ARUNACHAL PRADESH DRONE FRAMEWORK AND ACTION PLAN ROADMAP 2022

State Remote Sensing Application Centre
Government of Arunachal Pradesh
Itanagar

INDEX

FORESIGHT:

The world is moving in to The Fourth industrial Revolution -the digital revolution and for India, it brings tremendous opportunities to leapfrog many stages of development. The Arunachal Pradesh State is poised to leverage the emerging technologies not just to leap frog but to vault to a new era of transformation by framing new policies to enable the ecosystems or these technologies to flourish.

While technologies such as AI, blockchain and cloud are being adopted by the state, it also realizes the potential of Unmanned Aircraft Vehicles (UAVs), commonly referred to as drones, and is working towards democratizing the sky and enabling new participants in aviation. Drones are evolving beyond their military origin, they've moved to the consumer market and are currently being used in commercial and civil government applications that span sectors and industries ranging from construction, agriculture, healthcare, police, insurance, to journalism and cinematography.

The global market for drones is projected to be $100 billion by 2021 and the fastest growth opportunity would be from Government and business spends amounting to about $13 billion. The usage of drone and its technology is spread out across sectors and industries ranging from construction, agriculture, healthcare, police, insurance, to journalism and cinematography. The Indian UAV market is expected to reach nearly 4% of the global market. With 22.5% of the world's UAV imports, India tops the list of drone-importing countries.2

Further, with the Director General Of Civil Aviation (DGCA) issuing the regulations, India has the opportunity to become a global leader in drones and Arunachal Pradesh, is looking at tapping this opportunity by bringing in a policy that enables the drone industry to grow and improve service delivery to the citizens, demonstrating the use of technology for societal benefit.

VISION:

The Government of Arunachal Pradesh understands the potential of drone industry and realizes that the government will have to play the role of catalyst in developing the ecosystem that will enable the drone companies to flourish in the state. The state envisions to create:

To provide a drone ecosystem environment that will accelerate the economic growth in the State of Arunachal Pradesh creating opportunities.

A drone ecosystem built on the strong foundations of an encouraging policy, robust infrastructure, research & development, and market access would enable and encourage the use of drones, which in turn leads to creation of employment opportunities and economic prosperity in the State of Arunachal Pradesh.

IMPLEMENTING AGENCY:

State Remote Sensing Application Centre (SRSAC), an autonomous body under Department of Science and Technology, Govt. of Arunachal Pradesh shall be the nodal agency for implementation of drone technology and providing related drone services in the state of Arunachal Pradesh, as the Centre is already a notified agency for Remote Sensing and Space technology, etc.

The SRSAC shall see the implementation of the said policy and also develop platform for building skilled manpower for overall growth and development of the State by providing necessary infrastructure for the growth of Drone ecosystem in the State.

The SRSAC shall also from time to time evaluate the policy and may update the policy as required.

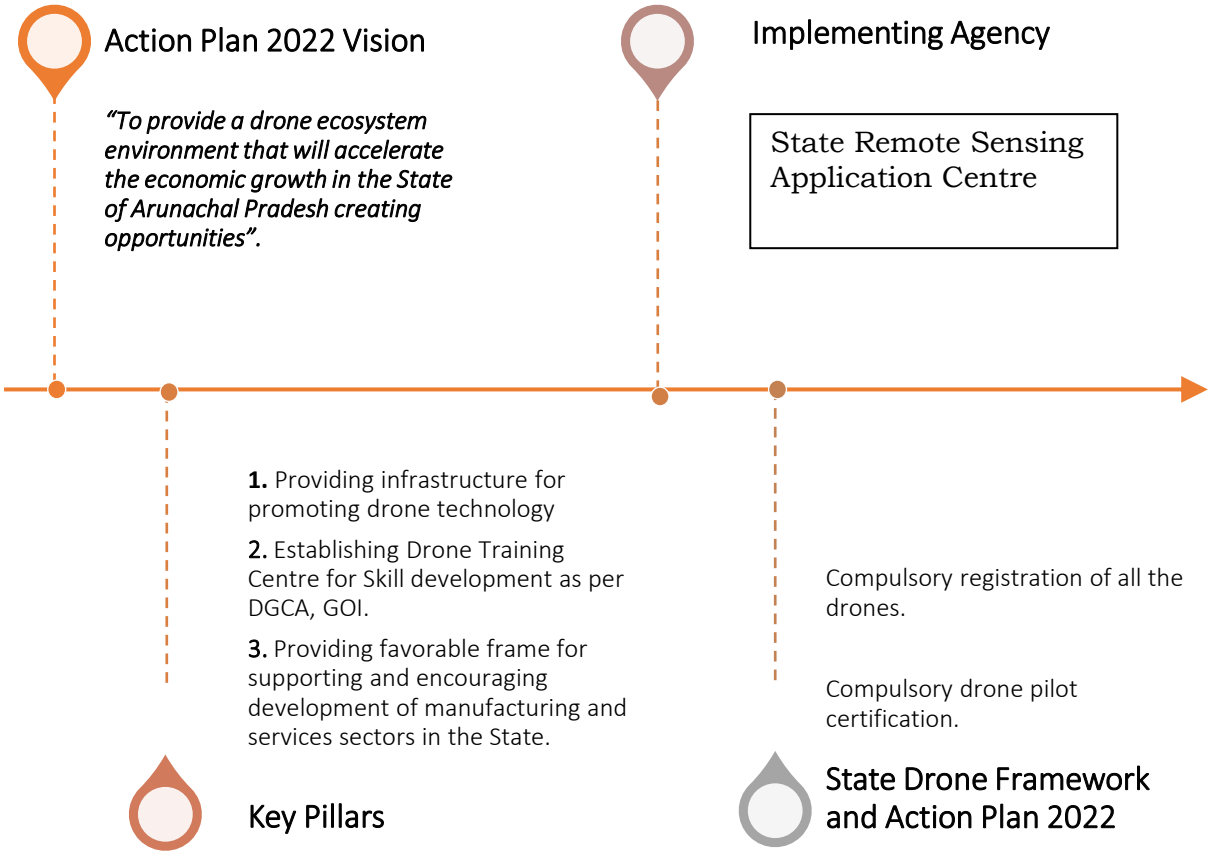
For promotion of Drone Technology and its allied services in the state, SRSAC shall develop a Centre of Excellence for Drone technology.

LEVERAGING DRONE TECHNOLOGY FOR ARUNACHAL PRADESH:

Arunachal Pradesh is a geographically diverse state with a majority of its population residing in rural areas, some of which are remote or hard to access. Thus, at a times, they deprived of essential services. Drone technology can be used to substantially impact public delivery and governance, improving vital indicators across all fields.

Some of the key sectors where drones can be effectively deployed by the government are discussed in the following sections.

Key points of Arunachal Pradesh State Drone Framework (APSDF) and Action Plan 2022:



KEY PILLARS:

The goal of this framework and action plan is to strike a balance between drone usage and regulations that ultimately result in the increase of economic activity due to usage of drones. The policy strives to achieve this goal by providing an environment that encourages and supports the usage of drones for greater public good and providing necessary resources for increasing the talent pool to address the various roles arising out of drone usage, from assembling of the drones to processing of the data acquired. The presence of a drone friendly policy and environment, supported by a pool of technical resources, is believed will lead to the establishment of drone manufacturing companies. This policy is the first step towards that endeavor and is based around three key pillars:

Infrastructure
Space for promoting drone technology

Skill Development
Training Centre

Incentives
Drone manufacturers Service providers

INITIATIVES:

SRSAC Drone Training Institute through State Drone Excellence Centre: While there are a wide range of potential applications, the focus areas for the government are agriculture, energy, Land Management, Forestry, municipal administration, mining, irrigation and public safety. The Government shall set up a State Drone Excellence Centre and a Drone Institute that will help government departments in procuring services from drone service providers in the following ways:

- Empanel vendors so that each department will not have to go through the RFP process
- Identify use cases or services relevant to the departments
- Enter in to framework agreements with vendors on prices, SLAs
- Undertake capacity building programs for government officials

Arunachal Pradesh government understands that since the drone industry in India is ready to take off, there will be a huge talent demand. The skill development needs to be developed through intensive training programs, developing educational curriculum and investing in research. The government plans to:

- Collaborate with Atal Innovation Mission to impart drone knowledge and skills to school students. Introduce drone technology modules and provide firsthand experience to the school students and support ATL initiative with teacher training sessions.

- Engage with TASK and introduce drone training modules in technical institutes to focus on skill sets required to make graduate students industry-ready. The modules will be created in collaboration with the industry and as per the DGCA guidelines. It will cover pre-flight, in-flight and post flight modules. Also, collaborate with government institutes to provide facility for practical training of students.

- Encourage the development of specific domain-led programs for specific requirements like aerial photography, surveillance, remote sensing etc. These domain-led programs will help develop a freelancing ecosystem. Government will provide incentives to the drone academies to create these specific modules.

- Collaborate with leading technological universities to create specialized courses on drone engineering so that the drone manufacturers can scout drone design engineers directly from colleges.

- Fund drone engineering research in leading technical universities through a public-private partnership model.

POTENTIALS OF UAVs APPLICATIONS:

In the previous section the paper briefly touched upon the current UAS applications in India and how various government bodies in India have adopted the usage of UASs.

This section talks about the key drivers of the UAS market in India. Later, the paper discusses applications in some specific industries where UASs can be leveraged for potential benefits in these industries.

As seen in previous sections, there is an increasing trend of adopting UAS technology across industries both in India and abroad. And there are multiple drivers driving the adoption of UAS for civil and industrial applications.

Ability to reduce costs of compliance

- Reduces costs of compliance due to its ability to provide aerial visibility
- Applications have been largely driven by video monitoring and surveillance to ensure compliance, for instance, Tata Steel began using drones for their mines in 2016
- Industry applications would become broad based when the regulations are clear.

Reducing cost of technology and easy accessibility

- Easy accessibility to UAVs and reducing cost of UAVs have made this an "interesting" opportunity
- Technology driving industrial applications are fairly mature. For example, technologies like 3D modeling have stabilized
- Smaller players are realizing the potential and have built capabilities across industries

Quality and scope of information

- The quality of information that we extract from deploying a UAS is immense
- Using a UAS system opens a wide scope of applications which may not have been possible before in the same time period, for example, surveying a large piece of land

However, most applications of UAS are focusing only on providing surveillance services or real time monitoring of assets. There is a sweet spot for UASs where the business potential of UASs usage is significantly higher than traditional methods.

Enable real time monitoring:

- Typically the most common use of UASs
- Monitoring difficult to access areas like chimney stacks etc.
- Not very amenable to drive analytics as it would require on the edge high computing power to process information in real time
- Limited by scalability; monitoring real time video feed over thousands of cameras without video analytics is a difficult task

Manage geographic spread

- Enable productivity and scalability to manage, monitor and survey assets over a wide geographic spread (e.g., monitoring transformers for utility companies, pipeline monitoring)

Establish a golden record:

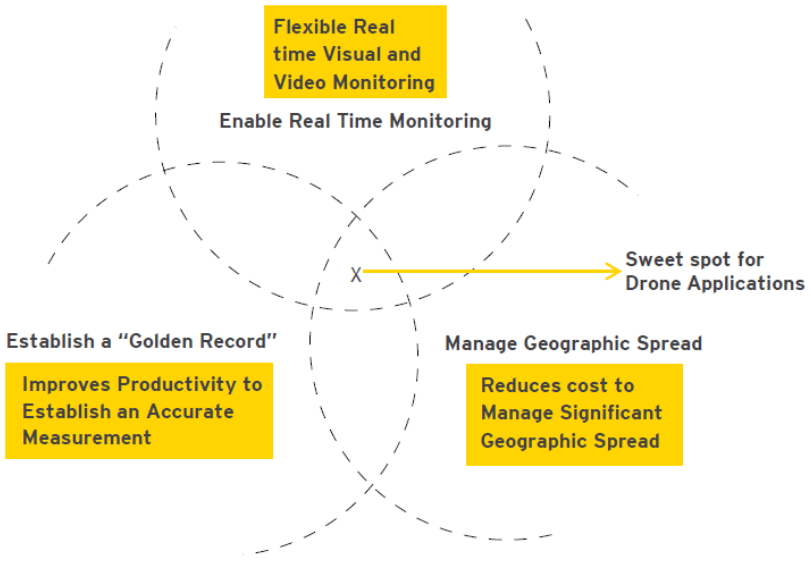
- Enables work measurement and work certification remotely and accurately (e.g., Site Audits, Civil Surveys and Measurement)
- Improves measurement accuracy and enhanced visualization (e.g., Site Surveys and Measurement, Construction progress)
- Generates 3D Digital Model for visualization and measurement

Application of Drones

UAVs, one of the most important component of the UASs, is just a platform or a medium to collect data. Leveraging other emerging technologies like Augmented Reality, Virtual Reality, Artificial Intelligence, 3D modelling and Internet of Things can enhance the output and insights that we draw from the data collected through UASs. There is a natural synergy between these technologies which complement each other when coupled with UASs to offer a rich output to the data. For example, we can stream the camera feed over the internet from the UAS to a VR headset in real time to offer an enhanced experience to the user.

The placemat on the next page explores some of the potential applications of these technologies when coupled with UASs across five key industries; Power and Utility, Agriculture, Highways, Mining and Railways. The bottom of the placemat briefly introduces these emerging technologies.

In this section, we will deep dive into each of these industries to explore the applications of UASs across different functions within each industry and how UASs along with emerging technologies can enhance the output and insights that can be drawn from such systems along with some examples from the industry.



IMPLEMENTING OF DRONE ROADMAP:

Implementation of drone technology requires an inclusive and collaborative approach that involves aspects like governance, strategic planning, security, regulation and proper awareness. Successful implementation requires participation from various stakeholders.

Action plan

This suggested action plan will help governments to fundamentally transform and address key problems through the use of drone technology in a cost-effective way and to deliver high-quality solutions.

Setting the vision

It is essential to define a clear vision for the use of drone technology to achieve the desired transformation. For this, coherent articulation of the present scenario with details on the key problems faced by various departments and the requirements that need to be addressed is necessary. Strong commitment from organizational leaders along with a high-quality project team, is imperative to generate actionable insights from the use of drones for driving key decisions.

Need assessment

An effective need-based assessment of the current scenario has to be undertaken before the adoption of such a project. This will involve (a) conducting consultative discussions with various stakeholders to develop a detailed understanding of the problems and requirements of various departments to identify specific use cases for drone implementation and (b) identifying the best practices in the industry that need to be incorporated prior to project initiation.

Project planning

It is essential to understand the technology carefully before implementing the project. A future-oriented view must be taken to

ensure that issues such as budget for maintenance, technology upgrade and scalability are deliberated well in advance.

Project management

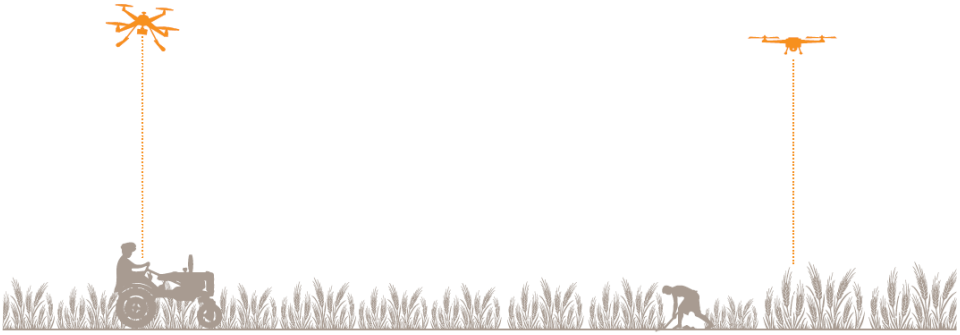
To ensure successful implementation of the project, it is essential that the selected vendor and system integrator (SI) are properly on-boarded. The project expectations and timelines must be pre-defined and clearly communicated to ensure that project objectives are met timely as per the identified use cases

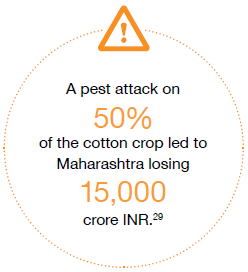
USE CASES OF DRONE TECHNOLOGY IN VARIOUS FIELDS

Due to ease of operations, limited human intervention and accuracy of results generated, drones have widespread applications. They are currently being used across the world for bringing transformational changes in the fields of agriculture, urban planning, disaster management, infrastructure, transport, surveillance, mining, forestry and many others. Some of the use cases are mentioned below:

1. Agriculture and allied:

The agriculture sector in the country is plagued by issues of plateauing yield, imbalanced use of fertilisers, over-exploitation of groundwater and improper irrigation. Besides this, crop diseases, pest attacks and degradation of soil fertility further reduce the agricultural output. Lack of mechanization for timely detection of these issues and course correction, farmers often suffer significant losses, which severely affects their already low purchasing power





- **Crop health monitoring**
  Routine surveillance using high-resolution, geo-referenced, ortho-mosaic 2D maps, spectral imagery and visual imagery can be used to capture the growth cycle and assess crop health to detect any potential problems swiftly as well as to assess damage and contain crop losses. Site-specific crop damage reports can be generated for appropriate action. This will help governments to ascertain an appropriate compensation plan for farmers.

- **Soil health assessment:**

  Soil quality can be monitored using parameters such as soil moisture through remote sensing, which can help develop fertility maps, and consequently assist in planning for more optimal crop rotation or irrigation.

- **Improved resource utilization**

  Ascertaining areas within a field that are most fertile or those that require additional water/fertilizers or chemicals can help farmers to optimize their resource utilization.

  These limited resources can accordingly be deployed in different parts of the field in different quantities.

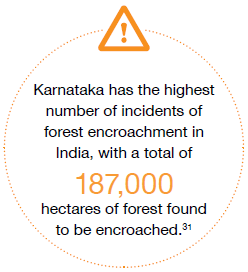
2. Urban Development:

- **City survey**

  Geo-referenced, ortho-mosaic maps processed from high-resolution aerial images can be deployed for land use monitoring and mapping to ascertain wet lands or kharab lands. Illegal land encroachment can also be detected in this way.

- **Improved urban planning**

  Increased visibility of developmental and expansion activities with accurate alignment of roads, canals and drains can assist in urban planning. Moreover, digital elevation models help in understanding terrain stability while planning highways or residential ventures.



- **Project monitoring**

  Thorough inspection and monitoring of construction projects for bridges, buildings, telecom towers, etc., can be undertaken to assess their delivery status, and plan any corrective action if required.

- **Project quality assessment**

  Thermal imagery, 3D virtual models and videography can help to ascertain the stability of critical structures built, while time-lapse records can help analyze planned work versus executed work.

3. Traffic Management and Homeland Security:

- **Road surface condition monitoring**

  Roads with heavy traffic movement can be routinely inspected to identify potholes or waterlogged areas, which often lead to accidents. For example, a drone can monitor the Delhi-Chandigarh or Bengaluru-Mysuru highway and provide a quarterly report on road condition. This data can be used by the Public Works Department for tendering maintenance contracts.

- **Improved traffic management**

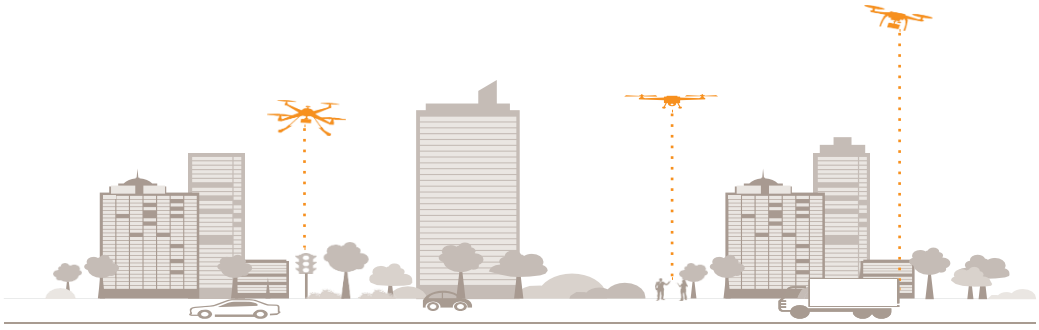
  City traffic maps can be created to get real-time information on traffic jams, accidents, etc., which will help in planning appropriate diversions to decongest specific areas. Furthermore, video analytics is expected to drive decision making and assist in traffic management and route planning.

Potholes killed
11,386
people between 2013–16.[32]

- **Traffic feedback**

  Real-time information on both vehicular and pedestrian traffic movement and congestion will enable evidence- based decisions on new roadway constructions, traffic signal requirements, pedestrian signal requirements, etc.

Traffic in Whitefield, Bengaluru, and ORR costs the IT industry
22,000
crore INR/year. As a result, companies are considering relocating outside the city.[33]



- **Real-time surveillance**

  Crowd monitoring can be done at public events such as political rallies, concerts, and exhibitions, and during religious festivities for identification of any suspicious or potentially unsafe activities or situations.

- **Security planning**

  3D models can be constructed for a location to conduct safety planning, identify traffic diversion routes and map deployment of security personnel across the area

4. Forest and Wildlife:

Wildlife conservation

Poaching and illegal trade can be curbed through round- the-clock monitoring of threatened species in national parks (e.g. Bandipur, Ranthambore).

Over
1,00,000
forest fires were reported in India between 2011–16, with over
54%
of forest area prone to fires.[34]

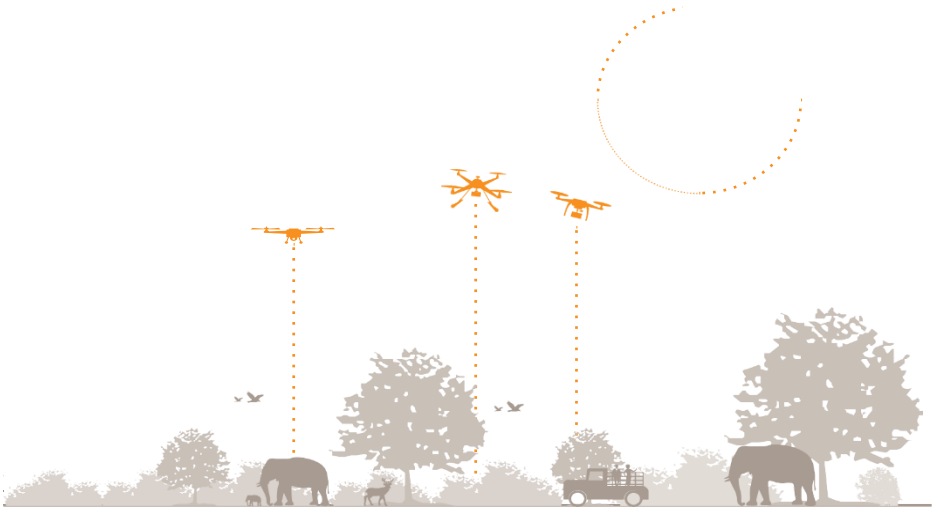
India accounted for
30%
of the world's tiger seizures between 2000–2015.[35]

- **Managing human-wildlife conflict**

Regular surveillance of both protected and unprotected forest areas for wildlife movement will reduce the possibility of human and wildlife conflict.

- **Forest protection**

Heat maps generated through thermal sensors can detect forest fires, while time-lapse studies of forest cover can highlight deforestation, afforestation and encroachment.



5. Healthcare:

Some of the challenges that plague the healthcare space include establishing and maintaining the right infrastructure, ensuring a robust public health delivery system for all citizens, ability to actively manage disease programmes using high-quality data for scientific decision making, and maintaining the general well-being of citizens by offering a clean and healthy environment.

- **Epidemic control**

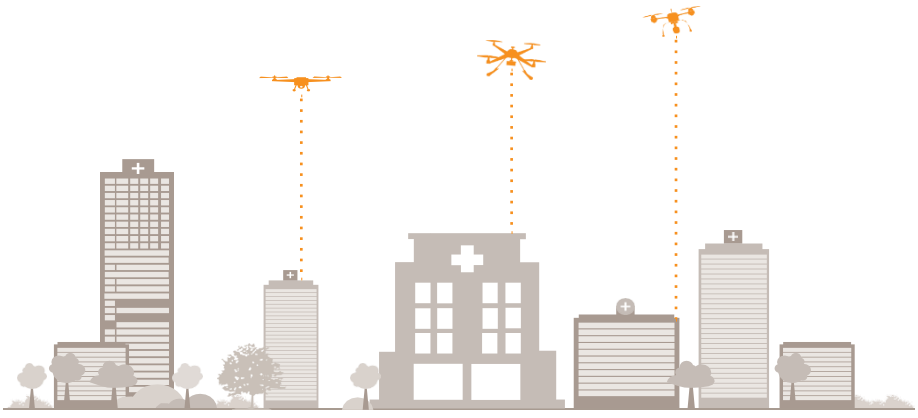
  Thermal imaging, combined with topographic, weather and population density data, can help in developing heat maps to ascertain breeding zones for mosquitoes carrying dengue, malaria, chikungunya, etc.

- **Cleanliness and hygiene**

  Information on exposed garbage piles, open drains and sewers, dead animals on roads, etc., can be captured and used to control health hazards.

- **Healthcare delivery**

  India, with its varied topography from hills to dense forests to marshy river deltas, can use drones for timely delivery of essential medicines, test kits and vaccines to these hard-to-reach areas.



6. Mining:

- Mineral Scouting

  Visual, hyperspectral and thermal sensors assist in mineral scouting for type of mineral available and the location.
  They also help in quantity estimation of mineral extraction.

- Managing encroachment

  Routine monitoring can help detect mine boundary violations and check the activities of the illegal sand mafia.

- Contract monitoring

  Mining contracts, based on volume of minerals extracted, can be monitored using aerial photos taken at separate time intervals for effective enforcement and implementation

7. Disaster Management:

- Real-time surveillance

  High-resolution live video feed of disaster-struck areas can be used to create 3D models for efficient decision making.

- Search and rescue

  Heat maps can be generated to determine the exact locations of survivors and livestock for effective rescue operations.

- Delivery of essential goods

  In hard-to-reach disaster-struck areas, food supplies, water, medicines, etc., can be dropped quickly without endangering more human lives. This will also result in

8. Tourism:

- Tourism marketing

  A high-resolution 360-degree view of tourist locations allows for virtual reality tours to generate interest in tourist sites.

- Asset monitoring

  Monitoring public assets and ensuring cleanliness of heritage sites such

as the Itafort, Tawang Monastery and Geyar Sinyik using real-time videography and penalties for violators will help prevent littering and preserve the beauty and tourism value of these monuments.

- Improved security

  Assessment of tourist movements through time-lapse videos can assist in managing tourist traffic effectively and avoiding any security issues such as stampedes.

Note:
Mentioned use cases are some model for departments, but infact the use cases of drone technology is much wider for all departments.

CONCLUSION: FUTURE FORMULATION AND SUSTANIBILITY

A typical drone operation involves various sets of activities, such as physical operation and maintenance of drones, ground activities for UAV operations, and analysis of post-flight data. These activities can be segregated based on stakeholder participation, and various elements of the value chain can be integrated with the help of technology layers over and above the platform.

This can also help in achieving scale in some aspects of the value chain, such as physical operation and maintenance, thereby reducing the cost of operations, which is prohibitive in some of the industries and use cases. In addition to cost efficiency, the government can also consider futuristic models wherein drone operations can be managed centrally without any investment in physical assets.

Multitudes of business models can be built around other elements of the value chain, such as sensors, cameras and methods of data analysis. The exact nature of such business models will unfold with the passage of time, but the government must play a proactive role in shaping the overall agenda through clearly drafted policies so that the technology can be leveraged by citizens, the private sector, government bodies and other entities alike.

Based on these emerging themes, the government should focus on strategically investing in creating a scalable ecosystem to allow for decentralization of data capture through drones while centralizing data processing for specific themes. Further, state governments should actively participate in becoming DSPs to enable decentralized regulatory oversight and, thus, fast-paced policy maturity in the country.

Overall, while the potential for application of drone technology is immense, the critical challenge for the State is achieving scale and overcoming the associated issues. It is on this front that the government has to take a leading role by investing in the ecosystem in order to allow the technology to thrive.