**AMITY UNIVERSITY UTTAR PRADESH**

**TERM PAPER**

**ON**

**COMPARITIVE OF TOOLS & ADVANCES IN GEOSPATIAL TECHNOLOGY**

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**DECLARATION**

I,Suparna Sarkar of B.Tech IT(3IT-2(Y)) hereby declare that the project titled ‘**Comparitive of tools and advances in Geospatial Technology’** submitted by me to the Department of Information Technology,**Amity School of Engineering and Technology**, Amity University Uttar Pradesh, Noida, in partial fulfilment of requirement for the award of degree of Bachelor of Technology in Information Technology, has not been previously formed the basis for the award of any degree,diploma or other similar title or recognition.

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**CERTIFICATE**

This is to certify that Ms Suparna Sarkar , student of B.Tech in Information Technology has carried out work presented in the project of Term Paper entitled “**Comparitive of tools and advances in geospatial technology”** as a part of First year program of Bachelor of Technology in Information Technology from Amity University,Uttar Pradesh,Noida under my supervision.

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**ABSTRACT**

Geospatial Technology is advancing day by day at a fast pace. It has several applications in various fields like agriculture, defence, surveying, Hydrography,cartography etc. A lot of research is being carried out to come out with efficient ways of storing and processing the geospatial data. Storage, processing and analysis of spatial data requires specific tools/softwares which can efficiently carry out the desired operations. Geospatial Information Science and Technology (GIST) incorporates an assorted scope of apparatuses and procedures for catching, breaking down and utilizing spatial data. Consistently, propels in geographic data frameworks (GIS) uncover energizing open doors for urban arranging, retail, space investigation, etc. Specialists take advantage of these open doors by remaining side by side of new techniques for enhancing and utilizing GIS advances.This paper will discuss the various tools that are used to capture the geospatial data as well as the tools that are required for storage and processing.Analysis can only be done when there is proper processing and safe storage of spatial data. Thus , advancement in this field is necessary .ArcGis is a very common tool for storage of the geospatial data. Lot of other tools like PCI Geomatica, Rolta Geomatica, ENVI, Erdas Imagine etc are also available. Other Geodatabases are being developed for the storage of big spatial data and faster and efficient processing to obtain most meaningful results from the data collected. Research is being carried out on 3D analysis and visualization , storage of big spatial data, faster processing and analyzing techniques.

1. **INTRODUCTION**

Geospatial innovation is a term used to demonstrate the scope of current apparatuses adding to mapping and geographic investigation of Earth and human social orders. These advancements have developed in some structure since the primary maps were made in ancient times. In the 19th century, elevated photography joined the long and significant schools of cartography . The cameras were sent in height on inflatables and pigeons, at that point on planes in the twentieth century. The science and specialty of photographic elucidation and cartography were quickened during the Second World War and with the Cold War, they took on another measurement with the coming of satellites and PCs. Satellites permitted images of the Earth's surface and human exercises. PCs permitted the capacity and quality of pictures just as the advancement of related programming, maps and computerized informative indexes on financial and natural marvels, by and large known as geographic data frameworks (GIS). A significant part of a GIS is its capacity to assemble the scope of geospatial information into a lot of layered maps that can break down complex topics and after that impart them to a more extensive group of spectators. This "stratification" is made conceivable by the way that each of this information incorporates data on the exact area on the outside of the Earth, consequently the expression "geospatial".

1. **Literature Review**

* George Percivall and Trevor Taylor in their research paper published in 2017 have reviewed the recent advances in fusion of big spatial data. This paper studies the effects of recent IT trends on geospatial data fusion, which includes big data, linked data , cloud technologies and new sources of geospatial observation.They faced some problems like sometimes data elements were created during fusion which aren’t even required. Also, the variety of geospatial data is increasing which may require new platforms. In many cases,creation of new associations involves additional processing.They also found out some solutions for the problems . For example, Iot devices provide geospatial data that can be used for a wide variety of applictions.
* Guangyu Liu, Chuanrong Li,Wenxin Tian and Ziyang Li in their research work (published in 2016) have discussed the heteroginity and volume of geospatial data.They discussed that satellite data can be categorized into various types. Satellite metadata can be facilitated to find out the most relevant information like satellite name, search boundary, sensor name,location information etc.Retrieval of satellite data is also discussed in this paper.Due to the mass heteroginity, sharing and integration of geospatioal data is an important issue for GI catalog services.

To overcome these problems ,opensearch was introduced by amazon.com .Opensearch protocol centralized and integrated the heterogenous data from different satellite data centres.

* Anjan Roy and Arun B Inamdar in their research paper of 2014 have studied the structural work for analyzing the vulnerability in climate change in a river basin; which is one of the many application areas of geospatial technology.Various tech tools and hydrological modelling is used to layout the framework. Soil and Water Assesment tool (SWAT) is used to analyze the soil water patterns over a period of time. Remote sensing tools like drones are used to survey the land covered around the basin area, which are then processed using SWAT. Meteorological predictors are the main devices that are used for prediction of climate change.After capturing the data through these devices, the data is processed in Grid analysis and display system.The framework had to be planned in various stages , due to the varying sections of the area.
* Sunghwan Cho, Sunghal Hong and Changsoo Lee in their research work published in 2016 have discussed about ORANGE, which is a platform for spatial big data analysis. It is based upon the Apache Hadoop.This paper also discusses various types of data which can be fed into this platform.It also talks about the management of metadata.Improvements are being made to enable faster processing of the large scale data on it. But currently there are some repeated data performance problems.This platform can be taken to an enterprise level.

* Karthi S and Prabhu S published their research work in 2017 that discusses storage and retrieval of geospatial data using Spatial Hadoop framework.It also discusses the technological advancements in GIS. The volume of remote sensing data is growing at a very fast pace, but the existing computers are not sufficient to satisfy such requirements.To solve this problem, the storage & retrieval of the data in cloud environment is discussed in this paper. Effiient ways of storing the geospatial data using Spatialhadoop is also discussed in this paper.Advances are being made on spatial partitioning and query systems.Improvements in the storage capacity are also dealt upon.Retrieval using spatial Hadoop needs more improvement.
* Jia Yu, Jinxuan Wu and Mohamed Sarwat in their research work published in 2016 have discussed about GeoSPark. This paper broadly discusses GeoSpark which is basically a framework for the processing of large scale spatial data. Using this tool, spatial data analytics programmes have been developed. In this paper , Geospark is demonstrated using 3D spatial analytics.Interactive performance of the spatial data on a large scale is also discussed. But the concept of defining the boundaries of the geographical features still requires more study and research.
* Zhaoje Niu, Bingsheng He, Amelie Chi Zhou and Lau Chieu Tong in their collective research work of 2017 have discussed the developments in spatial data analytics systems.work is being carried upon optimization of individual goals such as resource efficiency. Advances are being made for multi objective optimizations; to carry out processing for large scale workloads.But distributed analytics in geo data posses new difficulties in multi objective optimization.
* Ahmed Eldawy and Mohamed F. Makful in their research paper published in 2015 have studied and researched about Spatial Hadoop.It s basically an extension to Apache Hadoop wherein spatial data is fed into each layer. Spatial Hadoop uses Mapreduce network, which is a programming model for processing and generating big spatial data sets.ESRI introduced GIS tools on Hadoop. Hadoop GIS had a lot of limitations which were overcome by spatial Hadoop. It has built in Hadoop base code that pushes the spatial data inside the core functionality Hadoop.

1. **Geospatial Technology in today’s world**

Geospatial Technology , more commonly known as Geomatics is a technology which is concerned with the collection, storage, processing , analysis and presentation of geographically referenced data or information.

It comprises of a variety of services, tools and products that are used in collection , management and integration of geo referenced data. On a major basis it is a combination of three main technologies which are Geographic Information System(GIS), Global Positioning System(GPS) and Remote Sensing(RS).

There are various fields under geomatics such as cartography, surveying, hydrography etc. In this technology , first the data is obtained through various sensors mounted on tools like drone, satellites etc. These sensors capture the electromagnetic radiation emitted by various objects on earth under investigation.The data captured by these devices is then transmitted to research centres on earth where the scientists/experts put the data into format into geodatabases. This is where the storage and processing of the spatial data is done. Each spatial data has an attribute attached to it which is linked in geodatasets. The spatial data is usually stored in an array or rows and columns, with each cell storing some specific information.After processing, this data is analyzed to extract meaningful results which can be put in the form of bargraphs, piecharts n and histograms for efficient presentation of the information.This information is then finally put into use for practical applications like farming, weather forecasting, climate changes, irrigation patterns etc.

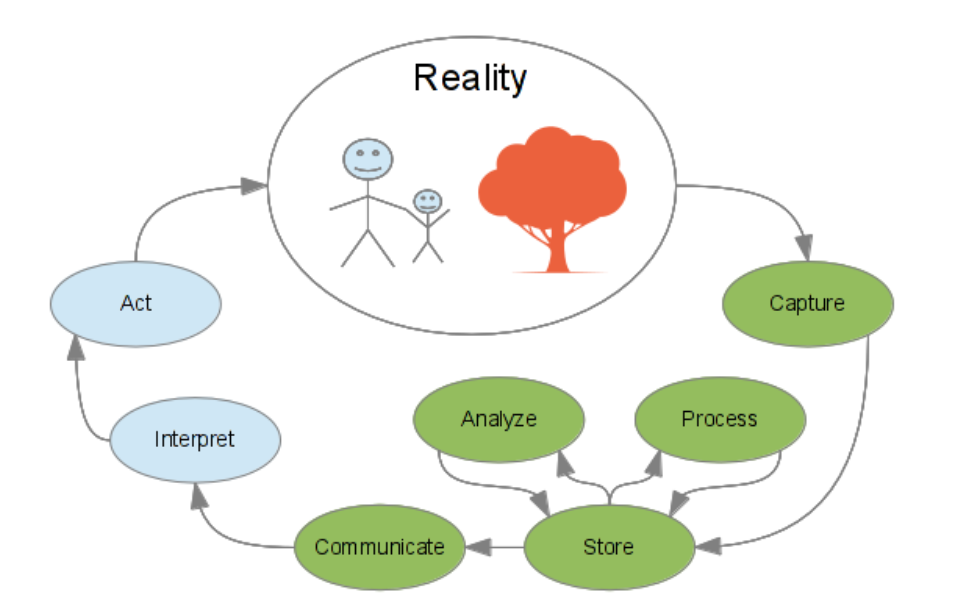
1. **Types of Geospatial Technologies potential to Human rights**

* **Remote detecting**: Pictures and information are gathered from cameras and from space & airborne sensor stages. Various business satellite picture suppliers presently offer pictures with subtleties of 1m or less making them reasonable for observing compassionate needs and human rights infringement.
* **Geographic Information Systems (GIS):** A series of georeferenced data programming tools (down to a specific region on the Earth's surface, otherwise known as geospatial information). GIS may be used to identify geographical patterns, for instance groups of diseases caused by poisons, difficult access to water, etc.
* **Global Positioning System (GPS):** A US Department of Defense satellite system that can give precise contact data to non military personnel and military clients with proper accepting hardware (note: a comparative European framework called Galileo will be operational in the coming years, while Russian framework works yet is confined).
* **Internet Mapping Technologies**: Software such as Google Earth and Web highlights, for instance, changes how geospice data is visualized and communicated. Microsoft Virtual Earth. Additionally, UI improvements make these progresses open to a broader group of viewers, whereas standard GIS is saved for professionals and people who put their time on complicated programming to learn.

**5. GIS and Geospatial Data**

Geospatial information determine the area of highlights or items on the outside of the earth. Highlights or properties can be determined as numeric names or qualities. Areas are typically characterized as sets of numbers (organizes) that determine longitude (separate east or west) and scope (north or south separation).

A definitive objective of geographic data frameworks and geospatial innovation as a rule is to empower individuals to get reality and to have the option to make a move dependent on that comprehension. To this end, geospatial data experiences various stages and various degrees of innovation.

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**Fig 1: Geospatial data flow**

**Catch**: Reality must be caught in any capacity and changed over into an electronic deliberation (information) - typically numbers. The catch of geospatial data can be accomplished in various ways: by means of cameras and sensors in satellites or planes, by means of GPS collectors in cell phones, or just by individuals strolling around and taking note of perceptions of the physical world or answers to questions put to them the general population who occupy this physical world.

**Capacity**: One of the parts of contemporary electronic geospatial innovation that enables it is its capacity to store enormous measures of geospatial data at a lower cost. In any case, there are numerous innovations and arrangements for putting away geospatial data, and the decision of capacity media in an association can extraordinarily influence the productivity and adaptability of the geospatial advances utilized by the association.

**Procedure**: Geospatial information in their crude structure for the most part require extra preparing to take out commotion and/or give the information a structure to process it all the more effectively. Satellite information frequently needs to experience advanced changes to have the option to be utilized with geospatial information from different sources or from different occasions. Overview information should frequently be translated and put in tables. Addresses must be changed over to numeric (geocoded) arranges. When playing out an examination with Geographic Information Systems (GIS), it isn't phenomenal to invest more energy gathering and cleaning information than playing out an information investigation.

**Examination**: Much of the investigation finished with a GIS includes connecting one lot of information to another. In wellbeing topography, a typical logical procedure is to contrast the area of malady episodes and potential wellsprings of organic or compound pathogens. The examination can extend from basic overlays of two arrangements of geospatial information to complex multivariate measurable models that can be utilized to envision future changes.

**Impart**: The geospatial data put away in a data framework must be conveyed to the general population concerned so they are valuable. Geospatial information is generally imagined as maps or diagrams.

**Decipher**: Maps and designs comprise of signifiers - signs and images. These are then deciphered by clients as conveying a sort of importance or information. This elucidation procedure (like most human practices) is unpredictable and relies upon the setting of the client and the setting wherein the information is utilized.

**Act**: Although geospatial innovation is once in a while just used to all the more likely comprehend, geospatial innovation is all the more frequently utilized as an apparatus to accomplish a more extensive, regularly business objective. This brings up issues of qualities ​​and morals as the learning of the truth of geospatial innovation is then used to adjust this reality to some degree (the part of geology, for what reason do we consider)? Couple utilizing a versatile application to locate an adjacent Thai eatery may not know about the business connections that lead a few eateries to seem higher up the rundown than others. A hued guide used to advance an open strategy activity may cover the suspicions made about the hidden information and inspirations of the cartographers. A military automaton pilot may need to focus on a rocket strike dependent on dubious geospatial insight, to help a mission reflecting flawed geopolitical goals and systems.

**6. Geospatial tools for GIS, Mapping and Data Visualization**

The collection, display, interpretation and handling of geospatial images, gps information, satellite images and historical information are essential for geospatial analysis. Applications for geospatial analysis include crisis management, weather monitoring and climate change modeling, various marketing assessment, population studies and predictions.

Today there are several softwares and tools available which can facilitate wide and distributed use of geographically referenced data in several application areas for better information sharing.

**6.1 FalconView**

It is a tool that supports various display settings and types such as altitudes, satellites, Lidar, Kmz, MrSID etc. In addition to this, this software also supports Skyview mode allowing the users to fly over while recording the data.

**6.2 GeoDa**

It is a free Gis software that is used for introducing new users into spatial data analysis. The major functionality of this software is geostatistics, which is predicting the statistical values associated with spatial phenomena. This one of a kind analysis tool is operated by renowned insitutions like Harvard University, MIT, and Cornell labs. With GeoDa,the users can easily perform many operations like autocorrelation, description, regression statistics and some other semi complex tasks can be analyzed. It is a great tool for non GIS users to become familiar with spatial analysis . There are promising avenues for which the tool has been promising which include economic development, healthcare and real estate.

**6.3 GRAY GIS**.

This software provides around 350 extremely robust vector handling tools and raster datasets. Many academics, environmental consultants and government agencies use this software because of its instinctive graphical interface & easy reliability. Value proposition of this software lies in the fields of spatial analysis,digital image processing, digital terrain modelling & manipulation and overlaying and statistics.

**6.4 ILWIS**

Formerly , it was a commercial tool but later on ILWIS (Integrated Land and Water Information Management) was changed to an open source GIS. It is a very old tool that excels at basic operations such as editing , digitizing and displaying the geographic data. Moreover, this

software can also facilitate remote sensing through various image classification tools, enhancement techniques and Spectral Band Manipulation. It is widely used by planners, designers, biologists, water managers and geospatial technocrats. It is available free of charge and is highly rated by the users.

**6.5 MapWindow**

This tool enables users to construct GIS apps without depending on traditional business GIS software. This software can perform approximately 90% of the tasks Gis customers expect, such as map viewers, processors and layouts. It can also include the distinctive and sophisticated device known as TauDEM to automatic water shedding. This software, however, has also shown some instability in the past. Free for customers, it is also accessible.

**6.6 QGIS**

The use of this tool has some advantages. It is an all-in-one community tool with plugins developed by the Qgis community. In addition, this software can integrate Qgis stack exchange for more support.

**6.7 GVSIG**

Founded in 2004, it is also a free, open source GIS software. It is one of the finest and most flexible 3-dimensional visualization tools in Gis. This program even exceeds Qgis in 3D. Furthermore, the versatility of information management with NavTable represents the promptness of viewing stored documents one by one in a vertical way. OpenCAD software supports the user in tracing the geometry, editing vertices, aligning & dividing lines and polygons. The Mobile function is intended to operate in the sector thanks to its interface & GPS instruments.

**6.8 SAGA GIS**

This software was originally designed for field analysis , for example slope shading, watershed extraction & visibility analysis. This tool allows multiple windows for displaying all the analysis work(maps, histograms, scatterplots, attributes, etc.), and provides the geoscience community with a rapidly growing set of geoscience methods.

It also assembles unique morphometry tools which include SAGA wettability index & topographic position classification. It demonstrates unique value proposition in field analysis. In short, SAGA Gis is fast, quite reliable and accurate.

**6.9 uDig**

It is an open source Gis software, a powerful mapping tool. Users easily import base maps using the various Mapnik features in uDig. This instrument also represents ease of use and includes symbology, catalog and Mac OS characteristics, among its most solid and trustworthy characteristics. But few of the main problems that decrease the usability of uDig are limited editing instruments and bugs.

**6.10 Whitebox GAT**

This software can exploit Lidar data without any restrictions or barriers. In addition, it also includes 410 tools for cutting, converting, analyzing, managing, buffering and extracting geospatial information. However, cartographic mapping tools are inefficient compared to QGIS.

**7. Major Geospatial technology trends for 2019 and Beyond**

Geospatial technology is omnipresent and is increasing quickly in many fields. Most technologies demand a space element and this is an evolving pillar. Nobody can be seen without geospatial information, regardless of our daily operations or sophisticated futuristic study. By 2019, fresh developments would influence various sectors in geospatial technology. Let's look at the principal 2019 geospatial trends.

**7.1 Miniaturization of sensors**

The dramatic decrease in chip size has improved effectiveness, decreased expenses and made technology more popular. Innovations in LIDAR sensors for independent cars and the mobile mapping pack have reached the LiDAR and the Earth observation regions, which began with the use of smartphones. In the past, primarily amateurs and students used small satellites, but big firms such as Planet revolutionized the satellite industry by introducing satellites of the size of a breadbox. Capella Space and Spire have also introduced very small satellites that have an effectiveness, capability and low costs benefit. Capella Space created the biggest radar satellite constellation.

**7.2 Transparent availability of EO data**

The move towards transparent access to earth observation information was one of the main progresses of the past year. In 2019, too this trend continues.

Planet has finished his first mission, which presently runs over 200 satellites: images of the whole earth 24 hours a day, seven days a week. In 2018, a platform for exploiting and analyzing this data was also introduced. It seeks to provide consumers with the means to observe the data needed to make informational choices.

Amazon has announced the 2018 development to enter the terrestrial business that could potentially upset the OE sector. The technology giant said it has set up a network consisting of 12 satellite systems worldwide and the technology giant plans to begin activities next year. It is possible for AWS Ground Station to cut processing time from 1 to less than 1 minute.

From an affordability point of perspective, the AWS Ground Station service also makes sense. While big satellite operators have their own ground stations, there is usually nothing but costly, non-flexible agreements and longer shipping periods for small-size satellite operators. This will be radically changed by AWS Ground Station and EO information will be available rapidly and transparently.

**7.3 Geospatial AI or Geo.AI**

An increasingly explicit subset of man-made consciousness consolidating the exactness of GIS with cautious investigation and a methodology dependent on the goals of computerized reasoning is called geospatial man-made brainpower, or essentially Geo.AI.

Geospatial man-made reasoning can likewise be known as another type of machine-based geographic learning. Utilizing basic cell phone applications, clients can give ongoing data about conditions in their condition, for example, car influxes, subtleties, surge hour, experience, rank: low, medium or moderate. Information is then gathered, arranged, examined, and improved for exactness and precision with the a great accuracy and many clients adding to the database.

This methodology of utilizing geographic area would fill the data hole, yet in addition add to increasingly viable answers for explicit geographic areas. For instance, it is ready to anticipate which region of ​​the city would confront most extreme clog, or which course ought to pursue suburbanites, or where the progression of vehicles can be rerouted.

**7.4 BIM**

Building Information Modelling(BIM) is a process or a procedure supported by a variety of tools and technologies. It comprises generation and management of digital images and characteristicks of physical places. Mix of geospatial data with plan and building work processes information, 3D displaying, reproduction, situation investigation, change of location. The interface among geospatial data and BIM makes a convincing cooperative energy between spatial, specialized and business information properties, assisting the development business with deriving and plan a beneficial efficient.

Geospatial data, alongside other computerized information with an area measurement, adds spatial representation to the BIM condition, encouraging consistent information trade among designing and natural experts, taking out repetitive information and improving information coordination forms for better arranging of development ventures.

BIM and Geospatial Solution Providers make incorporated work process advancement arrangements that empower clients to get to, keep up, and dependably use BIM information in a spatial setting all through. of the benefit life cycle. Straightforward utilization of spatial and social information at the database level (Oracle Spatial and Locator, PostGIS) encourages spatial coordination and basic examination, empowering the developing business to benefit as much as possible from its focused edge and its efficiency.

**7.5 Cartography as an administration**

Developments in cloud innovation have opened new doors for some organizations and uncovered new plans of action. Such a plan of action is mapping as an administration. Most maps can be discovered online with a basic Google search, however high goal maps of a specific spot are elusive. For instance, organizations like Nearmap, Carmenta and Harman Ignite give high-goal satellite pictures and maps for all areas around the globe, on interest and as indicated by client needs. The information can be utilized for an assortment of purposes, including street wellbeing the executives or the development of another structure. This truly altered cartography. Mapping as an administration is relied upon to be more than $ 8 billion by 2025. With more chances and developing interest in the commercial center, organizations are being urged to advance further.

**7.6 Savvy urban areas**

Savvy urban zones would open up a wide range of possible fresh results, better the nature of our urban zones and more interface them with innovation, thereby reducing obstructed spaces, contaminating regions, and altering the design of the models. Urban arrangement. Urban arrangement. Savvy urban regions undoubtedly talk about the ultimate destiny of urban accommodation, and government has began developing the guide to improve current urban fields.

**7.5 Spatial Hadoop**

Spatial Hadoop is a tool that uses Mapreduce framework, which is a programming model for processing and generation of big spatial data sets. It is basically an extension to Hadoop; wherein spatial data is fed into each layer(language,storage,operation layers).It was mainly introduced as a solution for processing of huge datasets. ESRI introduced GIS tools on Hadoop. It has built in Hadoop base code that pushes the spatial data inside the core functionality Hadoop, which is a key point behind the efficiency of spatial Hadoop.

It’s typical applications include e-commerce and IOT applications. Key value data format is used and batch processing is done. It has map and reduce programming approach and supported by JAVA. It can store large data in HDFS but is not interactive.It has Mahout-machine learning compatibility.

**7.6 GeoSpark**

GeoSpark is basically a framework for the processing of large scale spatial data.Using Geospark, spatial data analytics have been developed. It is a cluster computing system that processes large scale spatial data. It is also an extension of ApacheSpark. 3D analysis can also be done using Geospark.

It’s typical applicatons include e-commerce, gis applications,health care systems. Key value and RDD are the available data formats. It has batch and stream mode of Processing.Transformation and action programming approach is used.It is supported by JAVA, Scala and Python and is interactive.It has Spark MLib machine learning compatability.

**8. OPEN SOURCE GIS MAPPING SOFTWARE**

Open Source GIS mapping programming gives clients access to useful assets for making maps and including components, for example, content, pictures and recordings. Especially related to activities, for example, OpenStreetMap or Open Geospatial Data Project, these applications offer unlimited conceivable outcomes for gathering and envisioning spatial data and altering maps. Clients make ventures for:  


**Fig 2: Surveying of highway**

* Highlight the socioeconomics of an area
* Track the accessibility of regular assets after some time
* Graph of yield development and catch of any indications of malady
* Demonstrate how changing natural conditions influence the safeguarding of a memorable site

The capacity to collect maps for an assortment of purposes growingly affects regular day to day existence as it influences the advancement of keen city foundation. With thorough area information, government organizations and privately owned businesses can give benefits more proficiently and build up a feasible advancement technique. Custom maps can be connected to increased reality extends that give specialists valuable subtleties identified with a particular area.

In the mean time, open source mapping assumes a noteworthy job in the blasting universe of route frameworks and computerized vehicles. When characterizing courses, these frameworks consider an expanding number of variables, for example, ongoing refreshed traffic conditions and individual inclinations. GIS is fundamental for improving the presentation of independent vehicles and managing drivers to their goals as fast, serenely and securely as could be allowed.

**9. FRESH INSIGHTS FROM GEOSPATIAL ANALYTICS**

The ascent of Big Data and examination has been a standout amongst the most significant changes for organizations lately. In all segments, organizations are continually hoping to transform a consistently expanding volume of information into an upper hand, and many have discovered that GIST esteems ​​their endeavors. Geospatial examination applies geographic data to empower more intelligent basic leadership and light-footed issue goals.

With GIS information, examination masters can make representations, distinguish huge patterns, and make conjectures, producing reports that give important setting to the procedure. Chiefs gain perceivability through the blend of spatial data with the discoveries of Enterprise Resource Planning (ERP) frameworks. They can unmistakably perceive how urgent information about their associations is related with explicit occasions and places.

Geospatial investigation explains complex connections and shows approaches to streamline forms. Organizations and government offices can:

* Make increasingly educated decisions about structure or growing offices and stores
* Track when gadgets and gadgets outfitted with Internet of Things (IoT) sensors enter or leave the work territory
* Create applications for retail clients that enhance their in-store encounters (for instance, retail labeling innovation).
* Accelerate coordinations and lessen costs by running different steering situations.
* Find examples of crime in a locale
* Minimize the dangers of area related perils, for example, extreme tempests

**10. GIS AND DRONES**

Organizations and buyers are utilizing Unmanned Aerial Vehicles (UAVs) for a regularly growing rundown of utilizations extending from amusement to horticulture, frequently dependent on GIS bolstered route. For instance, explores different avenues regarding ramble conveyances have opened up chances to give sustenance and different items to clients with uncommon speed. Different organizations convey the flying machine to gather data from IoT sensors that screen modern destinations, perilous travel conditions, unsteady climate conditions or yield welfare, and send refreshes progressively.

In the meantime, rambles likewise improve the data accessible for mapping and control with GIS devices. A great part of the spatial information originates from satellite symbolism and readings from steered flying machine, yet automatons are a conservative method to gather point by point data on a littler scale. UAVs thusly have a noteworthy task to carry out in making geographic data all the more promptly accessible for open source mapping and modifying it as per the needs of organizations, governments, autonomous analysts and beginners.

**11. WHAT’S NEXT FOR GIST?**

For experts with mastery in space innovation and critical thinking, the future looks wealthy in conceivable outcomes. In the coming years, GISTs will probably turn into a considerably progressively pervasive part of our day by day lives, on account of the far reaching selection of keen innovation and IoT. As sensors that can share space-time data show up all over, from modern hardware to espresso producers, the volume of spatial information will develop exponentially.

In the mean time, shoppers and organizations will require expanded usefulness and mix of room programming applications. Carpool administrations and route applications have exhibited to the open the intensity of uses running on GPS and guide stages to give constant updates. These sorts of highlights could likewise be utilized progressively by organizations and governments when utilized for purposes, for example, following resources and expanding the compass of advertising efforts.

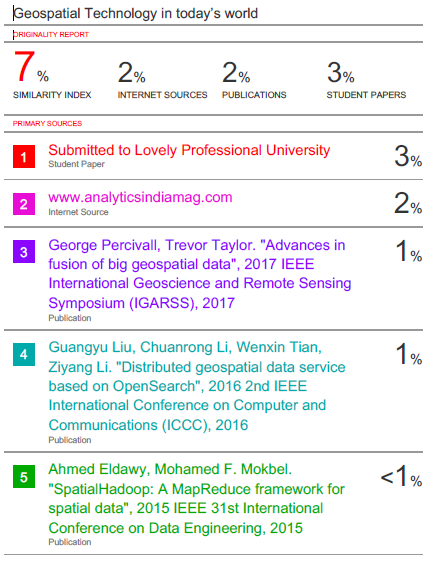
The multiplication of spatial information and the product market implies that organizations will progressively require experts acquainted with each layer of the GIS innovation stack. Information experts should advance their procedures for gathering, cleaning and arranging spatial data. GIS programming designers likewise need to see every one of the information assets they need to make space-based applications to make this data work.

**12. CONCLUSION**

This paper has broadly discussed various geospatial tools used for storing, processing and analyzing of geospatial data.The processing of a large variety of data requires different tools with specific capabilities . Due to the heteroginity of geospatial data, newer platforms are being developed . which have been briefly discussed. Geospatial Technology has a broad scope in future and thus advancements are necessary . Wide variety of applicatios areas require specific platforms for interpretation of the geospatial data. New tools and platforms like Spatial Hadoop and geospark have made analysis faster and 3D visualistion easy.

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**14. Plagiarism Report**