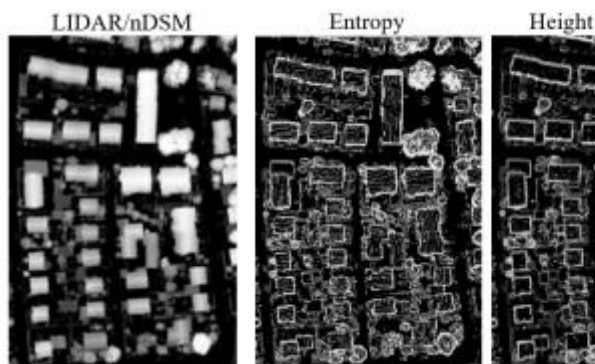


Generic workflow for building detection and 3D modelling.

Generation of Additional Features

Depending on the data source employed, building detection techniques can be classified into three groups: (i) ones that use airborne or satellite imagery data, (ii) ones that exploit three-dimensional information, and (iii) those that combine both data sources. However, the two main limitations of using information from multi-modal sources (e.g., Lidar and imagery data) are the additional cost of acquisition and processing, and the issues related to co-registration. For this reason, in real-life applications such as the cadastral ones, sometimes only one type of data is considered. To this end, several indices and features are calculated to efficiently distinguish buildings from the other urban

objects such as vegetation and ground. In this context, depending on the data used, the normalized difference vegetation index (NDVI) is calculated (when the NIR band is available in images) and the normalized digital surface model (nDSM) is calculated (when DIM or Lidar point clouds are available). However, additional features can be calculated and image-stacked, especially from Lidar point clouds, to further contribute to the classification performance. Such features come from a physical interpretation of the information, e.g. the entropy, the height variation, the planarity and the distribution of the normal vectors.



Generation of additional features from Lidar point clouds.

Classification and Building Detection

Usually, the methods of building detection are discriminated into the ones that apply a supervised machine-learning scheme and those that use a model-based approach. The main advantage of the machine learning approaches is that they are flexible and data-driven methods, requiring only training samples to successfully generalize the building properties and thus to perform an accurate classification. In contrast, model-based approaches consist of many parameters that need to be fine-tuned for each study area. Therefore, supervised learning paradigms provide higher generalization capabilities, i.e. robustness against data being outside the training set. Recently, in the context of machine learning, state-of-the-art algorithms like deep learning classifiers through convolutional neural networks (CNNs) have been efficiently applied for the building detection task.

In general, a CNN classifier has two main components: the convolutional layer and the classification layer. A convolutional layer is essentially a network feature extractor that employs convolution filters (i.e. transformations) to the input data (image-stack features). These extracted network features are able to optimize the classification performance. Spatial coherency is an important element of the transformations involved in the convolutional layer. This is an important property of a deep CNN model since spatial characteristics significantly affect building detection accuracy. The aim of the classification layer is actually a supervised learning scheme with the capability of transforming the inputs from the convolutional layer into desired outputs, i.e. the labelled classes.

Therefore, a CNN classifier, in contrast to a shallow machine learning method, first filters the input data in a way to maximize the classification accuracy and then performs the classification. The output of the CNN is a classified image on a pixel level, including information associated with the label of each class. Post-morphological processing is adopted to reduce classification noise, taking into consideration the spatial coherency property, i.e. through min operators followed by majority voting filters, etc. Finally, to evaluate the final building detection results, objective criteria are used such as the completeness, correctness and quality rates based on the TP, FP and FN entities, whereby TP stands for true positives (e.g. reference building pixels that were correctly detected), FP stands for false positives (e.g. building pixels that not exist in the reference dataset) and FN stands for false negatives (e.g. reference building pixels that were not detected).



Buildings ■ Vegeta

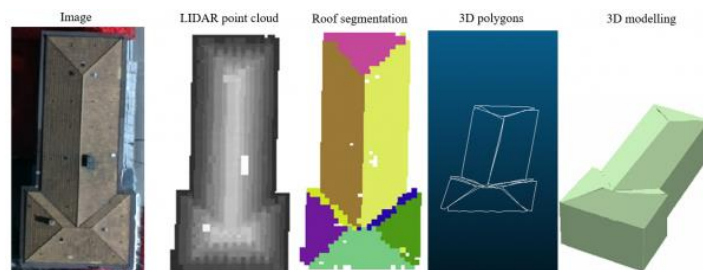
Collection of training samples for each class (left) and classification results through a CNN classifier (right).

Building Roof Segmentation and 3D

Modelling Results

The extracted building boundaries from the classification process are slightly dilated in order to clip the raw Lidar or DIM point cloud. Then, for each 3D point cloud of each building, a building roof segmentation process is carried out. The most-used plane detection techniques from 3D point clouds are region growing, RANSAC and Hough methods. In fact, adaptive point randomized Hough transform (RHT) can extract satisfactory results, satisfying greatly the accuracy vs. computational time trade-off. For each detected plane, the corresponding boundaries are extracted to generate the associated 3D polygons. Once the normalized height values of each polygon

vertex are available, the corresponding 3D building model can be extracted.



Building roof segmentation and 3D modelling.

Conclusion

Automatic building detection and 3D modelling is a continuous, essential and crucial task for a variety of applications. Modern technologies support the development of a generic workflow. Two key emerging technologies are: i) various new sensors that can provide multiple information (e.g. multi/hyperspectral Lidar point clouds), and ii) cutting-edge methods such deep machine learning schemes.

Further Reading

- Maltezos, E., Doulamis, A., Doulamis, N., Ioannidis, C., 2019. Building extraction from LIDAR Data applying deep convolutional neural networks. *IEEE Geoscience and Remote Sensing Letters (GRSL)*, Vol. 16, pp. 155-159.
 - Maltezos, E., Doulamis, N., Doulamis, A., Ioannidis, C., 2017. Deep convolutional neural networks for building extraction from orthoimages and dense image matching point clouds. *Journal of Applied Remote Sensing*, Vol. 11, 4, pp. 042620-1-042620-22.
- Last updated: 21/09/2020

Drone Regulations in India

<https://procejurelaw.co.in/2020/10/24/drone-regulations-in-india/>



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A Drone, in technical terms, is known as Unmanned Aerial Vehicle (UAV).

The Unmanned Aerial system consists of 3 elements:

1. Unmanned Aerial Vehicle
2. Ground Controller
3. System of connection between UAV and the ground controller.

A UAV is an unmanned aircraft (No human pilot onboard) which is remotely controlled by a pilot. The main components of UAV include body, sensors, actuators, power supply, software, etc.

Initially, the use of UAVs was majorly in the field of defence. But with time the use of drones extended to numerous fields like commercial, research, scientific, etc.

Applications of drones are increasing in various simple and complex tasks every day. Therefore, it is essential to regulate drone operations to ensure the safety, security, and privacy of citizens.

The Indian Government has taken prompt steps to build an ecosystem for the safe and secure development of Drone applications.

Policy Steps were taken By Government of India

Civil Aviation Requirements 1.0[1]

The Office of the Director-General of Civil Aviation of Government of

India issued CIVIL AVIATION REQUIREMENTS SECTION 3 – AIR TRANSPORT SERIES X PART I (CAR) on 27th August 2018.

These requirements are also known as Requirements for Operation of Civil Remotely Piloted Aircraft System (RPAS). The Ministry of Civil Aviation of Government of India (MCA) launched Digital Sky[2], an online platform for registration of drones.

CAR 1.0 focuses on VLOS (Visual Line of Sight) operations.

CAR regulates the following affairs

1. Issuing an Unmanned Aircraft Operator Permit (UAOP)
2. Issuing a Unique Identification Number (UIN)
3. Other operational requirements for civil Remotely Piloted Aircraft System (RPAS)

Categorization of RPA

CAR has categorized the RPA's into 5 categories:

1. Nano RPA – Less than or equal to 250 grams.
2. Micro RPA – Greater than 250 grams and less than or equal to 2 kg.
3. Small RPA – Greater than 2 kg and less than or equal to 25 kg.
4. Medium RPA – Greater than 25 kg and less than or equal to 150 kg.
5. Large RPA – Greater than 150 kg.

Procedure to Apply

Every RPA except the following will need UIN

- Nano category intended to fly up to 50 feet (15 m).
- Owned/operated by NTRO, ARC, and Central Intelligence Agencies

UIN will be granted to those RPAs which are owned by the following entities:

1. A citizen of India
2. Central and State Government or any other entities owned
3. Companies or Corporate bodies which
4. Have registered office or place of business in India
5. Have a Chairman and at least two-thirds of the directors are Indian citizens.
6. Or dominant ownership and effective control rests in India
7. UIN number can also be granted to RPAs which are owned by the Companies which are not registered in India but have leased it from the Company or Corporate bodies mentioned above.

The UIN application has to be submitted through the Digital Sky platform to the DGCA.

Documents Required for Issuing UIN

1. Contact details of Owner/Lessee(CIN, GSTIN, PAN card)
2. Purpose of operation
3. Base of operation
4. Specifications of UAS
5. Certificate of Compliance from the manufacturer for No Permission No Takeoff (NPNT)
6. Operating Manual from the manufacturer
7. Maintenance guidelines for UAS from the manufacturer
8. Equipment Type Approval(ETA) from the Wireless Planning & Coordination(WPC) of the Ministry of communication, Government of India
9. Security clearance from the Ministry of Home Affairs, Government of India

Requirements for issuing UAOP

Every Civil RPA operator shall need UAOP except those using following RPAs

1. Nano RPA
2. Micro RPA, but it is mandatory to intimate the local police 24 hours before the operations.
3. Any RPA owned or administered by NTRO, ARC, and Central Intelligence Agencies. The agencies shall also have to intimate the local police and concerned ATS units.

Documents required for Issuing UAOP

Standard Operating Procedure (SOP) mentioned under Para 12 of the CAR 1.0

1. Permission of the land/property owner used for the landing and takeoff of the RPAs
2. Details of the remote pilot along with the Identity Proofs
3. Required security clearance from the MHA

4. Security program approved by the Bureau of Civil Aviation Security (BCAS)
5. Insurance details The UAOP is only valid for 5 years.
2. Radio Telephony techniques
3. Knowledge of principles of flight and aerodynamics
4. Aviation Meteorology

Safety Provisions

The Pilot/Operator is accountable for the custody, security, and control of the RPAs. The operator must notify the loss of RPA to the Director of Air Safety and the DGCA(except nano RPA). The operator also has to notify to the DGCA for the cancellation of UIN, in case of any irreparable damage to the RPA. Any registered RPA (having UIN) cannot be sold or dumped without taking permission from DGCA.

Training Requirements

To ensure the overall safety of people and property, CAR 1.0 specifies certain requirements to operate the RPA.

Basic requirements include:

1. Remote pilots should have attained 18 years of age
2. Remote should have passed 10th Std in English

Technical requirements include:

The remote pilot should undergo a ground training program at any Flying Training Organization (FTO), approved by DGCA.

The DGCA has also specified some theory subjects to be studied during the training program. They include basics of:

1. Air Traffic Control (ATC) procedures and flight planning

Drone Ecosystem Policy Roadmap[3]

MCA also released a Drone Ecosystem Policy Roadmap at Global Aviation Summit 2019, held in January 2019 (Drone Policy 2.0).

Drone Policy 2.0 focuses on the following aspects:

1. To expand the operations of CAR to BVLOS(Beyond Visual Line of Sight)
2. To define and expand segregated airspace to avoid the UAS operations in non-segregated airspace(Airspace for manned aircraft operations)
3. Principles of airworthiness can be introduced to achieve safety, security, and privacy by improving design parameters.
4. To develop drone ports to facilitate take-off and landing of UAS.
5. To promote Make in India Initiative by allowing 100% FDI in commercial drone services.
6. To introduce advanced pilot training practices to meet the standards set by CAR 2.0.
7. To improve the freight capabilities of commercial UAS operations.
8. To enable operators to have professional liability insurance
9. To allow the use of algorithms, if it does not affect privacy, security, and safety in operations.
10. To devise a UAS Traffic Management system for managing the traffic generated by UAS.

National Counter Rogue Drone Guidelines[4]

On 18th October 2019, the Ministry of Civil Aviation published the National Counter

Rogue Drone Guidelines 2019 (NCRD Guidelines).

The main objectives of the NCRD Guidelines were:

1. To assess the threat of drones to the safety and security of citizens by laying down drone threat regulations.
2. To explore technologies capable of handling drone threats.
3. To understand the extent of the drone threats.

The NCRD guidelines aimed at developing various anti rogue drone measures to manage drone threats effectively. It laid out a plan for the deployment of counter rogue drones(C-UAS) for the protection of vital assets.

Voluntary Disclosure Scheme for non-compliant Drones[5]

On January 13, 2020, the MCA released a public notice providing an opportunity of voluntary disclosure of all unregulated drones including models, prototypes, toys, RPAs, automated and radio-controlled drones.

According to this scheme, the data of such non-compliant drones were to be submitted digitally through an online portal named “Digital Sky”.

The Disclosure scheme included updating 2 types of information

1. Information related to the owner of the drone for issuing Ownership Acknowledgement Number (OAN).
2. Information related to the drone for issuing Drone Acknowledgement Number (DAN).

The voluntary disclosure scheme was only valid up to 5 PM on January 31, 2020.

Draft UAS Rules 2020[6]

On 2nd June 2020, the Ministry of Civil Aviation released the Draft UAS Rules 2020. These Rules are a next step of the Indian legislature in regulating the Drone operations as it not only specifies the general rules on functioning and controlling the Drone but also specifies rules on the other unregulated issues. As the Drone industry is evolving in India, these regulations shall play a vital role in ensuring better development by providing a foundation for the drone industry.

Part 4 of these Draft UAS Rules state distinct rules on import, manufacture, and maintenance of UAS.

The new draft rules provide for an authorization number for the following

1. UAS Importer
2. UAS Manufacturer
3. UAS Trader
4. UAS Owner
5. UAS Operator

This widens the scope of regulations, as now the import, trade, and manufacture of drones get regulated too.

As proposed in the drone policy 2.0, Part VII of the Draft UAS Rules specifies regulations on Drone ports. No Drone port can operate unless it is licensed or has been authorized by the Director-General. Without a license or authorization, a drone port cannot be used for arrival, departure, surface movement, and associated maintenance or commercial activities.

The Draft rules 2020 also provide for penalties for violations of the regulations.

Schedule 12 of the draft rules 2020 specifies 2 categories of penalties. Category 1 includes penalties of imprisonment up to 2 years and fine up to 1 lakh rupees. Category 2 includes penalties for imprisonment up to 6 months and fine up to 50 thousand rupees.

[1] CIVIL AVIATION REQUIREMENTS SECTION 3 – AIR TRANSPORT SERIES X PART I (CAR) <https://urbantransportnews.com/wp-content/uploads/2018/08/Govt.-of-India-Drone-Policy-2018-Guidelines-for-Operation-of-Civil-Remotely-Piloted-Aircraft.pdf>

[2] Digital Sky
– <https://digitalsky.dgca.gov.in/>

[3] Drone Ecosystem Policy Roadmap – <https://www.globalaviationsummit.in/documents/DRONE-ECOSYSTEM-POLICY-ROADMAP.pdf>

[4] National Counter Rogue Drone Guidelines- <https://www.civilaviation.gov.in/?q=en/documents/guidelines>

[5] Voluntary Disclosure Scheme –(Public Notice) – [https://www.civilaviation.gov.in/sites/default/files/Drone Registration Public Notice 13012020.pdf](https://www.civilaviation.gov.in/sites/default/files/Drone%20Registration%20Public%20Notice%2013012020.pdf)

[6] Draft UAS Rules 2020
– [https://www.civilaviation.gov.in/sites/default/files/Draft UAS Rules 2020.pdf](https://www.civilaviation.gov.in/sites/default/files/Draft%20UAS%20Rules%202020.pdf)

Develop Drones- Defence Ministry Challenge

Defence Ministry announces startup challenge to develop drones, AI-based satellite image analysis

- **Soumyarendra Barik**
 - By Soumyarendra Barik ([@imsoumyarendra](https://www.instagram.com/imsoumyarendra) soumyarendra@medianama.com) September 30, 2020
 - The Defence Ministry **launched** a startup challenge to build solutions around underwater drones and AI-based satellite image analysis, among other things. The challenge — Defence India Startup Challenge 4 — was announced at the Innovations for Defence Excellence (iDEX) event on Tuesday, and selected startups and MSMEs stand to win a grant of ₹1.5 crores, in tranches, to develop their solution. Interested startups can submit their applications at idxdio@ddpmod.gov.in until November 30. Last month, India had placed a **ban on importing fixed-wing mini drones** for military purposes from December 2020.
 - This is the fourth in a series of startup challenges, organised by iDEX, which was first **launched** in 2018 to help develop technology-based solutions for the defence sector, by offering startups and MSMEs building those solutions, grants and funds. iDEX is funded and managed by a Defence Innovation Organization (DIO), a non-profit company, set up by defence undertakings Hindustan Aeronautics Limited and Bharat Electronics.

The solutions that are to be built as part of DISC 4:

- Autonomous underwater swarm drones
- AI-based satellite image analysis
- Predictive, preventive and prescriptive machine monitoring

- Super resolution for improving spatial resolution
- Prediction and forecasting of atmospheric visibility
- Computer generated targets for virtual training
- Remote real-time in-flight health monitoring of aircrew
- Foliage penetration radar
- Reduction of RCS (radar cross-section) of naval warships
- Target detection in chaff environment (a radio-frequency countermeasure released by military aircraft)
- MF-TDMA (Multi-frequency time-division multiple access) based wideband SATCOM modem

As per iDEX's website, the drones should be equipped with advanced image processing and Artificial Intelligence capabilities, and should be able to detect underwater mines. The AI-based satellite image analysis will be used for target identification and classification along with recognition of various spatial parameters and troop movements. The Defence Ministry also launched a set of guidelines to monitor product development milestones achieved by iDEX winners.

"In order to further strengthen our defence system and make it self-reliant the participation of private sector is also crucial. For this we have taken certain steps like partnerships with private sector, technology transfer, 74 % FDI through automatic route and the recently released negative list of 101 items for import ban after a stipulated period," Defence Minister Rajnath Singh said.

Aside from this, the Ministry also announced an initiative where defence personnel will be able to submit their own tech-related solutions. Called iDEX4Fauji, the initiative aims to support innovations identified by members of the armed forces "There are more than 13 Lakh service personnel working in the field and on borders, handling extreme conditions and

equipment and would be having many ideas and innovations to improve such equipment. There was no mechanism to support such innovations. iDEX4Fauji would open this window and allow our Faujis [soldiers] to become part of the innovation process and get recognised and rewarded. Services Headquarters will provide support to the soldiers & field formations all over the country to ensure maximum participation," the Defence Ministry said in a statement.

Drones and Prices

<https://www.top10drones.co/in/review/drone-720-x>

DRONEX PRO ₹ 7,089

- Precision Flight Performance Technology
- Ultra HD Wide Angle Camera
- Steady Hovering
- Intuitive Controls
- 3 Speeds For Different Skill Levels
- Foldable, Pocket-Size Design

Main Features

Since DroneX Pro is small in size and was made with a focus on simplicity, it might create a wrong impression of being just "a toy" for kids. However, as soon as we started testing, all of these concerns faded away. DroneX Pro comes with a Ultra HD rotating camera with 120° wide-angle lens that "broadens your vision" and provides a pretty cool vibe to your footage - image and video quality easily competes with those high-class expensive drones and doesn't disappoint. Another feature that we really enjoyed was flight tracking — by simply drawing a path using a smartphone (any of them works with DroneX Pro), we were able to plan the flight trajectory in

advance and it was pretty fun yet accurate. If we had to choose something to improve in DroneX Pro, that would be the flight time which is up to 10 minutes. However, most of the drones in this price range offer more or less similar flight time, so it's not something that outweighs the advantages DroneX Pro has to bring. This drone also features headless mode that allows you to change direction any time you want, different speed modes, WIFI connection to stream your adventures live, and some pre-installed tricks, such as 360° flips and rolls, that make this whole experience feel and look professional even if you're trying it for the first time.

Portability and Design

The first thing that you notice after unpacking DroneX Pro is how solid this drone feels in your hands. It is almost a surprise that such a low-priced drone could bring the feeling of extreme durability that usually comes with those bulky, expensive devices. The main reason behind this is ABS plastic that makes DroneX Pro much lighter yet stronger than its competitors. Another great thing about this drone is its portability — thanks to its foldable rotors, DroneX Pro becomes hardly bigger than a regular smartphone and could easily fit into the pocket or any bag you carry on a daily basis.

Ease of Use

One of the main purposes of this drone was to make it super easy to use for anyone, and we can confirm that the creators of DroneX Pro succeeded to serve this purpose. We noticed this at the set up already — you don't need to have any special knowledge to make this drone work. All we did was charge the battery (it was empty, but if it's full — one less thing for you to do!), download and install an app by simply scanning the QR code in the manual, and we were able to take off in seconds! It is actually possible at a push of one button. Another thing and this is actually what impressed us the most, are

DroneX Pro's intuitive controls and its steady hovering capability that allow you to capture some professional footage already on your first flight!

Value

Of course, the price is not the least important thing when talking about drones because, let's be honest, finding a quality device that meets all your needs and doesn't exceed your budget might sometimes seem impossible. Although the performance of DroneX Pro was pretty close to some of the high-class drones we've tried in the past, its price was nowhere near those — selling slightly under 7,100 ₹, DroneX Pro holds the most valuable features of any professional drone and doesn't disappoint with the results, too. Totally worth the money, if you ask us!

How to get DroneX Pro?

It's as simple as flying the drone itself! Also, you're in luck since it's now available 50% OFF! Follow these steps to purchase this incredible device while the offer still stands:

1. Visit [the official website](#)
2. Select the offer
3. Fill your shipping information and payment method
4. Start taking stunning pictures!

Aarav Ghosh

October 25, 2020

I've bought DroneX Pro for my son since he wanted to learn how to fly a drone, and I thought this one might work well for a beginner. I've been flying drones for a while and was really curious about DroneX Pro's features. We were both pleasantly surprised during the first flight already! It literally took only minutes to get used to it, and it was very exciting for both of us,

despite the fact that I've been doing it for years. Great drone, totally recommend!

Tactic Air Drone ₹ 7,089

- HD Resolution Wide-Angle Camera
- Anti-Collision System
- Foldable, Compact Design
- Intelligent Gesture Control
- Good Flight Time
- Follow Me Mode

Pam (comment) *October 25, 2020*

- I'd say it's an amazing gadget for both beginners and pro users. Many built-in features make Tactic Air Drone easy and interesting to pilot, and the footage you get with that 4K camera is more than I've actually expected. Didn't disappoint!

DRONE 720X ₹ 7,009

- 720p HD Camera
- 80km/h Speed Limit
- 70m Control Range
- Easy To Operate
- Live Audio Streaming
- Altitude Control
- 20p HD Camera
- 80km/h Speed Limit
- 70m Control Range
- Easy To Operate
- Live Audio Streaming
- Altitude Control

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Overview



RACURS, Russia

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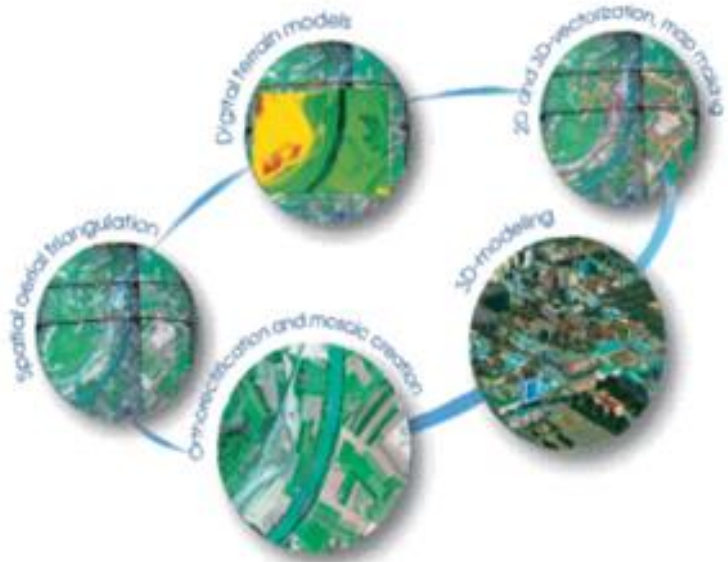
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General questions: info@racurs.ru

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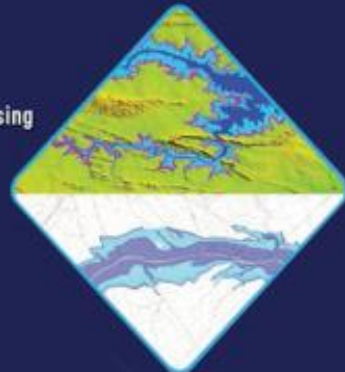
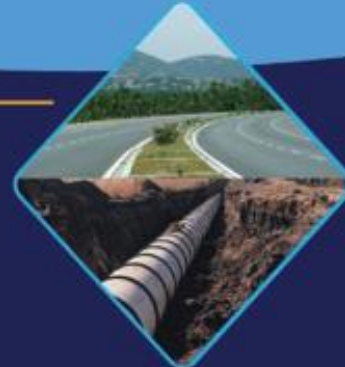


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