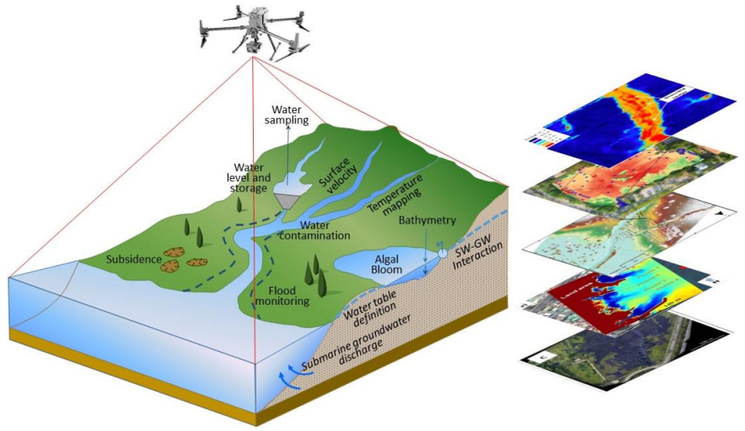
USE OF DRONE IN WATER RESOURCE MAPPING

Aditya V Machnoor[1*] Ajaykumar[2]
[1*]Ph.D. Student-Water Science and Technology, IARI, New Delhi
[2]Ph.D. Student -Department of Agricultural Economics, UAS, Bengaluru

Water management is a major issue that has been growing in importance in recent decades. As the demand for water rises with social and economic development and population growth, the freshwater resources become scarcer due to climate change, aquatic ecosystem deterioration and human impacts. UNESCO (2019) reports that water use has been growing 1% yearly worldwide since the 1980s and the global water demand is expected to continue this trend until 2050. This would result in an increase of 20% to 30% above the current level of water use. In this context, ensuring water in sufficient quantity and quality to meet food security, environmental goals, public health needs and the production of energy, services and other goods remains one of the biggest challenges for water managers in the future. Many aquatic systems have been severely polluted by agricultural, domestic, and industrial activities and waste disposal, which affects the supply of clean drinking water and harms the ecosystem function and organisms. This situation requires effective management and intervention in catchments, which also means learning more about hydrological systems and filling current information gaps. In this regard, unmanned aerial vehicles play a vital role Unmanned Aerial Vehicles (UAVs), commonly referred to as drones, have revolutionized various industries by offering innovative and efficient solutions to complex challenges. One domain where UAV technology has particularly excelled is in water resource mapping. Water resources, being essential for human survival and sustainable development, require accurate and up-to-date data for effective management and conservation. UAVs have emerged as a game-changing tool in this context, enabling the collection of high-resolution spatial data in aquatic environments with unprecedented precision and cost-effectiveness. Water resource mapping entails the comprehensive assessment of water bodies such as rivers, lakes, reservoirs, wetlands, and coastal areas, to monitor their health, quality, and availability. Traditional methods of data collection, like ground surveys and satellite imagery, often present limitations in terms of resolution, accessibility, and real-time monitoring. UAVs have effectively addressed these limitations by offering a flexible platform capable of capturing intricate details from low altitudes, accessing remote and challenging locations, and providing near-real-time data updates. UAVs are playing a pivotal role in ensuring the sustainable management and conservation of vital water resources around the world. As technology continues to advance, it is likely that UAVs will continue to push the boundaries of what is possible in water resource mapping, contributing to a more informed and sustainable approach to water management.



TYPES OF UAV'S OR DRONES:

1. Multirotor
2. Fixed Wing
3. Single Rotor Helicopter
4. Hybrid VTOL(Vertical Take Off and Landing)

Fig: Multirotor

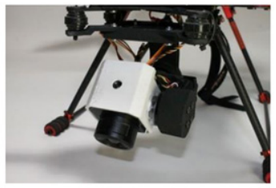
Fig: Fixed Wing

Fig: Single Rotor Helicopter

Fig: Hybrid VTOL

TYPES OF SENSORS USED IN WATER RESOURCE MAPPING:

1. RGB – Used in flood monitoring , water quality analysis and measuring flow velocity
2. Multispectral- Used in surface and groundwater interaction and flood monitoring
3. Hyperspectral- Used in Bathymetry, hydrogeochemistry and mapping rivers and wetlands
4. Microwave- Used in analysing river level , estimating snow depth and soil moisture
5. Thermal- Used in temperature mapping, groundwater discharge and wetland mapping
6. LiDAR- Used in 3D reconstruction, bathymetry, water surface elevation and estimating the water eroded area



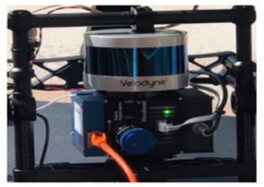


Fig: 1.RGB; 2. Multispectral; 3. Hyperspectral combined with LiDAR; 4. Thermal sensor

MECHANISM

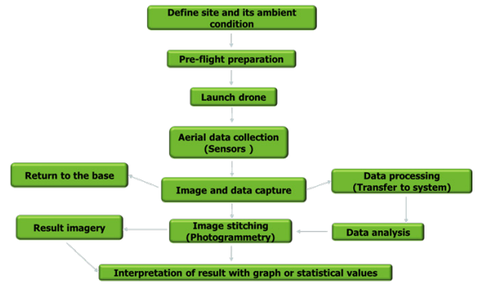
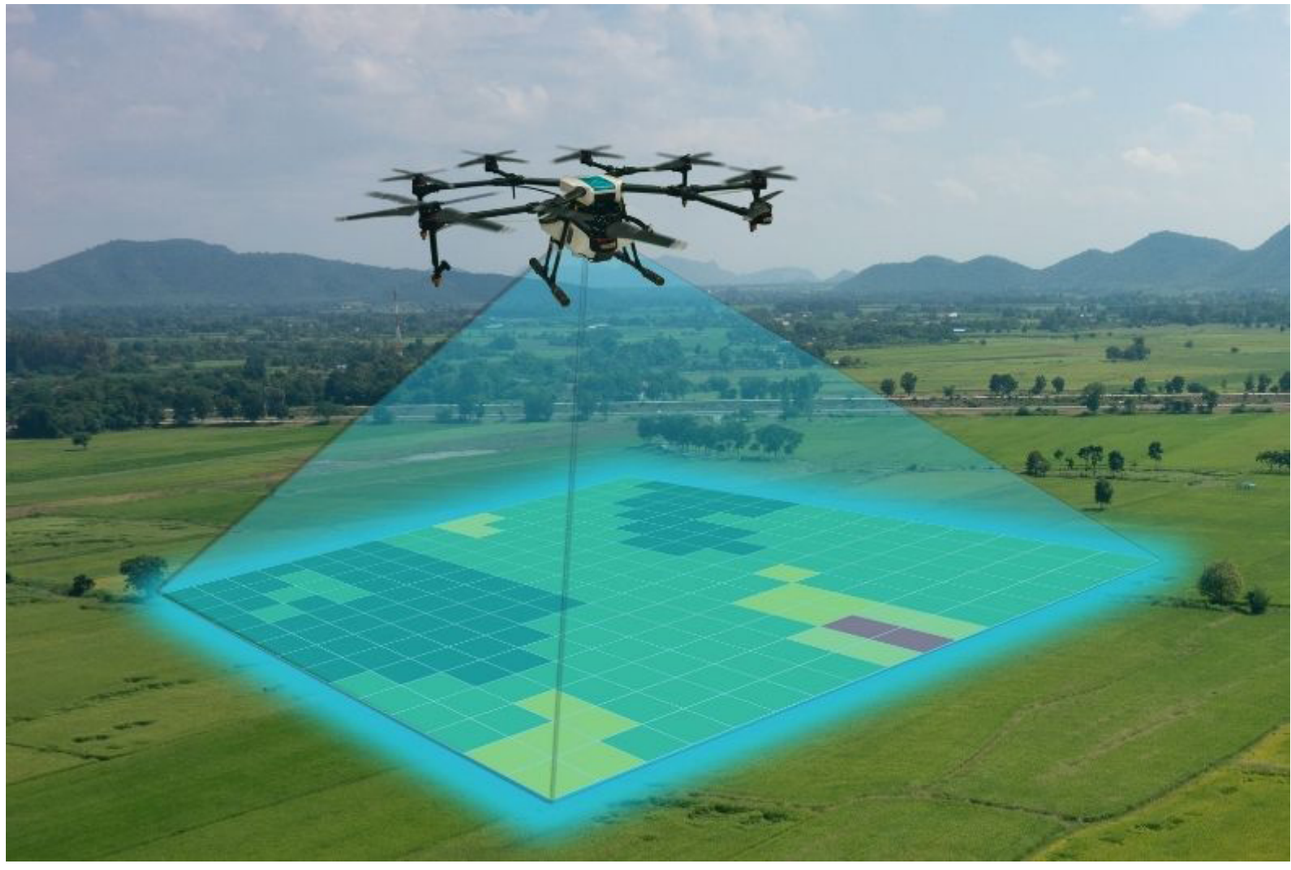


Fig: Flowchart of water resource mapping through drone



DRONE TECHNOLOGY PROMOTION IN INDIA

- SVAMITVA (Survey of villages and mapping with improvised technology in village areas) Scheme
- Liberalization in Drone Rules 2021 which gives generalised rules for using drones in unauthorised areas
- Approval of the Production-Linked Incentive (PLI) is a scheme which helps in progression of drone technology in India
- Hara Bharat Camping is an initiative of Telangana Government to promote reforestation using drone technology. The aerial seeding will be done by seedcopter
- Gwalior Drone Mela by Ministry of Civil Aviation, GoI
- Kisan Drone Yatra was launched by GoI in agricultural sector to mechanise the farming phases in development of agriculture

CONCLUSION

Unmanned Aerial Vehicle (UAVs) have revolutionized the way researchers and water managers collect data, offering a safe, cost-effective, and more accessible alternative to traditional methods. Over the past two decades, UAVs have dramatically transformed the field of hydrology. Thanks to their unparalleled ability to cover large areas and recent advancements in sensor technology, they now enable a more comprehensive understanding of water resource mapping. These UAVs have become instrumental in generating highly accurate representations of river morphology, mapping surface properties, and studying interactions within the system, either independently or in conjunction with other instruments. Furthermore, UAV technology has evolved rapidly, progressing from early prototypes like balloons, paragliders, and paramotors to sophisticated lightweight platforms capable of operating in challenging and hazardous environments, thus reducing risks for operators. The decreasing costs of electronic components, coupled with the extensive customization possibilities for platforms and sensor combinations, have made UAVs more accessible, even for small research groups and modest institutions and UAVs are bridging the gaps between satellite, airborne imagery and ground-based measurements in better mapping of water resources which are hard to do with traditional methods.