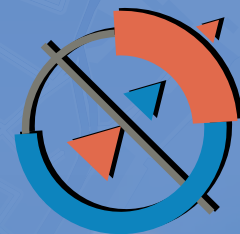


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Use of location intelligence and powerful visualization tools are redefining how maps are used across workflows **P-14**

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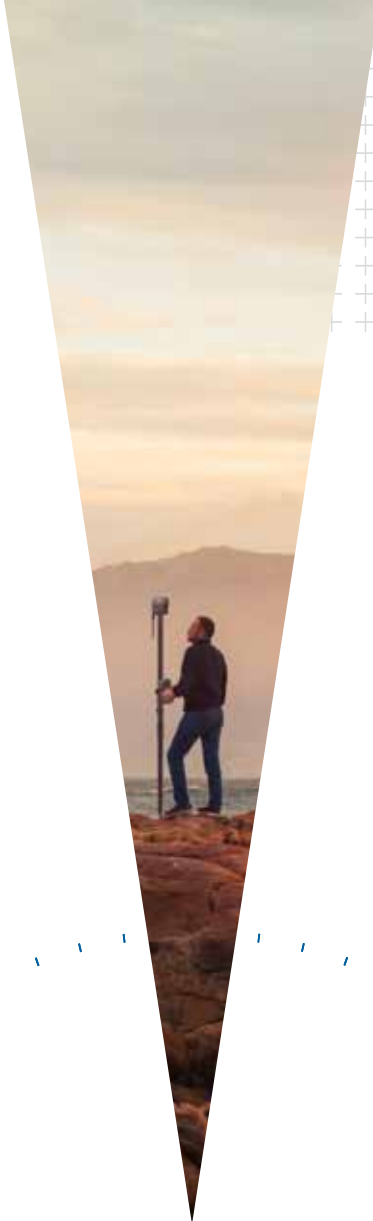
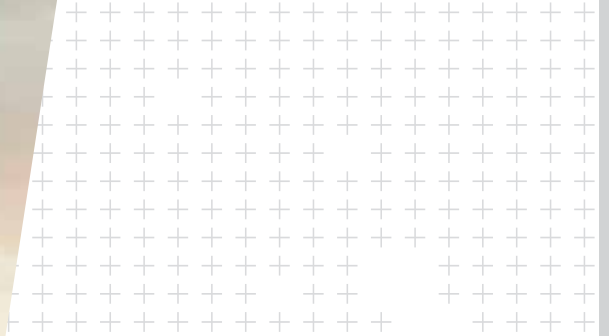
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IN CONVERSATION

Dr. Virginia Burkett
Chief Scientist,
Climate and Land Use
Change, United States
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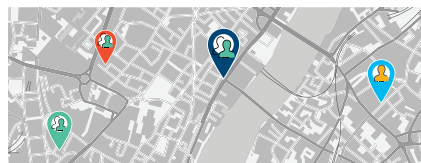
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The Power of Where



Prof. Arup Dasgupta

Managing Editor,
arup@geospatialmedia.net

In a '50s movie thriller two bored young girls play a dangerous game of dialling random numbers and delivering a cryptic message "I know who you are and I saw what you did". Unfortunately, one of the numbers dialled

was that of a murderer who sets out to find who sent the message. A classic problem of location in space-time or 'where' and 'when'. In the '50s that took some doing which is why the movie was a thriller, but today the task is too simple because we are data, message, location and all. We are sensors spewing out data about ourselves and our friends, acquaintances and relatives through apps that are supposed to 'help' us to remain in touch.

Recent events have shown how such apps have been used to compromise our wellbeing and the wellbeing of our countries. Most of us are compelled to skip the yada yada about security and permissions by clicking 'yes'. The purpose of the verbose legalese of the security and permission statement which runs into pages being precisely that — to direct us to just press 'yes' and compromise ourselves. In fact, a very Faustian compact. Well, not that bad really.

Location is at the heart of applications, both civil and military. From locating a restaurant to locating survivors in a disaster hit area, location is the key. Location is traditionally associated with maps, which is why some countries treat maps as secret documents. In a sense traditional maps are static models of a past reality, but that has changed. Location is not only about static objects but about mobile targets as well. It is called location awareness. Think of self-driving cars, tracking of assets, controlling drones from flying into no-fly zones and protecting individuals from straying into hazardous areas. One could imagine similar applications in the areas of homeland security and international border management.

Satellite data, particularly the 24X7 approach of satellite swarms, has made data almost real time. Today augmented reality, self-driving vehicles, asset tracking and similar real-time applications need such data and thus maps have transitioned from paper documents to digital models which are updated in real time not only from remotely sensed imagery but also instantaneous positioning information from GPS and local sensors. We are a part of the real-time data as we use our devices for location. A search for the nearest Thai restaurant does use your instantaneous position information.

The flip side of this is the invasion of individual privacy. Should advertisers bombard you with advertisements and 'offers' from Thai restaurants because you prefer that cuisine? even as I write Google and Amazon are making suggestions based on my search history and online purchases. Sometimes, it becomes hilarious. I started using Uber in Bangalore when I was there on an extended trip, but even though I am back home I still get 'offers' for rides in Bangalore!

Unfortunately, this hunger for real-time mappable data also gives rise to illegal surveillance and other dark web activities. Location information is thus a double-edged sword that cuts both ways. Realizing this, Europe has spelt out its position in the General Data Protection Regulation (GDPR) which will come into force very soon. Basically, even if you share your personal data, you are still in control and can decide how it can be used and even revoke permissions.

It is a good sign that regulation is keeping up with technological changes. 5G is around the corner and its massive data-handling capacity will bring in new problems. On the one hand geospatial mapping of potential problem areas which can limit 5G networks is an excellent application, on the other side the attendant health hazards due to the use of millimeter wave communications also needs to be mapped. Ultimately, the enhancement of the data deluge will also be vulnerable to data misuse.

Over and above data regulations we need data ethics. Modern maps, being instantaneous data, need to be ethically used.

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TRIMBLE LAUNCHES TSC7 CONTROLLER FOR SURVEYORS

Trimble has released the Trimble TSC7 controller, a new field solution for land and civil construction surveyors. The TSC7 brings powerful enhancements to the field and was designed based on customer feedback. It provides a tablet experience with a physical keyboard and a sunlight readable 7-inch touchscreen that supports pinch, tap and slide gestures.

Users can interact with the TSC7 intuitively, easily zooming, panning and selecting items on the large touchscreen. Front- and rear-facing cameras allow users to video conference their office from the field for on-the-job support, and capture high-definition videos and images that provide valuable context to their data and clients.



KEY FEATURES

- It has improved handling due to its lightweight, rugged, and ergonomic design.
- Hot-swappable batteries mean users can better manage time in the field.
- Microsoft Windows 10 Pro Operating System allows multi-tasking from the field.
- Modern connectivity across GSM, LTE, Bluetooth, and Wi-Fi with EMPOWER modular units.

NVIDIA'S VR-BASED SIMULATOR FOR AUTONOMOUS VEHICLE TESTING

NVIDIA recently announced its plans to employ virtual reality technology for testing of autonomous cars. The Cloud-based system known as DRIVE Constellation Simulation System is an integration of NVIDIA's powerful AI car computer (DRIVE Pegasus) and a virtual simulation software (DRIVE Sim Software) to accurately test and validate self-driving cars based on billions of driving miles.

This new system will dramatically improve the testing capability considering different driving conditions. The system makes use of two different servers to create a photorealistic simulation and is capable to generate billions of miles of AV testing. This comprehensive solution is expected to be made available in the third quarter of 2018. It will allow NVIDIA customers like Google and Uber to improve their autonomous vehicle systems before putting it to the real-world test.



KEY FEATURES

- The simulation server is capable of generating a stream of simulated sensor data and feed it to the DRIVE Pegasus for processing.
- Allows the system to validate algorithms and ensure that the simulated vehicle is being operated correctly.
- Can simulate a range of testing environments such as different weather, different times, and different types of road surfaces.

TOMTOM'S TWO NEW SATNAVS, GO BASIC AND GO CAMPER

TomTom introduced two new satnavs systems for those without devices installed into their cars already, or those who don't want to use their phones. The TomTom Go Basic is an entry-level satnav in name and price but comes loaded with many features. It has built-in Wi-Fi that can receive updated maps and software without the need to connect it to a computer. It can also be connected to a smartphone so that notification can be received on the screen.

KEY FEATURES

- **Go Basic** picks up the users driving habits, so the more the driver uses it for directions, the better it will get at predicting the destination in "My Places" before having to change it manually.
- **Go Camper** ensures that you are driving on the right road suited to your vehicle type, weight, size and speed. There are also camper-specific points of interest, including camper spots and caravan sites.



HEXAGON RELEASES CULTIVATION SOLUTIONS AgrOn

Hexagon has launched an integrated cultivation management solution, HxGN AgrOn Production, to empower its customers for optimizing resource efficiency, increasing yield, reducing inputs and ensuring the quality of their products. HxGN AgrOn Production brings immediate benefits to agricultural and forestry companies — providing instant control of all stages of the cultivation process and enabling resource optimization and efficiency.



KEY FEATURES

- Cost-effective and efficient precision agriculture solutions.
- Comprises of software and hardware solution..
- Explores true potential of digital agriculture through assistance.
- Complete Optimization of forestry operations.
- Optimization and automation of entire crop cycles from planning to cultivation.

LEICA INTRODUCES GNSS TECHNOLOGY SMART ANTENNA FOR CONSTRUCTION

Leica Geosystems has announced the new Leica iCON gps 70 T smart antenna as part of its Leica iCON gps 70 series for reliable and easy stake-out jobs on any construction site. The new Leica iCON gps 70 T now allows the user to focus on his immediate environment without having to stare at the pole bubble to keep his receiver in a vertical position. The user can look around for other people, machines, excavations, motor vehicles and structures. It will make a significant improvement to the user daily experience on the work site.



KEY FEATURES

- **True Tilt Compensation:** The combination of the latest GNSS technology and inertial measurement unit (IMU) equips the gps 70 T with true tilt compensation.
- Extended measurement possibilities.
- Improves quality and accuracy of the collected data.
- **Core Central Interface:** users to benefit from the simple-to-use workflows that require less training and avoid costly downtime.



NOVATEL COMES OUT WITH POSITIONING SOLUTIONS

NovAtel has introduced many new precision positioning solutions for space-constrained applications. With enhanced positioning accuracy in a compact form, the PwrPak7D, PwrPak7DE1 and OEM7600 are suitable for automotive, airborne and other smaller unmanned systems. NovAtel's new PwrPak7D and PwrPak7D-E1 enclosures provide space efficiency without sacrificing position accuracy and heading stability, even in stationary, slow-moving or hovering dynamics.

KEY FEATURES

- **PwrPak7D and PwrPak7D-E1:** Dual-antenna, multi-frequency enclosures; integrates an inertial measurement unit (IMU) dual-antenna receiver board to deliver GNSS and inertial navigation system (INS) capabilities.
- **OEM7600:** NovAtel's high-performance positioning solutions in an extremely small form factor.
- Protective shielding to isolate emissions from surrounding electronics.



The knowledge that sea level is going to accelerate over the coming decade is important for policymakers who are planning structures like hospitals, roads and the bridges. People in the coast, especially in the Gulf Coast and South Atlantic, where there are storms and frequent hurricane landfalls, also require the information. It is encouraging for USGS to work with states and local decision makers who are anxious to get the facts, highlights **Dr. Virginia Burkett, Chief Scientist, Climate and Land Use Change, United States Geological Survey**

“ DID YOU FEEL IT ” USGS ENCOURAGES CITIZEN PARTICIPATION

What is the mission of the USGS?

United States Geological Survey (USGS) is the science arm of the US Department of the Interior, which manages one out of every five acres of land in the country, most of Alaska, and vast lands in the western United States. It also monitors and delivers information on a wide range of natural resources.

In my particular group, which is Climate and Land Use mission area, we manage the Landsat satellites — Landsat 7 and Landsat 8. Once the Landsat 9 launch comes into operation in a couple of years, that too will be part of our work. Landsat 9 will replace Landsat 7, which will be running out of fuel during the 2020-2021 timeframe.

Could you throw some light on the work done by your group — the Climate and Land Use Change Mission Area?

We have a lot of exciting things happening at CLU group. We have a new user platform that we are launching for lower 48 states in the US, and, ultimately globally, so that the users can have access to analysis-ready data from the Landsat archives — at 30-meter

resolution, every eighth day coverage of Earth surface, and cloud-free images since 1985. It is a game changer for people who want to know the impact of a management action on particular piece of land, or how a dam affected the downstream area.

On the climate end of things, we are working on the 4th National Climate Assessment and we just released the Volume 1 of that through the US Global Change Research Program. It involves 13 agencies, including NASA, the Department of Agriculture, Department of Transportation, NOAA and many others. We are now in the public review phase of Volume 2, which describes the impacts, risk and vulnerability to climate change for the United States, where we would look at how climate is affecting regions and sectors of the country, such as the water sector, the agricultural sector, and coastal regions. Basically, it is an analysis of trends and impacts we have seen and that are expected based on recent science.

What are the key findings of the study?

There are no major surprises. It just confirms what we had said in our last IPCC report — that the sea level is rising and the temperature continues to increase. Also, there is increase in the storm intensity in the North Atlantic base where hurricanes form and make land fall in US. We have high confidence that the intensity of storms — whether you are looking at rainfall, wind speed, the surge, aerial extent of storms or tropical cyclones — are in the higher categories.

Early this year we had three impactful hurricanes affecting the protected islands of the United States and coastal Texas, leading to severe impacts and cost to the country.

You mentioned increase in the intensity of storms and rainfall. How can we be more proactive in the use of the data and technologies for disaster preparedness and management, rather than being reactive once such disasters strike?

The knowledge that sea level is going to accelerate over the coming decade is impor-

tant for policymakers planning structures like hospitals, roads and the bridges. And people in the coast do use the information, especially in the Gulf Coast and South Atlantic where there are storms and frequent hurricane landfalls. It is encouraging to work with states and local decision makers who are anxious to get the facts.

Can you tell us about your hurricane warning systems or interactive services that citizens can use directly to keep a track on how a storm is moving?

We are quite advanced in that regard. We do not provide hurricane warning but the National Oceanic and Atmospheric Administration (NOAA) issues hurricane warnings, project the areas of landfall, the timings and the intensity. My parents lost their home in Hurricane Katrina, but they were evacuated. There were still 1,400 deaths, but most of the people were evacuated early. We learned a lot of lessons there. Fortunately, now we have well-established warning systems, so people can anticipate the intensity and the area affected, and be prepared.

Do you use a lot of data from crowd sourcing, social media and voluntary information? How do you verify that?

We are very active on social media, and trying to use whatever data sources we can obtain to give people early warnings. Let me give you the example of earthquake early warnings. We only have some 200-odd seismic monitors and we augment those stations with Twitter data constantly. We monitor all tweets that have the word 'earthquake' in them — be it in English, Spanish or French — all around the world. The alert from these tweets comes within seconds once a quake strikes. For example, during the Napa Valley earthquake in 2014, we had a robust number of tweets within 29 seconds. Sometimes, we wouldn't even detect some minor quakes had it not been for the tweets.

Another example which has been on for more than 20 years now is our "Did You Feel It" program, where people report online or on their cellphone network a tremor or a

quake that they have felt. They evaluate the intensity, post photos of the damages and that augments what we get from the seismometer network.

Do you use VGI and citizen participation for monitoring natural disasters only or also for change detection purposes?

Yes, we do a lot of that. For example, we use citizen scientists in our national phenology network. We have a huge citizen science network in what we call "Nature's Notebook", where people report the budding of certain type of trees or plants and then we track the trends through time. For instance, we have noticed an earlier arrival of the spring season in the United States. We also rely on citizen scientists for other types of monitoring that we cannot maintain with our staff alone. These citizen scientists go out, survey and report the occurrence of invasive species, for example. We have about a dozen programs where we specifically train and rely heavily upon citizen scientists across the country.

The USGS National Map service relies heavily on citizen scientists for updating map features. We use volunteers for identifying features along the roads, and mark cemeteries, hospitals, law enforcement agencies... all the things that you want to look for in a map.

The current US administration has a different take on Climate Change. How do you deal with that?

We are part of the US government, and we are a science arm of the government. Our role is to produce scientific evidence that underpins decision-making. What decision-makers do with it is their purview, their role and their job. Our job is to provide the best science to describe the changes. We use ice core records, sediments, corals, tree rings to reconstruct how the climate has changed over centuries. We also look at how the temperature has changed precipitation levels and how that effects stream flow and migratory birds, we have a biological arm as well. We were able to release the report (the National Climate Assessment) with the approval of the administration. 🌍



How **GDPR** Impacts Location Data

The regulation, which emphasizes importance of content, is the most important change in data privacy regulation in 20 years, replacing an outdated data protection directive from 1995.

By Shilpi Chakravarty

Everything is based on location. Whether you are ordering food, taking a drive, or ordering medicines, everything has location as a core component. Hence with an exponential increase in connectivity, ubiquitous cameras and sensors, there is a huge amount of data being produced every moment. While this trend can benefit companies in a big way by capturing these data in innovative measures, customers or common man feel a threat to their privacy.

There is also a growing trend where customers are increasingly sharing their location data with map or navigation and weather services. To address privacy concerns and bring current privacy rights in accordance to digital age, the European Union is implementing the new General Data Protection Regulation (GDPR) in May 2018.

According to the regulation, enterprises that collect data from citizens in EU countries will need to comply with strict new rules around protecting customer data by May 25.

What is GDPR?

The EU GDPR is the most important change in data privacy regulation in 20 years, replacing an outdated data protection directive from 1995. The European Parliament adopted the GDPR in April 2016. The regulation entails provisions that require businesses to protect the personal data and privacy of EU citizens for transactions that

occur within EU member states. It also looks into the exportation of personal data outside the EU.

With a widespread reach to all 28 EU members, the regulation ensures that all companies and businesses will have to adhere to one standard. However, to maintain such high-quality standard most companies will have to make a large investment to meet and to administer.

This might also have an adverse effect as according to an Ovum report, about two-thirds of US companies believe that the GDPR will require them to rethink their strategy in Europe. Even more (85%) see the GDPR putting them at a competitive disadvantage with European companies.

How is GDPR going to impact processing of location data?

According to GDPR, location data is considered as “personal data” in Article 4 (1). Under this clause personal data are granted extended rights, including a right to access and a right to erasure.

Under the right to access users can obtain confirmation about whether data concerning them is being processed, where and for what purpose. The right to erasure can put an expiration date on the data already collected.

GDPR consequently describes requirements for data processing companies and organisations. Processors are required to offer explicit and transparent notification about their data practices. A “Privacy by Design” approach should

ensure that data processors take the measures necessary to collect, process and store data in a secure way.

The regulation also mentions that special rules that apply to the processors of sensitive data. This will include guidelines for data assessments and the mandatory appointment of an official data protection officer to inform and advise the organization.

Furthermore, the regulation emphasises the importance of consent. In future it will need to be clear and affirmative, putting an

end to pre-checked checkboxes when installing or using apps.

Need to understand location complexities

Location data is extremely personal and valuable. Considering its complexities, it is difficult to foresee as to how many ways location data could be used or misused.

Hence, this issue needs to be researched and there is a dire need to educate people about privacy rights as well as data science.

Organizations can use GDPR as a guideline to evaluate their data practices and to ensure their external communication gives users all the information they need to provide consent.

In times to come GDPR will steadily increase the pressure on businesses that process data. There is an immediate need to improve security standards and also set measures about how data is being used. 🤖

Shilpi Chakravarty, Assistant Editor
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Ten Key Features of GDPR

The General Data Protection Regulation (GDPR) is all set to become a law soon. With its wide-ranging norms and privacy being the focal point, the regulation gives individuals a lot more power over their personal data.

It caters to complex questions like what personal data is collected, how it is being used, what happens when they want to remove consent, etc., hence empowering individuals with more data privacy. The new law will apply to all businesses not just based in the EU, but also those dealing with EU citizens. Let us look at 10 key features of GDPR that will impact individuals and businesses:

1: Specific permission Unless or until you give permission to an app or website to use your details in a specific way, the data can't be used for any other purpose or sold to third parties.	2: Privacy by design According to this feature when you sign up for a service, you should not be asked for data that is not directly needed or relevant for the purposes of using that app or service.	3: Data portability Here you get the right to ask for any data that a company has about you in a readable format so that you can reuse it.	4: Right to be forgotten By giving someone your data does not mean they have the right to keep it forever. Under the GDPR you have a right to be forgotten and will be able to ask companies or platforms to delete your data.	5: Definitive consent There has to be a clear and affirmative consent before private data is processed. When the legislation was announced, EU Parliament had clearly said that "silence, pre-ticked boxes or inactivity will thus not constitute consent. In future".
6: Info in readable language It is the right of the individuals to get and read the information clearly. So, the new rules will put an end to "small print" privacy policies and that information should be given in clear and plain language before any data is collected.	7: Limits on use of profiling Personal data is automatically used to access and analyze personal choices, predict performance at work, economic situation, location, creditworthiness, etc. Under GDPR, profiling will be allowed with the consent of the person concerned.	8: Same law for everyone Now the regulation will ensure that everyone abides by the same rules. Savings from dealing with one pan-European law rather than 28 are estimated at €2.3 billion euro per year.	9: One-stop solution Hugely beneficial for businesses as they will have to deal with only one regulatory body rather than 28, making process simpler and cheaper for companies to do business in the EU.	10: Adopting techniques New rules promote techniques such as anonymization, pseudonymization (replacing personally identifiable material with artificial identifiers), and encryption (encoding messages so only those authorised can read it) to protect personal data.

Hence the new data protection rules not just give individuals a clear, effective information about how their data is being used, they also give businesses the opportunity to innovate and win back trust from consumers.

FACEBOOK is not yielding

The social media giant is attempting to circumvent GDPR by shifting users outside the EU who would now be governed by Facebook Inc. in the US rather than Facebook Ireland. **By Aditya Chaturvedi**

As a result of the new change in the terms of service of Facebook, its existing 1.5 billion users won't be safeguarded under the new data protection laws of Europe (GDPR). This comes in the wake of Facebook being at the center of a controversy about its handling of personal data, allegations of leaking data for profit, and the mounting criticism from different quarters.

The new policy depends on the users who will be regulated via the European headquarters of Facebook in Ireland. Facebook is maintaining that it has planned transparent privacy rules worldwide and would soon act upon it.

By the new move, Facebook users outside the EU would be governed by Facebook Inc. in the US rather than Facebook Ireland. It is seen as a way of circumventing the stringent General Data Protection Regulation (GDPR) by shifting user base outside the EU. More than 70% of its 2 billion members would be impacted by this change. As of December last year, Facebook had 239 million users in the US and Canada and 370 million in Europe.

Billions under the impact

The social media giant also had 1.5 billion members in Africa, Asia, Australia and Latin America — and they are the ones affected by the change. Users in the US and Canada were never subject to European jurisdictions.

Stephen Deadman, Deputy Chief Global Privacy Officer, Facebook had said, "The GDPR and EU consumer law set out specific rules for terms and data policies which we have incorporated for EU users. We have been clear that we are offering everyone who uses Facebook the same privacy protections, controls and settings, no matter where they live,"

According to Sylvia Kingsmill, Digital Privacy Expert at Consultancy, KPMG said such moves would enable the tech firms to look for loopholes and find the ways to avoid the new regulations. "I think that the public expectation is that their data, which they freely give up to corporate giants, is protected and I think this kind of move will catch up with the firms that make it," said Kingsmill

Kingsmill further added that regulators and lawmakers in the US and Canada are working on their own version of the GDPR.

Facebook's next move

Facebook, just like many other tech giants, established its international headquarters in Ireland, in 2008, because of the low corporate tax rate in the country. This shift also meant that consumers outside of USA and Canada would be subject to European laws and regulations.

With the new change, users outside Europe will no longer be able to lodge complaints with the Irish data protection commissioner or in the Irish courts. GDPR offers greater control to users and the penalties for data breach are very high — up to 4% of the company's global revenue.

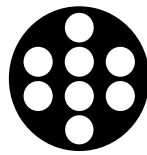
The Cambridge Analytica scandal rocked Facebook and it received much flak due to its negligence in handling user data and allowing companies to harvest user profiles for political purposes. Facebook CEO Mark Zuckerberg had publicly tendered an apology for the data breach.

It remains to be seen whether Zuckerberg is ready to walk the talk on data privacy following the recent controversies and actively takes up measures to boost user confidence and prevent future data breach. Meanwhile, before Facebook implements similar laws, the consumers outside Europe and US would be in a limbo.

What's at stake here concerns not just Facebook but expresses the dire need of instituting data privacy laws worldwide and recognizing the privacy rights of the netizens. There is already a cat-and-mouse chase between cyber criminals and authorities and in the absence of proper regulatory mechanisms, legal frameworks and punitive measures. The risks of data breach are enormous and in a rapidly evolving, fast-changing, and interconnected world no one can afford to take data privacy lightly. 

Aditya Chaturvedi, Correspondent, Aditya@geospatialmedia.net





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SEEING IS BELIEVING

Common problems cannot be solved without intervention and intervention is impossible without visualization offered by 'maps'. Maps have been an integral part of human history for thousands of years, and their ability to make communities live a better life is felt more strongly with each passing day.
By Shimonti Paul

A table of data may present facts and figures, but it doesn't tell a story. A static table of data can help us realize there is a problem, but it cannot tell us accurately 'where'. Only maps can accurately point out which are the most affected areas, enabling us to know why those areas have got most affected, what can be done to reduce the impact etc.

As **Jim Herries, Product Engineer and Cartographer, Esri** explains, "Digital maps are pushed into our digital lives regularly. Our fundamental desire to know where things are, how to get there, what the weather is like... these are joined today by a desire to understand where problems or needs exist, and compare alternatives to solving them."

Maps are becoming an indispensable part of our lives. They are becoming all pervasive. From better governance to more profitable businesses to enabling the communities live happier lives, maps are enabling people to make more informed decisions and achieve more efficient outcomes.

Guruprasad S, Director, Market Screening Solutions, Bosch aptly puts it, "Map as a service is of utopian help to public health and payers to look at population health management, seasonal diseases heat map and strengthens the focus of social determinants of health, for better healthcare delivery planning, focussed campaigns, targeted outreach programmes etc."

The trend is not new

Maps are not new to mankind. Though the concept of 'democratization of maps' has picked up recently, maps have been an integral part of the human history for thousands of years. From cave paintings to ancient maps of Babylon, Greece, and Asia, through the Age of Exploration, and on into the 21st century, people have created and used maps as essential tools to help them define, explain, and navigate their way through the world.

It is interesting to discover that the earliest maps were actually 'story' maps. Cartographers acted as artists, as they painted pictures based on knowledge, memories and fears of travelers. The maps so created, not only described the landscape, but also the events that had taken place within it. These beautiful pieces of work allowed travellers to identify routes, while experiencing a story. Human intelligence evolved, the power of visualizing location became clearer. With advancements in technology, maps took the form of digital roadmaps and permeated every household through smartphones.

Mapping is a central function of Geographic Information Systems (GIS), which provide a visual interpretation of data. GIS analysts and specialists have emerged as the new gurus of cartographic science. Factors such as extensive use of GPS or Remote Sensing, globalization of data, use of Internet, web mapping services, new software applications, have contributed greatly to the use of GIS and cartography for more and more applications every day.

The world is realizing that common problems cannot be solved unless intervention is made and intervention is impossible without visualization, and thus without 'maps'.

Maps in Governance

Governments use GIS and maps to improve their workflows and services to citizens. Visualizations through maps are used to accomplish better land-use planning, road and utility maintenance, emergency management, infrastructure assessment and development and property management. Local, state, and federal governments have found maps particularly useful in urban planning, including classification of land uses, zoning and subdivision planning, land acquisition, assessing urban growth, environmental impact policy and water quality management. Mapping can be of great help when it comes to managing urban growth and solving housing issues associated with the increasing population.

In the words of Herries, "Maps help governments assess the needs of citizens, look for any spatial components of those needs or issues, and compare different plans of action to address those needs." For instance, consider the "Clean Streets LA" initiative. The city of Los Angeles put maps to use, assessing every single street in the city with regard to how much trash or even dumping was present. The resulting data might have been kept out of the public's eye, but instead the city chose to address the issue of trash and illegal dumping in a very public way. Citizens can see maps of the entire city, and of course go look around their neighborhood, to see how clean or dirty their neighborhood is, schedule a pick

MAPS LEADING TO SMARTER PROPERTY MANAGEMENT

The Challenge

The city of Virginia Beach has properties and roadways spread over 795.13 square kilometer and 56.33 kilometer of beaches.

With such a large area to cover, the need for a robust system of property management was rightly felt. With five different municipal departments taking care of more than 2,000 different properties, and tracking information such as size, value, usage, condition, and

future development, the manual system was turning out to be time-consuming in accessing, sharing, or updating information.

The prospective spatially enabled solutions needed to have features like user access control and rights based on a department's area of responsibility on a given piece of land. While allowing this versatility, the solution had to retain the ability to share one unified view of information across departments. Additionally, the city wanted to tailor access to individual users, based on their particular workflows and level of responsibility.

The Solution

To achieve the desired results, powered by GeoMedia Smart Client, a product of Hexagon Safety and Infrastructure, the City of Virginia Beach developed a unified information source for municipally owned property that could provide citywide access to property information.

The property records management solution enabled the City of Virginia Beach to achieve improved collaboration and communication among city personnel and increased efficiency and productivity. It enhanced the availability of municipal geospatial data, and upgraded the city's ability to manage and maintain all city-owned real estate. With the help of the solution, the city could achieve excellence in tracking the condition and maintenance needs of city properties. It could also query data repositories and by analyzing spatial data carry out more effective maintenance of city property records.

Thus, it would be totally apt to say that the power of GIS & Maps enabled the City of Virginia Beach to gain a clearer understanding of its properties, helping it achieve more efficient planning and maintenance.



or engage in other ways. Maps help create that engagement with citizens, to improve their lives specifically and the city overall.

GIS-based mapping helps the governments achieve better governance as they are able to solve problems more quickly and efficiently.

Maps in businesses

Organizations today are collecting data at every level of their business and in volumes that in the past was unim-

aginable. It is an accepted fact now that about 80% of all data has a spatial component.

According to Guruprasad, "It is estimated that roughly 2.5 quintillion bytes of data are generated per day. With this huge volume of data being churned out, business intelligence solutions have become a necessity rather than a luxury. In this highly data intensive scenario, spatial analysis provides powerful 'where' perspectives and contextual insights. Being able to visualise the 'where' is invaluable for planning and enhances many business intelligence applications. As better insights delivers a better impetus for decision making, spatial analysis acts as a key differentiator for businesses today, enabling them to grow faster and smarter."

Traditionally, data would get presented to the user in the form of long reports, either with graphs and pie charts, or in a spreadsheet format. Now, given the complex interrelationships of multidimensional data, visualization

MAPS CAN HELP YOU GET WINGS TOO!

Why

Based near Skirwith in Cumbria, the Edensoaring Gliding Club offers pilot training and trial lessons for gliding. The gliding region includes the Pennine Ridge, an area that can be pretty dangerous for an unfamiliar pilot.

To ensure safety of the gliders, the Gliding Club decided to have a printed 3D view of the area, as this could help the trainee pilots easily understand the challenges associated with the landscape. Needless to say, the map had to be very detailed such that it clearly indicated valleys and other subtle terrain features. This was necessary for ensuring the safety of the gliders.

How

Edensoaring Gliding Club got in touch with Lovell Johns, a leading UK mapping company, to create the 3D view of the area. The company, on the basis of a detailed digital terrain model produced by the Ordnance Survey, first produced a view of the area. It then added colored tints to the map with the intent to further highlight the elevation.

What

Based on Ordnance Survey Explorer mapping, the 3D views of the terrain were created and printed. A digital version of the map from the same data set was also created. This allowed the members of the gliding club to interact with the 3D model and thus gain a greater insight into the complex terrain. A better understanding of the terrain using the maps enabled the gliders to gain more confidence before jumping into the unknown.

technology has become ineluctable for offering an accurate, high impact insight to business intelligence users.

Humans think visually, therefore spatially. Data gains immediate visual impact with the help of maps. This is more emphatically true for data with a spatial dimension. Maps best represent spatial phenomena or relationships such as flow or proximity, while also facilitating visualization of statistical measures for an area or region. In addition, maps allow multi-measure displays.

The importance of visualization in business can be better gauged from **Peter Hawkins, Regional Director, Digital Content, Asia Pacific, HERE, Singapore** words, "Visualisation on maps or any sort of special platform is critical. I think the old adage applies here that one picture can tell thousand words. It is critical how people visualize and interact with maps. The maps and special data is going to get more complex, fast pace and near real time. And the way people consume and interact with it has to change." Hawkins shares that we have announced a stringent visualization strategy, which is going to become an important element in resolving a number of interface problems and challenges faced by the industry.

Spatial analysis is helping the industry to gain invaluable insights in stock delivery, store management, inventory management, marketing and sales.

Santiago Giraldo, Director, Product Marketing, CARTO- points out, "Historically, location data was only available to highly trained specialists and used to produce static GIS maps depicting the past or current status. However, today location data and insights have become more accessible by turning the map into an interactive

model, where all types of professionals can do sophisticated analysis on their own.”

Today more people are using spatial data presented on maps to make faster, smarter decisions to improve business operations.

“While many early adopters have been in the financial sector, verticals like retail, telecommunications and real estate are also experimenting with and receiving benefits from spatial analysis based on maps today,” adds Giraldo.

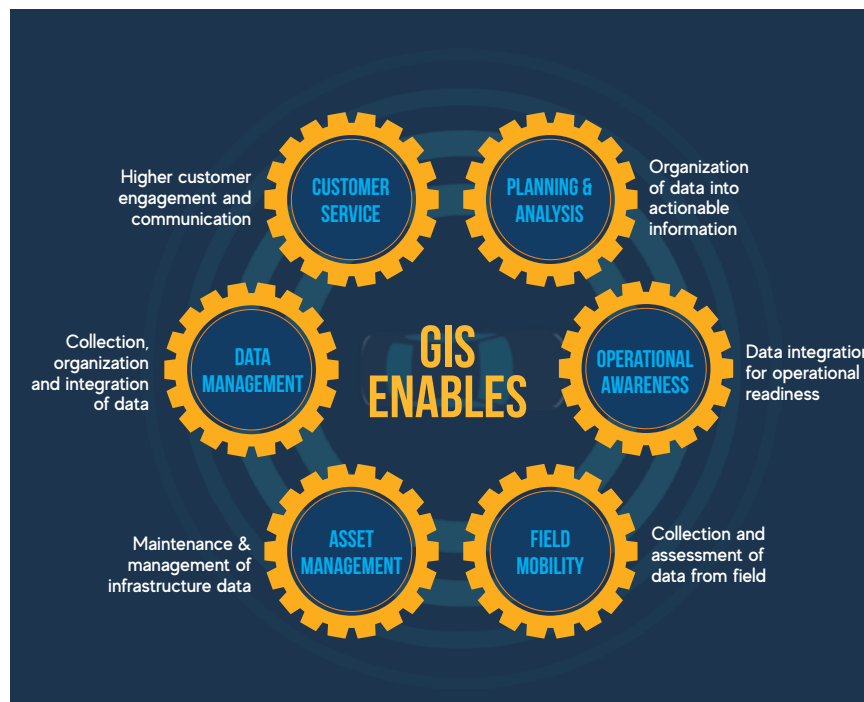
‘Customer mapping’ enables organizations to identify the markets where they can find the highest concentration of the best potential customers. The resulting color-coded maps help in site-selection, which involves considering factors like income, community growth rate, available workers, the physical features of the area such as roads, water, etc. and by using GIS, each of these factors can be layered on top of each other to identify the best possible location for a business.

For example, while considering relocation, a children’s clothing store could map the population of people with children in the targeted age group throughout the area under consideration. The data, once put into a GIS can generate maps wherein the highest concentration families with children are depicted using dark colors and those without using lighter colors. The final map so generated will highlight the ideal areas for the clothing store to be relocated.

Maps for citizens

Community development scales new heights when the power of maps is put to use. Maps are playing an increasingly important role in helping us create a safer, happier world. Be it leading a healthier life or producing higher quality food for feeding more mouths or having better preparedness for disasters, maps helps in identifying threats and taking corrective actions on time.

Both public and private sectors are developing innovative ways to harness data



integration and spatial visualization power of GIS to provide enhanced healthcare services. Maps play a critical role in determining where and when to intervene, improving the quality of care, increasing accessibility of service and finding more cost-effective delivery modes.

Mapping allows healthcare professionals to identify health-related trends and target healing efforts based on those results more thoroughly. For instance, by integrating visualization in a Cancer Surveillance Program, healthcare professionals can visualize the locations of patients and determine if clusters of specific types of cancer are associated with similar working conditions or residential areas. Such studies often reveal important correlations, such as association between people residing near heavily sprayed fields and higher incidences of prostate cancer among them. For years, healthcare professionals have relied on hand-drawn maps for identifying affected areas; things have

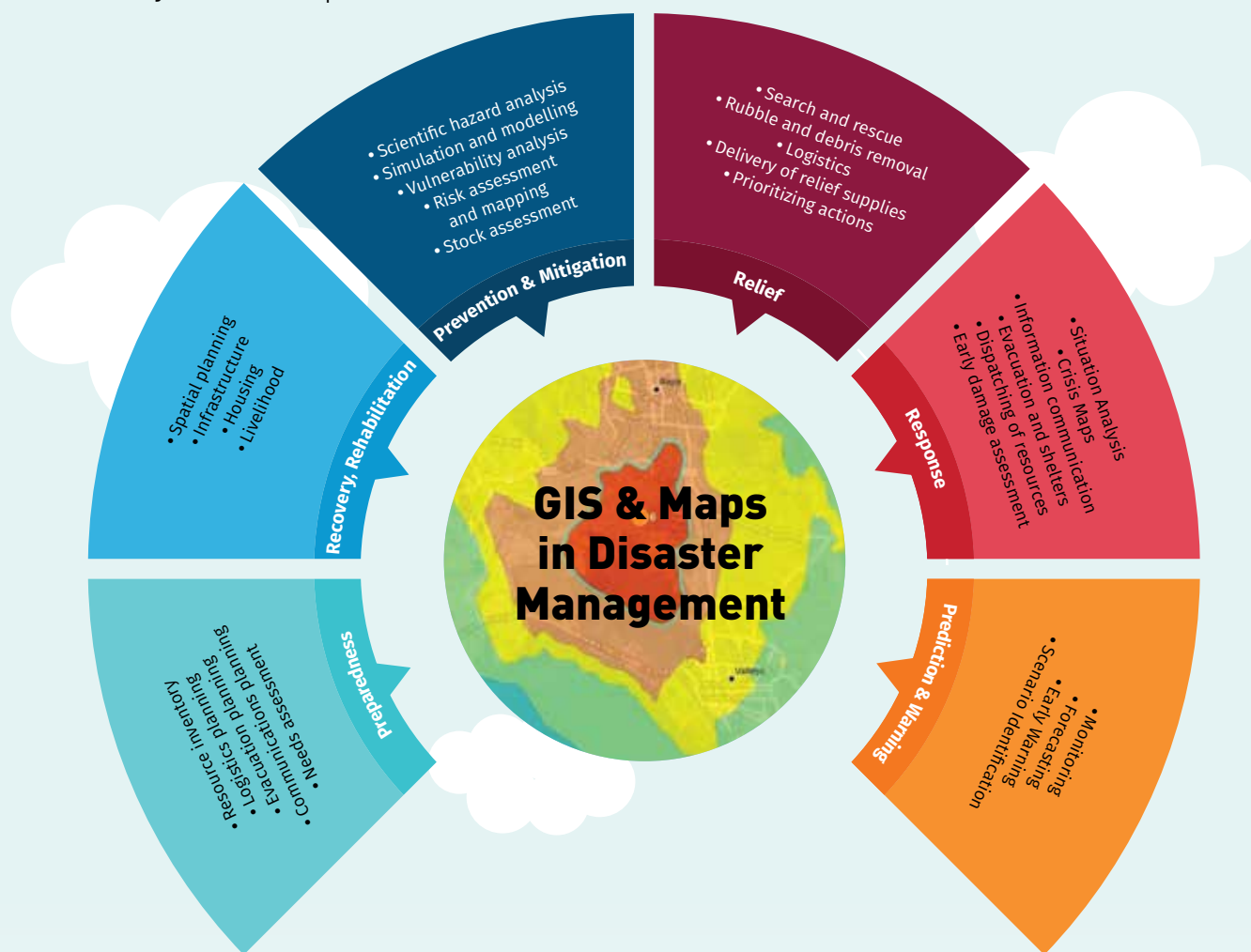
become more systematic and accurate with maps generated by GIS.

With rising incidents of chronic diseases such as cancer, diabetes, etc., mapping enables healthcare professionals to identify where certain diseases are more likely to or already have become prevalent and proactively begin implementing preventative strategies.

Using geography and other inputs, GIS can also help in identifying where the diseases are most likely to spread next. This kind of information can help in saving lives as it enables healthcare professionals to prepare in advance for the disease. Maps such as these play a significant role in management of disease outbreaks as they help visualize where infected people live and the potential spread of the disease. Mapping can also be used to gain a better understanding of vaccination rates in differing areas to determine which locations could be hit the hardest in case of a serious outbreak.

Use of maps can enable community leaders and developers to work more closely with hospitals to take larger steps in addressing national healthcare needs. The system can help identify which neighborhoods are in

Maps play a critical role in determining where and when to intervene, improving the quality of care and accessibility of service



greater need of specific health services such as more rehab centers or senior care facilities. Analysis of patient demographic data can help answer these questions.

Maps for disaster management

Be it modeling through early warning systems or using decision support systems to understand which disaster is going to affect or is affecting which region the most, visualization achieved through GIS can help in mitigating the risks of a disaster to a great extent. As maps help in identifying disaster prone areas, preparations can be better, efforts can be more directed and response can be faster.

For instance, landslides are one of the major disasters that occur in hilly region. The disaster risks can be mitigated using maps. A 'Landslide Hazard Map' includes "zonation showing annual probability of landslide occurring throughout an area" (USGS). A landslide susceptibility map is a

basic concept of landslide susceptibility and it includes the spatial distribution of factors related to the instability processes in order to determine zones of landslide-prone areas without any temporal implication.

This approach is useful for areas where it is difficult to secure enough information concerning the historical record of landslide events ranks the slope stability of an area in categories that range from stable to unstable. Susceptibility maps show where landslides may occur. This identification leads to better preparedness and thus lesser or no loss of lives.

Maps can be used to indicate vulnerability to different extents under different conditions. Areas likely to remain unaffected or remain comparatively safe could be identified and even alternate routes to shelters, camps, and important locations could be worked out.

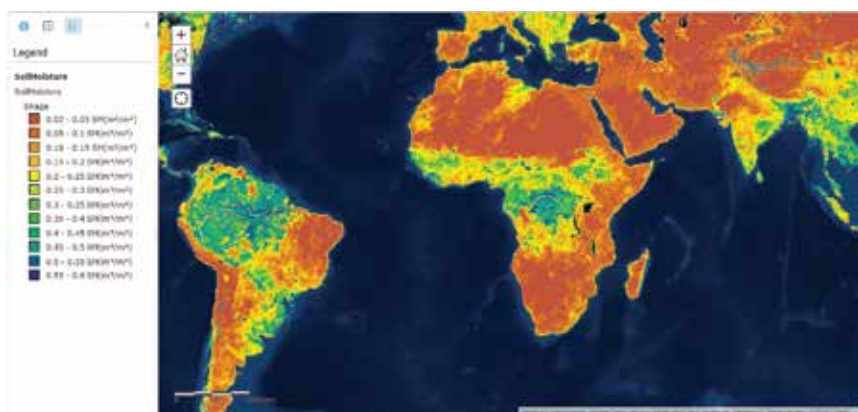
Identification of vulnerable areas leads to smooth rescue and evacuation operations.

Mapping of affected areas lead to better organization of rehabilitation and post-disaster reconstruction works could be properly organized.

More food to eat with maps

Use of GIS-based visualization to achieve higher quality food production is not a new phenomenon anymore.

Agricultural mapping is day by day becoming crucial for monitoring and management of soil and irrigation of farmlands. It is facilitating agricultural development and rural development. Accurate mapping of geographic and geologic features of farmlands is enabling scientists and farmers to create more effective and efficient farming techniques. As farmers are able to take more corrective actions in the form of better utilization of fertilizers, treating pest and weed infestations, protecting the natural resources etc., we are bestowed with more and higher quality food production.



SERVIR, a joint initiative of NASA and USAID, uses maps for indicating percentage of moisture in soil for suitable crop production

While natural inputs in farming cannot be controlled, they can be better understood and managed with GIS applications. GIS can substantially help in effective crop yield estimates, soil amendment analyses and erosion identification and remediation. More accurate and reliable crop estimates help reduce uncertainty.

Mapping in agriculture helps farmers to achieve increased production and reduced costs by enabling better management of land resources. The risk of marginalization and vulnerability of small and marginal farmers, who constitute about 85% of farmers globally, also gets reduced.

Undoubtedly, the insight gleaned from the dimension of 'place' opens doors to new learnings and potential patterns that enable the decision-makers to take better decisions and achieve more productive outcomes.

Benefits are limitless

Gartner predicts that the number of organizations using spatial analysis is expected to quadruple from 9% to 36% by 2021. Additionally, the number of people using spatial analysis within those organizations is also expected to quadruple from 5% to 20% during that time.

According to Herries, "Every business needs to understand its customers, whether

it sells directly to people, indirectly to other businesses. If only those customers would stay the same, the business person's life would be easier." But people keep changing, aging, and moving. Their tastes and preferences change. Sometimes their world changes underneath them, such as during the Great Recession or when a big company in town lays off (or hires) thousands. C-Level executives need clear visualizations of their company's assets, competitors, and customers. "Maps reveal what tables and charts can hide: the 'where' in their business. Where are the customers? What challenges are they facing? Where are the suppliers? Where is our competition?" he explains.

Maps help in creating sound marketing plans. As maps enable identification of target markets, marketing plans become more efficient. Using GIS and mapping, businesses can identify an area's market and the customers within it. This helps them to focus on offering the products that can best match the demands specific to that market area. This approach ensures higher sales and more satisfied customers.

Mapping also helps in determining if a location is apt for a service or not. For instance, mapping can enable a senior center to identify where there is highest

proportion of senior citizens in a city. This knowledge allows it to establish itself at the most suitable place instead of a random location. Mapping prevents a business from taking a wrong decision. For instance, a restaurant serving Chinese cuisine can identify beforehand whether a similar one exists in the area. Unless there are enough customers to support both, the new one may decide to choose a new location.

Maps help in analyzing sales and identifying geographic patterns that enable the businesses to take more informed decisions. For instance, peaks through the sale of different items at several coffee houses in a chain can help the manager of the chain to determine which items are preferred in which location. As he accordingly makes the items available in different locations, business for the chain is likely to become more efficient.

According to **Sanjay Dhakar, VP – Engineering, Jugnool**, India's first auto-rickshaw aggregator, "There are multiple aspects to visualization for business. One is on the customer side — when a customer is taking a ride or ordering food, it is critical to display all the data in front of him. For instance, exactly where the biker or the driver is. So this is one area where we are using visualisation of maps in showing real-time location of drivers. On the backend side, our team uses visualisation to see which area the drivers are. Lastly, the analytics team uses visualization to make sense out of the data that is collected."

Map usage is getting democratized with the creation and usage not remaining limited to the privileged few. As more and more people are realizing the significance of maps in making the world a better place, more and more map-based solutions are cropping up. Taking things further, many organizations are taking advantage of location intelligence, gaining additional business intelligence. They are enabling their data locationally, visualizing it on maps, and then doing analytics on that data to gain further insight 📍

The number of organizations using spatial analysis is expected to quadruple from 9% to 36% by 2021

Shimonti Paul, Deputy Executive Editor
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I Know Where You Were Last Weekend!

Whether you want to find the nearest restaurant or advertise deals to shoppers who are in the neighborhood, or just locate your friends, location-based services (LBS) have become an inseparable companion of yours. They not only grant user access to relevant, up-to-date information about their surroundings but also allow businesses to provide current updates to their customers. **By Shilpi Chakravarty**

In today's world of mobile, wearable, location-aware, and digitally aware technologies, we are always "on" and always connected. In this ever-connected ecosystem, we have a deeper concept of location; one that is more refined, instantaneous, and even predictive in some cases.

Location intelligence is providing the powerful "where" perspective to businesses, and propelled by the innate ability to make the best of the technologies available, the service industry is effectively grooming a new kid in the block.

With more and more innovations happening in its realm, location technology is becoming the key differentiator to businesses to improve customer experience, drive revenue and increase operational efficiency.

Technologies like the Internet of Things (IoT), autonomous vehicles and sensors are capturing information that has never been captured before, creating entirely new avenues for geospatial data collection. As a result, location-based analytics and platforms that can process and detect trends and provide intelligence are becoming more popular, points out **Anthony Calamito, Chief Geospatial Officer, Boundless.**

"With self-driving cars and smart cities initiatives becoming more of a reality, it will be imperative to understand how all the location information can be used to make smarter decisions," he adds.

As **Santiago Giraldo, Director, Product Marketing, CARTO** explains, location-based services provide a layer of insight that we simply didn't have in the past. "This extra context about where interactions or touchpoints occur can help organizations make more informed decisions about where to invest in their own innovations."

For example, better understanding of traffic patterns might provide insights about where to place sensors within a smart city. Or, identifying pockets of residential areas with repeated weather damage might help insurers make decisions about where to test out their latest drone surveillance technology.

Adding a layer of intelligence about where they could have the greatest impact could

help protect that investment and increase rates of adoption, says Giraldo.

However, with fluctuating financial markets there is a need to build more security. "There is a need to have response to cryptocurrency that is coming up today as well as the large e-commerce platforms and payment platforms," points out **Peter Hawkins, Regional Director Digital Content, Asia Pacific, HERE, Singapore.** To drive the level of governance, innovation and future development, location is important. More and more people are embracing location and it is rapidly becoming prevalent everywhere.

As users, we assume that most applications, especially mobile-based, embed location-based services. However, **Joe Francica, Managing Director, Location Intelligence, Pitney Bowes** feels that the use and popularity of location technology depends on how much it becomes embedded with enterprise computing. "Without it, organizations are blind to the impact location has on business. From insurance to banking to retail, every business is now a consumer and a creator of location-based data. Those that learn to think spatially, win," he adds.

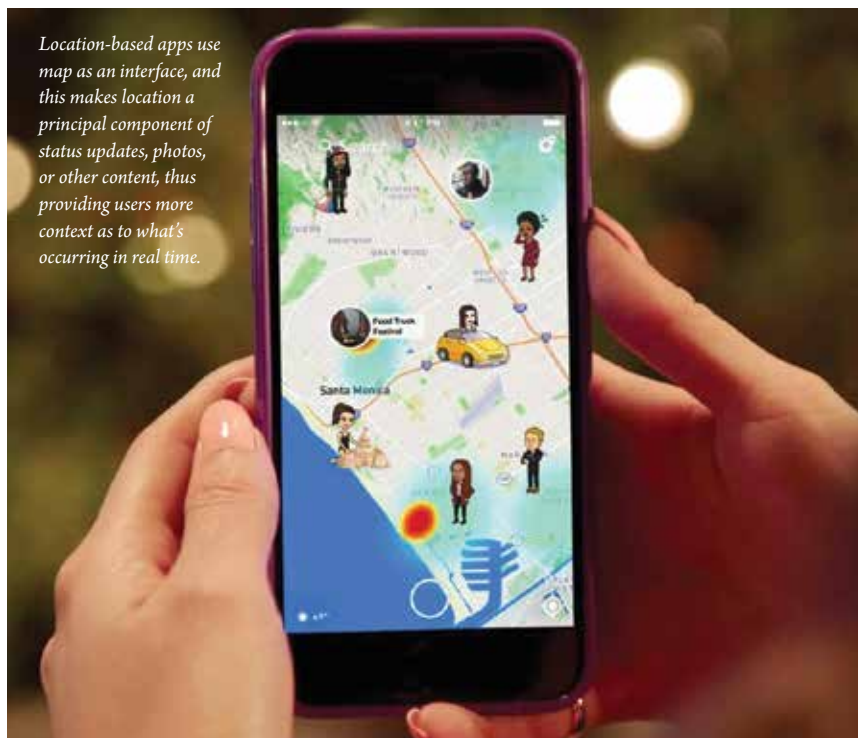
"The practical applications for location technology are endless. Big Data, touted as the new oil, provides a landing platform from which we have only just begun to see the possible innovations of the future," emphasizes **Dr Steve Marsh, Founder and CTO, Geospock.**

Whether it is global giants like Uber, Swiggy, Grubhub, Groupon, or localized service providers like Grofers, BigBasket, Netmeds, UrbanClap, Jugnoo, or even the India government's clean India initiative Swachh Bharat Toilet Locator, location technology is enabling the service industry to pamper the customers and thus garner brand loyalty. And did we mention, more smiling faces!

Power of 'where' critical to next industrial revolution

Location-based services are expected to reach a market size of \$1.89 billion by 2022. With the advancement of connectivity, location will be at the core of many technology trends in the future from AI and robotics, to data analytics and quantum computing.

Location-based apps use map as an interface, and this makes location a principal component of status updates, photos, or other content, thus providing users more context as to what's occurring in real time.



HOW CRUCIAL IS LBS?

An IDC Custom Research and Survey, sponsored by CISCO, emphasises that LBS uses customer location data to offer personalized information and services to customers. The survey also reveals that is getting widely adopted by business.

Lines of Business (LOB) value being customer centric, and IT agrees



LBS is early in its lifecycle (11% adoption) ... but over 70% expect to deploy LBS across their WiFi network in the future

Does your mobile strategy include LBS today?

Early use cases for LBS



90% of LOB respondents report over half of their end users are receptive to LBS

According to **Guruprasad S, Director, Market Screening Solutions, Bosch**, “Location technologies are at the very core of a digital revolution. It will primarily be a combination of machine learning (AI more broadly) and Cloud and edge computing, which will be powering greater automation. Location-based services and technology will move from the rudimentary ‘static’ state to a dynamic ‘location aware’ state.”

Location-based intelligence is expected to infiltrate and revolutionize industries like healthcare, government, entertainment, etc. In times to come, in healthcare, location-based services will play a very critical role for epidemic mapping and planning, and

will be a core contributor for the preventive component of social health.

In addition, the technology is radically affecting the automotive industry. We find news about driverless vehicles is everywhere — with automotive giants from Nissan to Uber testing new vehicle capabilities. In Asia, it’s no secret that automotive companies are working towards providing driverless fleets to complement an automated and robot-driven Olympic village. Adding to this Dr Marsh says, “The 2020 Games will see recent and evolving developments in automotive showcased to the world, not only impacting the future of automated vehicles but also the development of cities with truly smart capabilities.”

With petabytes of data collected every day from things like public transportations systems, drones and autonomous vehicles to more fixed assets such as air quality and building sensors; the opportunity to gather, process, and glean insight from location intelligence is ever increasing. “The implications of this technology will impact and mould how we live our lives in the near future,” he adds.

No wonder why Esri and Alibaba Cloud, the Cloud computing arm of the Alibaba Group, entered into a collaborative agreement and are working together to bring enhanced location intelligence technology to Cloud users.

Jack Dangermond, President and Founder, Esri describes the agreement as both a recognition of successful implementations and a shared belief that location intelligence in Cloud infrastructure is pivotal to address customers' needs and solving real-world problems — especially those that need scalable computing, storage, and networking capabilities.

Even for developing countries, location will become more relevant with the uptake in technologies. "Urban migration is a huge part of what is happening in India. The consumers are moving from rural areas to bigger towns and bigger towns to metros. All of these are consumers for banks, FMCG and hospitality companies. They are using and leveraging location data to understand who these consumers are and provide them with real time access and extra value," says **Ajay Kelkar, Co-Founder, Hansa CEquity**. His words corroborate the fact that Location intelligence is fast becoming a core asset to many sectors.

Location is the golden thread

The power of location data is being felt across many disciplines and industries, and following the trend, firms are actively combining footfall data with their digital advertising capabilities to provide the best possible location based service to the customers. Location technology is helping them to come up with more focused digital campaigns.

According to *LSA's Market Landscape Report on Location Intelligence*, over the past several years the discussion surrounding location and location data has changed from a focus on "geofencing" and real-time purchase incentives to more compelling and brand-friendly talk about audiences and attribution.

Location targeted mobile advertising is expected to reach \$32 billion by 2021. By fueling new services, enabling improved decision making and helping companies to better tailor advertising and marketing efforts, location intelligence is providing businesses with a competitive advantage.

A very good example is of PepsiCo introducing Foodicons in India. The company has taken 100 food items which are popular in India and put them on their bottles. It is the

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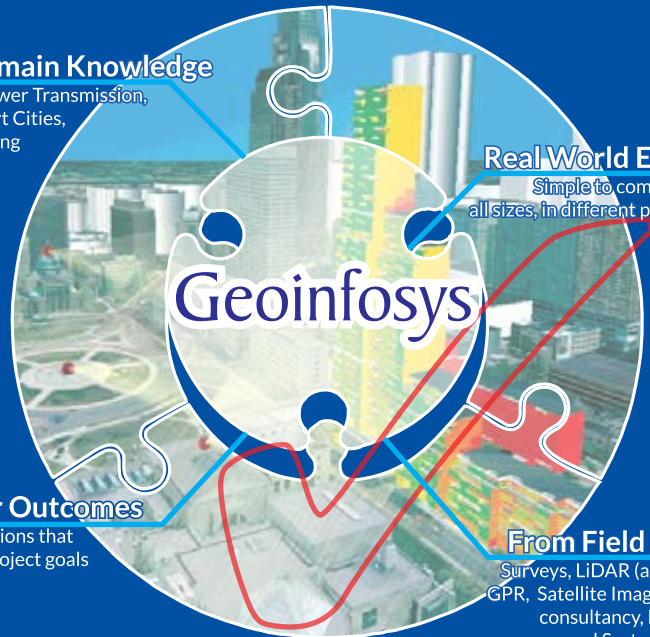
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company's first geocoded encrypted promotion where if you buy a Pepsi bottle and you are in a particular place for example place X you can SMS the code to your number and you will find 20 deals around the place X. Now you can go to the nearby eatery and get may be 20% off or 15% off and it will be within 10 minutes distance.

Elaborating on this **Raj Rishi Singh, Director Marketing, Pepsi, PepsiCo India** says, "Packaging is our strongest asset and the Foodicon bottles are an innovative take on our usual packaging. The new Pepsi Foodicon bottles feature different interpretations of age old street food favourites and have helped us stand out on the retail shelves. We have created 25 distinct Foodicons, representing

popular food from across India such as Bombay's preferred vada pavs, Delhi's beloved samosas and Chennai's favoured dosas."

So, it is great for Pepsi's partners as they get increased footfall. It is also great for consumers as they get something for buying a Pepsi. It is something which is a long-term platform.

All big brands like H&M, Marks & Spencers, Lifestyle, etc. have jumped on the bandwagon and are using location-based advertising (LBA) to lure their customers. Now, imagine you are passing by a mall and you get a message of 40% off on H&M clothes. The probability of you visiting the store becomes much higher than you being at home or some other place. Thanks to

location, advertising at the right place and moment is possible now. All this is done while you share your location with the apps in your mobiles.

Thus, location has become a kind of cookie substitute in the real world, a way to identify audiences and their affinities. It also provides, for the first time, an accurate and scalable offline attribution mechanism for digital campaigns and some traditional media (e.g., outdoor, TV).

"On B2C side, we are able to do marketing on the basis of location. For instance, there is a certain area in the city which has less demand compared to others, we run specific offers for that area. When our users enter into that low demand area, we can



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The power of place is thus more important than ever, for businesses operating in the new age. With mobile devices becoming ubiquitous today, the amount of location data that they generate is enormous

send out notifications of them about the offers,” says **Sanjay Dhakar, VP Engineering, Jugnoo**, a one-stop solution app for all hyper-local needs.

Apps – making LBS all pervasive

Location based services are driving innovation in diverse areas; be it retail or dating, LBS is helping all to get the right match at the right time. Location-based apps have really intruded in the day-to-day lives of people. Whether you want to buy groceries, medicines or commute from one place to another, there is an app to facilitate you.

These apps use map as an interface, and this makes location a principal component of status updates, photos, or other content, thus providing users more context as to what’s occurring in real-time. Along with this, there are push notifications that tell you about the latest deals, dangerous situations, upcoming events, etc. The suggestions that these apps come up with are mostly based on your social media profile, interests and who you follow.

Uber can be one of the best examples here. The ridesharing giant, which has millions and millions of datasets on where people ride, who these people are, where they live, what are their traffic patterns, where are their commuter patterns, etc. decided to use this treasure of data and location to provide food to the customers. So, this is how UberEats started. It was started first with limited portions and a delivering time of 30 minutes. But now the app has hundreds and hundreds of restaurant options.

“So for all the data that we have, it is based on how people use the app, how much time are they going to use the app, etc. Then we can be very geo-targeted in the way we talk to them about what are the promotions running, what are the restaurants do they like, what time of day do they like to have

their food, etc,” elaborates **Manan Javeri, General Manager, UberEats India**. When a company has such rich data, it doesn’t have to talk about advertising, but using that data to try to build a new business. “So we are not selling ad space but selling convenience and location is the backbone of all of it,” he adds.

Taking a step further is an app like Geme.io, which plugs us into our current surroundings — here and now. Another app that started with providing food services and has now expanded its reach and provides almost ‘anything from anywhere’ is Jugnoo.

“In applications like ours, everything is based on location. Whether you are ordering food, taking a drive, or ordering medicines, everything has location as a core component. It is the central part of the products we offer. These days majority of the applications has location as the central part,” explains Jugnoo’s Dhakar.

Another interesting case is Delhivery — an e-commerce logistics company that delivers shipments at the door steps — converts raw addresses to geocodes. As **Dr Kabir Rustogi, Principal Data Scientist, Delhivery** elaborates, “Delhivery converts raw addresses to geocode. At present the best way to reach customers is through addresses. Most of the work at Delhivery in the domain of location is done through machine learning. By converting these addresses to geocodes one can know the exact place and can deliver at exact time. You also know how much traffic is there in the locality or what kind of roads you can find in the locality, etc.”

Even in healthcare, LBS has made a major mark. Taking example of a maternal and paediatric application suite, Guruprasad says, “We have a suite of mobile health applications. We call it the maternal and paediatric application suite which covers

conception, pregnancy management, pre and post-natal, and infant care. Very personalized care is being delivered on a hand held device. Since the hand-held device has a particular location and coordinate, it really adds much more meaning to how we can deliver care to an expecting mother and later to the infant, at a time when they need personalized care the most.”

These apps are not just limited to providing day-to-day services or facilitating businesses in tracking their shipments, fleets, warehouses, etc., they are also used for social welfare like the trellyz’s Miniila app that tracks missing children and also finds nearest relief services. **Shelley Taylor, Founder of trellyz** and creator of the app says, “It is exciting to be able to put our technology to work to help this vulnerable population find more of what they need, when and where they need it. Knowing where it is safe to sleep or find food could prevent these children from going missing, being trafficked or worse.”

Kelkar adds, “To my mind, the data equity is starting to become more important than brand equity today. And location equity adds to the data equity by adding an extra layer of metadata, which accentuates information about you.”

Tapping this large market, many startups are using LBS to come out with new products or apps. Right from location-based social messenger like KahaHo, which tracks your near and dear ones, to an app like Get My Parking that provides real-time updates of parking information to commuters, enterprises and public administration firms. The list is serpentine.

The “power of place” is thus more important than ever, for businesses operating in the new age. With mobile devices becoming ubiquitous today, the amount of location data that they generate is enormous. And marketers around the world know the power of this data to identify audiences, gain competitive insights and observe offline consumer behavior. 📍

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FACING HIRING ISSUES? HOW CAN LOCATION DATA HELP YOU

Knowing the best next location to open, expand or redesign means being aware of many different datasets simultaneously, such as area incomes, education levels, individual buying capabilities, etc. But does it rattle your minds that companies nowadays are using this enormous data to hire teams or individuals.

These companies in order to add more rigor to their decision-making are using these datasets at every stage of the talent lifecycle. Thus, location data allows talent acquisition professionals to influence the strategic direction of their companies and elevate their own careers.

In a report by talent acquisition professionals – Global Rebuilding Trends 2018, 9,000 recruiters and hiring managers were surveyed around the globe about their attitudes and behaviors around data. The report shows 64% of recruiters and hiring managers use data at least “sometimes” while 79% of recruiters and hiring managers are at least “somewhat likely” to use data in the next two years.

However, what is new is the volume of data available and the speed with which it can be analyzed. So, data can now be used to predict hiring outcomes, not just track them.

Determining strategic location for new offices

Where there is possibility of maximum sales, population, demand, etc are integral factors to decide strategic location for new offices. Location-based data can greatly improve sales force productivity by helping companies design balanced sales territories to optimize coverage and customer service levels. Data on customer density, travel times between different sites, the locations of customers with high buying potential and other factors can be brought together and analyzed to ensure that territories are set up to reach customers both effectively and efficiently.

Realising the power of this data, the report gives an example of how pharma giant Novartis which used data effectively to find an apt location for its office.

By leveraging data, Novartis was able to compare each city's talent pool on factors such as mobility and employers. Career level was also a key point of comparison as the company successfully recruits most employees at mid-career. In the talent report, Mumbai was the clear winner over Bangalore with its much larger population of mid-career talent. Once the data was

shared with all stakeholders, it only took three weeks to reach consensus on Mumbai.

Where to recruit tech talent, thanks to the data

Another example where data has been used optimally is by a Sydney-based company called Atlassian where they were facing a tech skills shortage. They needed to start recruiting internationally to meet their hiring goals. So the



talent acquisition team used data to pinpoint key European markets where the supply of tech talent exceeded the demand, and where the company had been successful relocation-wise in the past.

They also used data to unearth what those targets were looking for professionally in order to optimize messaging. From there the team used targeted online campaigns and recruiter outreach to find the right talent, kick off the relocation conversation, and ultimately meet their hiring goals.

The opportunities that enterprises can capitalize on using location intelligence is to leverage location-based data and ensuring that the data are relevant, accurate, and complete. Better geocoding is essential and companies are accessing faster processing of large volumes of records that come in a variety of formats, often from different sources. As a result, organizations are using geoenrichment to append these myriad data sources to existing corporate data such as client lists, loyalty programs, or social media interactions whereby advanced location analytics can reveal proximity patterns not seen in other forms of business analysis. 🌐

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GEOSPATIAL KEY TO THE UK 5G ROLLOUT

With accurate digital geospatial environment network planners can place access points that can immediately show where the signal communication is compromised.

By Keegan Wilson

Last month Ordnance Survey (OS) published a comprehensive report written to assist UK local authorities and telecommunications network planners with 5G millimetric wave

(mmwave) deployment. Authored by Richard Woodling, Managing Consultant at OS, the guide identifies the geospatial features that are important to the deployment, how to identify them and where new features need

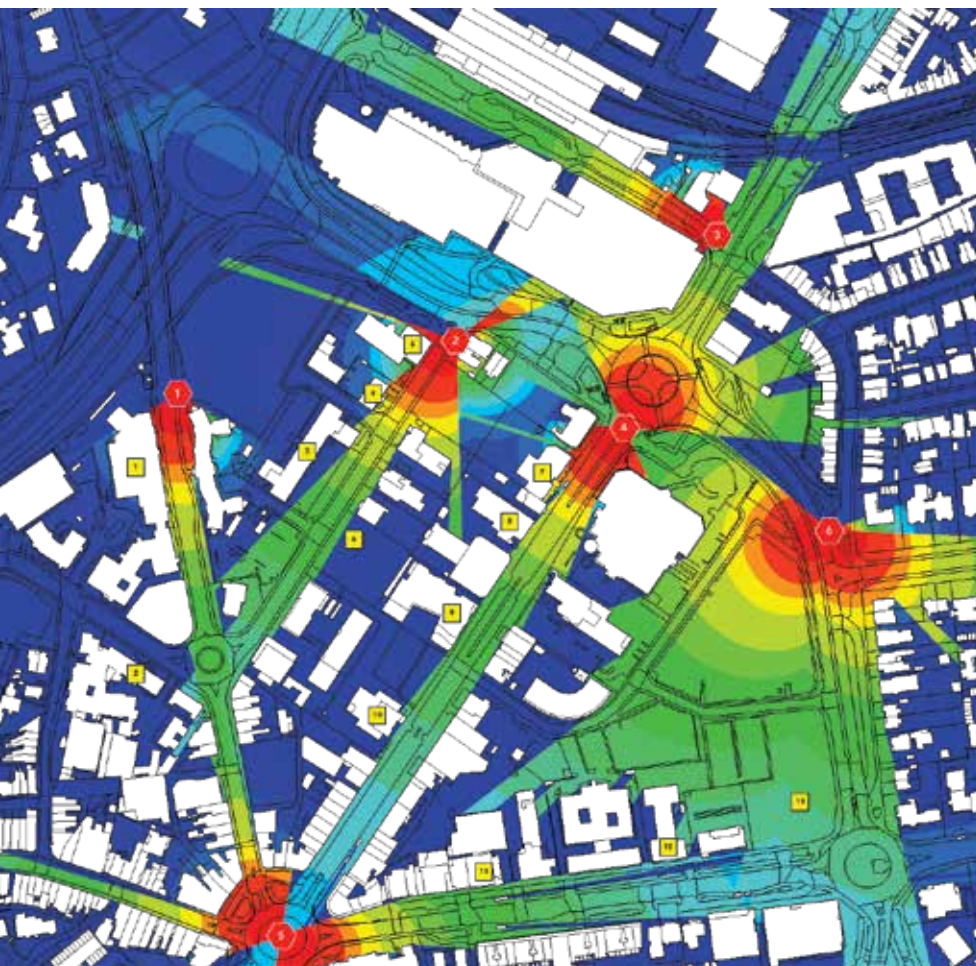
to be captured and the techniques required to do this. Woodling provides a detailed focus on the specific geospatial considerations for planning a 5G mmwave network.

The research was undertaken by OS, the Met Office and 5G innovation Centre, and the resulting reports support the UK government's a £1 billion commitment to keep Britain at the forefront of connectivity by accelerating the deployment of a next generation digital infrastructure and driving forward new 5G business opportunities. The aim is to aid a speedy and efficient rollout for 5G in the UK by examining how geospatial elements — be they built or natural — effect the propagation of 5G mmwave signals.

5G, and its ability to transmit large amounts of data, will revolutionise mobile broadband connections. It will particularly allow for massive machine-type communications between intelligent machines that require no human input (e.g. advanced manufacturing) and ultra-reliable and low latency communications (i.e. communication services that are essentially real-time with full availability).

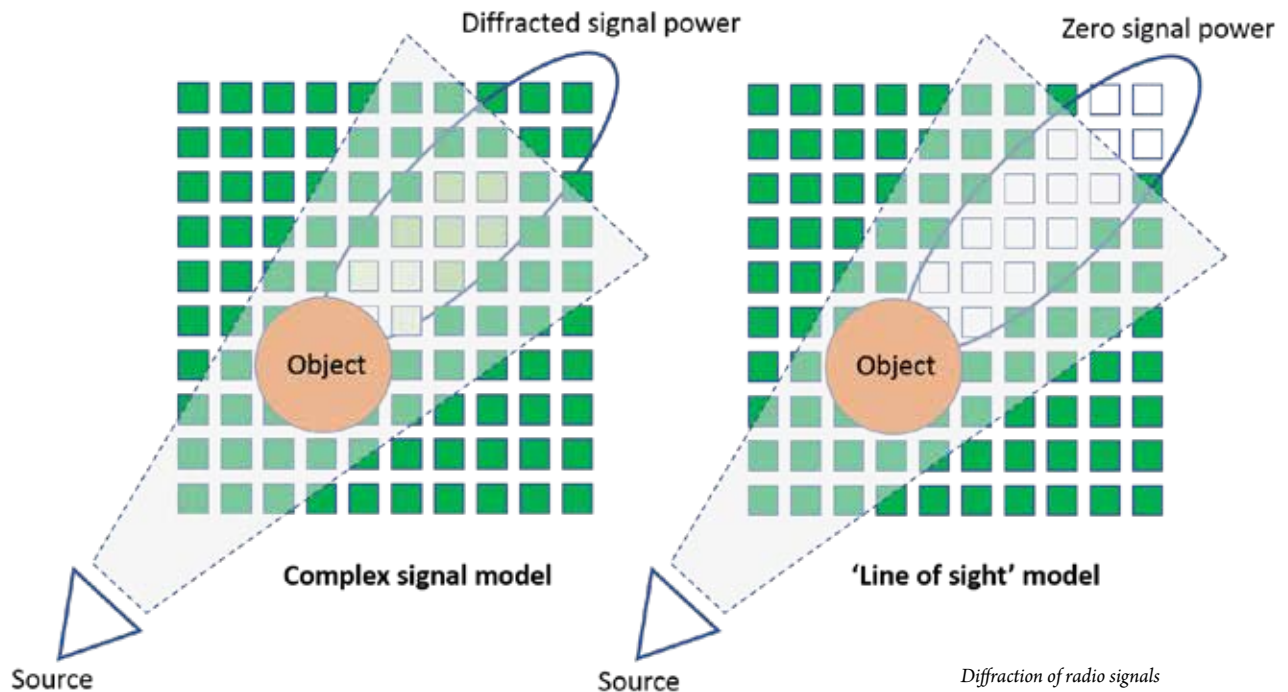
Why geospatial is critical?

Woodling explains that 5G is needed to support ever larger data requirements, as well as wide-ranging new applications, such as Connected Autonomous Vehicles (CAVs), advanced manufacturing and robotics, haptic surgery, augmented reality, smart agriculture, smart homes and cities. Why geospatial is key lies in 5G's radio characteristics.



A radio network plan

Comparison of shield diffraction and line of sight on received signal power



Diffraction of radio signals

He says, “Radio signals at all frequencies are affected by the surrounding buildings, vegetation and material types, but the effects with mmwave frequencies are much more pronounced, to the point where signals levels can be heavily reduced (attenuated) or stopped altogether under certain circumstances.”

To understand this, OS led a research team creating a dynamic 3D digital mapping environment of Bournemouth in which to virtually model the 5G environment. The research aimed to improve understanding of signal behavior when deploying in the field but from behind a desk, removing trial and error, and the delays and the associated costs these bring.

Network planners can exploit the accurate digital geospatial environment to place an access point, which immediately lets them see how signal communication is compromised. Using this method, a virtual network can be rapidly constructed, and performance assessed. Included in the intelligence of OS’s Bournemouth model are features that can interrupt 5G’s signal,

including weather conditions, tree foliage and the lifecycles of vegetation, and with access to pre-build data, details modelling of the impact of future building projects. This provides the capability to model the communication coverage, range and reliability as the environment changes over time in a cost-effective manner.

Evidence from the project identified that any object over 10 cm will influence mmwave propagation. Depending on the use case being fulfilled, this effect may or may not be significant. Woodling says, “In the case of Connected Autonomous Vehicle (CAV) deployment, ubiquitous and reliable coverage for safety critical reasons makes it essential to have a full understanding of signal propagation. This implies that in this case new objects must be surveyed at 10 cm resolution or better.

“However, if, for example, the use case is to predominantly provide service to mobile devices (handsets), users will most likely be moving, and the probability of losing a connection reduces. In such cases objects

less than 0.5 m can most likely be ignored and the only requirement will be for a complimentary street survey identifying new features to augment OS standard data at 0.4m resolution.

Assessment through survey must

Construction materials can have a sizeable effect on signal behavior. For instance, a building clad in a fine metal mesh would reflect, absorb and scatter signals. Other materials also have different effects on propagation due to their electromagnetic properties. These properties can be built into the planning model to determine how the signal will behave and propagate.

Given the need to identify new features and material types, Woodling says, “It is necessary to survey the area of interest to identify whether any of these potential ‘blocking’ or signal-reducing objects and surfaces exist.” The term ‘survey’, says Woodling, “does not automatically imply a comprehensive and detailed street survey using highly specialized equipment. Plan-

ners should assess areas and circumstances individually against use case requirements to determine the most effective approach to be adopted.” Simple feature placement by observation or full Lidar scanning are the extremes.

mmwave equipment operates at low signal power with signal propagation reducing over short distances. Therefore sites (antennae locations) will need to be spaced within a few hundred metres of each other, increasing antennae deployment density. These sites need to be affordable to rent, or ideally be zero cost. To reduce costs, the premise in the UK is that public assets owned by local authorities provide good candidates. Assets such as lamp posts with good access to power and connectivity to core telecoms networks through microwave or fibre links, providing the ‘backhaul’, may be ideal. “A specific use case, such as CAVs and their need for constant 5G connection, may demand deployment on other assets at additional cost. In time connectivity may be inherently built into the highway infrastructure”, says Woodling.

In terms of 5G modeling, statistical modelling and ray tracing are the two major approaches to be considered

Busy urban areas with buses, haulage vehicles and trams, all have the potential to reduce or block signals from one side of the street to the other, Woodling concludes that “if the use case demands ubiquitous coverage and high capacity, it is reasonable to model these vehicles as permanent features that essentially divide the road into two, requiring more antennae sites to be deployed.”

Two important models

Radio planning is not new, the physics is well understood. For 2G/3G/4G network planning tools will typically demand modest geospatial models for satisfactory planning. “These models have limitations

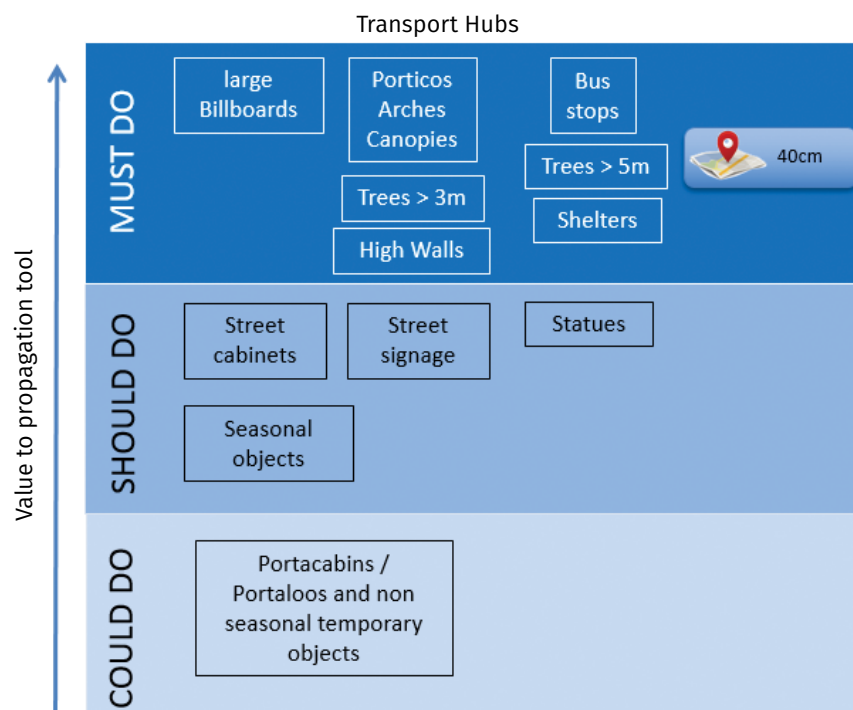
at the higher frequencies being considered for 5G,” says Woodling, who goes on to say a more detailed representation of the real world is needed. In terms of modelling, he explains, “two major approaches are broadly to be considered: statistical modelling and ray tracing.”

Statistical modelling uses data collected from a large body of real-world observations in specific environments (e.g. ‘dense urban’). These observations are then combined into a model that can predict how signals may propagate in similar environments. These models can perform well in general cases at predicting coverage and capacity, but they are much less useful when considering the precise placement of individual pieces of equipment in a mmwave environment (as they do not take into consideration the real-world clutter of street furniture and natural features or, building materials. “Tools built using this approach”, says Woodling, can offer good performance in many cases.”

Ray tracing is a much more sophisticated approach. It requires a comprehensive understanding of the real-world environment. Ideally, including a detailed high resolution 3D model including building materials and natural features (e.g. trees). “This technique”, says Woodling, “gives a high degree of accuracy and is beneficial in very dense urban environments where the additional information has most impact and potential to reduce costs”.

However, Woodling advises that “ray tracing models are more complex than a statistical model and are dependent on performant hardware to be efficient and require high-resolution data (sub 10cm).”

“When choosing a planning tool”, says Woodling, “it is worth considering the benefits and costs associated with each approach compared to the 5G use case(s).” He recommends any local authority exploring the deployment of 5G discuss this subject with network planning providers or speak to specialist consultants for best advice. 🗺️



Additional geospatial features for consideration in transport hubs

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MAPS

PROVIDE AGENCIES

WITH THE

POWER TO ACT

Preparedness protocols were severely tested during Hurricane Katrina. What could agencies within Louisiana learn in the aftermath of the storm, and how could that knowledge be applied to future events?

By Anthony Calamito

The Louisiana Department of Health and Hospitals (DHH) is charged with protecting and promoting the health of residents, including ensuring adequate medical facilities are available to citizens in the event of a severe storm that results in widespread, dangerous flooding. In order to better anticipate how to direct people at hospitals and other healthcare facilities during a flood event, DHH works to identify those facilities most at risk for flooding and damage so that evacuation procedures can begin with as much advance notice as possible.

“When something happens leading up to a hurricane or storm, people want to know how many hospitals are vulnerable, how many nursing homes,” says Henry Yennie, Program Manager for Emergency Preparedness, DHH. Increasingly, Yennie finds that this type of information is best communicated visually.

“It’s extremely important to give the leaders making decisions about resource allocation visual information,” he says. “It’s one thing to map something based on static data. It’s another to create a map based on dynamic data. The ability to make maps based on that data is priceless — you can’t put a value to it.”

GeoSHAPE comes to rescue

DHH uses a system known as GeoSHAPE to assist in generating this valuable visual information. GeoSHAPE — Geospatial capabilities for Security, Humanitarian Assistance,

A photograph of New Orleans Cemetery.

In 2005, Hurricane Katrina contributed to the deaths of 35 nursing home residents who were not evacuated.

Partner Engagement — is an open-source project designed to enable collaboration on geospatial information. With support from Boundless, a St. Louis-based GIS software provider, GeoSHAPE enables both federal and Louisiana state authorities to work together to overlay storm and flooding data over facility map information.

For Yennie, the loss of life at a Florida nursing home during Hurricane Irma in September 2017 was reminiscent of another incident, this one closer to home: In 2005, storm surge from Hurricane Katrina contributed to the deaths of 35 nursing home residents who were not evacuated. GeoSHAPE is part of the effort to avoid such incidents in the future by providing a visual picture of areas that will be affected by severe flooding.

“We can take the areas most impacted, bring in census data and operational status data, and other information into a map, making it a really dynamic useful tool that is more than just dots on a page,” he says. “Boundless is the foundation of database decision-making for us.”

In August 2016, heavy rains — up to two feet over four days in some parts of Louisiana — caused rivers to rise to record levels. Yennie was able to identify the hospitals and other facilities in the path of the flood. Aside from rising water, factors such as high temperatures and humidity can also provide cause to evacuate a facility. Hospitals might be able to provide medical necessities on generator power, but will likely be without air conditioning. Maps of affected areas that also display weather information provide an instant visual picture of the situation.

During Hurricane Gustav in 2008, three major hospitals in Baton Rouge were without power for weeks, relying on generators that

GeoSHAPE is part of the effort to avoid natural disasters in the future by providing a visual picture of areas that will be affected by severe flooding

were not sufficient to power HVAC systems. “Temperatures in ICUs rose into the mid 90s,” says Yennie. “We came very close to having to evacuate them. The maps allow us to focus on the high-risk areas.”

Helps to implement emergency plans faster

As vital as DHH’s mission is to the citizens of Louisiana, particularly those most vulnerable to severe weather events, the realities of finance still play a role in how this important work gets accomplished. DHH maximized the agency’s investment by selecting an open source project, which allows them to work within budget constraints while still providing vital services. Yennie says that despite having a high number of emergency incidents that require a state response, there is still very little funding for public health. “We rely almost totally on federal funds, and each year those funds shrink,” he says. “We have to have something that gives us what we need in a cost-effective manner.”

Also of high importance to the agency was the learning curve involved. In an emergency, the more people who can provide the visualization of location-based information, the better. “We need to be able to not rely on an expert,” says Yennie. “We need the ability to construct the maps, without an expert, in a sustainable way.” With support from Boundless, GeoSHAPE allows Yennie’s emergency preparedness plans to become action in a faster, more efficient manner. “You can see what you need to focus on proactively, rather than waiting for something

to happen,” he says. “Boundless has given us a cost-effective way of getting that data and visualizing it.”

In the thick of a major hurricane or heavy rainfall, disaster response efforts are rightly focused on those who can be saved. After the waters recede and essential services are restored, other tasks, such as cleanup and remediation, can begin.

A grim aftereffect of major flooding — one that’s somewhat specific to the state of Louisiana, where many bury loved ones in above-ground vaults and tombs — is the tendency of caskets to become displaced. While the structures appear sturdy, they’re no match for flood waters and storm surges. “It’s a cultural thing in southern Louisiana, you don’t see it in a lot of other states,” says Yennie. “Even when someone is buried underground here, there’s no guarantee, because the water table is so high.”

“It’s a massive undertaking to develop a system with a centralized repository of who’s in what spot,” explains Yennie. “A lot of it falls on the shoulders of people who own or manage the cemetery...or it falls on the funeral homes to place something on the casket that identifies it.” Post-Katrina, a law was passed requiring funeral homes to put an ID card in a small tube on each casket, but many of the tubes were not water-proof—meaning the information printed on the card was worthless once water breached the tube.

In 2016, DHH piloted the use of beacon technology, using a small piece of plastic containing a transmitter to track the movement of caskets. In the future, Yennie hopes to be able to use mapping technology to pinpoint the location of displaced caskets and to help in returning them to the proper location. 📍

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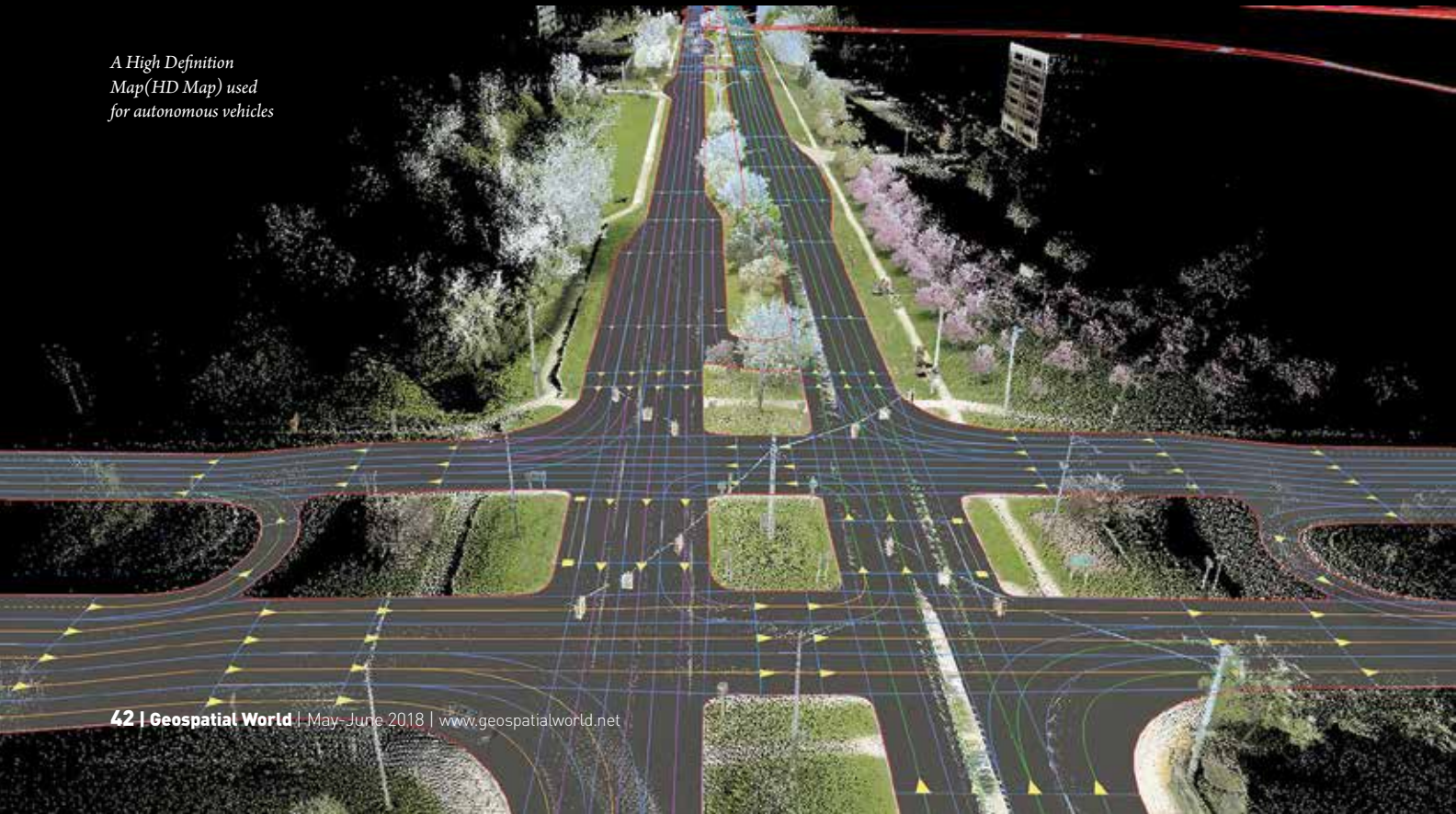


NEW AGE HD MAPS

POWERING AUTONOMOUS VEHICLES

In this era of autonomous vehicles, where machines and robots need to make decisions on roads, we need a new set of maps, purposefully built for robotic systems. Maps now need to be democratized beyond humans. **By Harsha Vardhan**

*A High Definition
Map(HD Map) used
for autonomous vehicles*



The maps that we see on our phone are no more enough for our cars to navigate. They need a new kind of intelligence, and new generation of maps have evolved for this — High Definition Maps which are making the world ready for autonomous cars.

Autonomous cars can drive themselves efficiently if only they have access to high-precision maps. The digital material contained in today's navigation systems is not enough. To be able to drive itself safely, a car needs to know its position on the road down to the centimeter. When turning, for example, the car cannot approximate the point at which the steering wheel should be turned, an area in which human drivers are experts at making adjustments. Digital driving instructions need to be ultra-precise.

High Definition Maps, popularly known as HD maps, have extremely high precision at centimetre-level accuracy. This is necessary because the robots need very precise instructions on how to maneuver themselves around the 3D space. In most cases, the tolerance for error might be high, but there might be cases such as driving on a road to the town hall that literally cliffs on one side, where there is no room for error. So, the maps need to be extremely precise and contain a lot of information, which humans may take for granted. Not only that the maps should contain where the lanes are, where the road boundaries are, they also must know where the curves are and how high the curbs are.

With 5-cm accuracy, we are approaching an era of a holy grail for mappers, as a 1:1 map, if ever really made would, be as big as the world itself. So, HD Mapping is really mapping at 1:1 mapping. HD Maps are not just about scale, but also about comprehensiveness.

Why are HD Maps needed?

Use of digital maps in navigation devices and mobiles has become passé, more so, because these maps are simple, primarily meant for humans, who can understand simple instructions as they navigate. In this era of autonomous vehicles, where machines and robots need to make decisions on roads, we

need a new set of maps, purposefully built for robotic systems. Maps now need to be democratized beyond humans.

While robots have the capability to do some things more efficient than humans, humans are still much wiser. The real-time decision-making capability, when it comes to driving and navigation is one of those key areas, where humans still have the edge. For example, the decisions humans really take for granted such as stopping the vehicle at the right place, watching for a traffic signal at the intersection, or to avoid a split in the last minute to avoid an obstacle on the road, become very hard for robots to make. So, as part of the decision-making process, mapping becomes a really critical component of helping the robots make the right decisions at the right time.

How are HD Maps made?

At a very high level, there is a hardware component as well as the software component. A hardware component is more visible because if we look at the picture of a self-driving car, you will quickly recognize it because it has a lot of sensors typically around its rooftop. And these sensors are really useful for map creation and map update purposes. There is a combination of sensors such as cameras, LiDAR, GPS, IMU, and radars. These sensors typically also help in providing redundancy to the self-driving cars, in case if any of the sensors fails.

When it comes for a self-driving car to precisely locate itself, the visual sensors such as cameras typically have limitations. This is where the LiDAR sensor plays a role in precisely measuring the depth or distance in a 3D space. However, both LiDAR and cameras are typically working together, running very fast, multiple times per second. If a car is typically driving at a speed of over 100 km per hour, at that speed the sensors are collecting a lot of data at a very high speed as well. In this scenario, the car is consuming and creating the maps at the same time.

The other part of this is the software. The software part is also really interesting as it powers the hardware to collect and record the data and this information must be made shareable.



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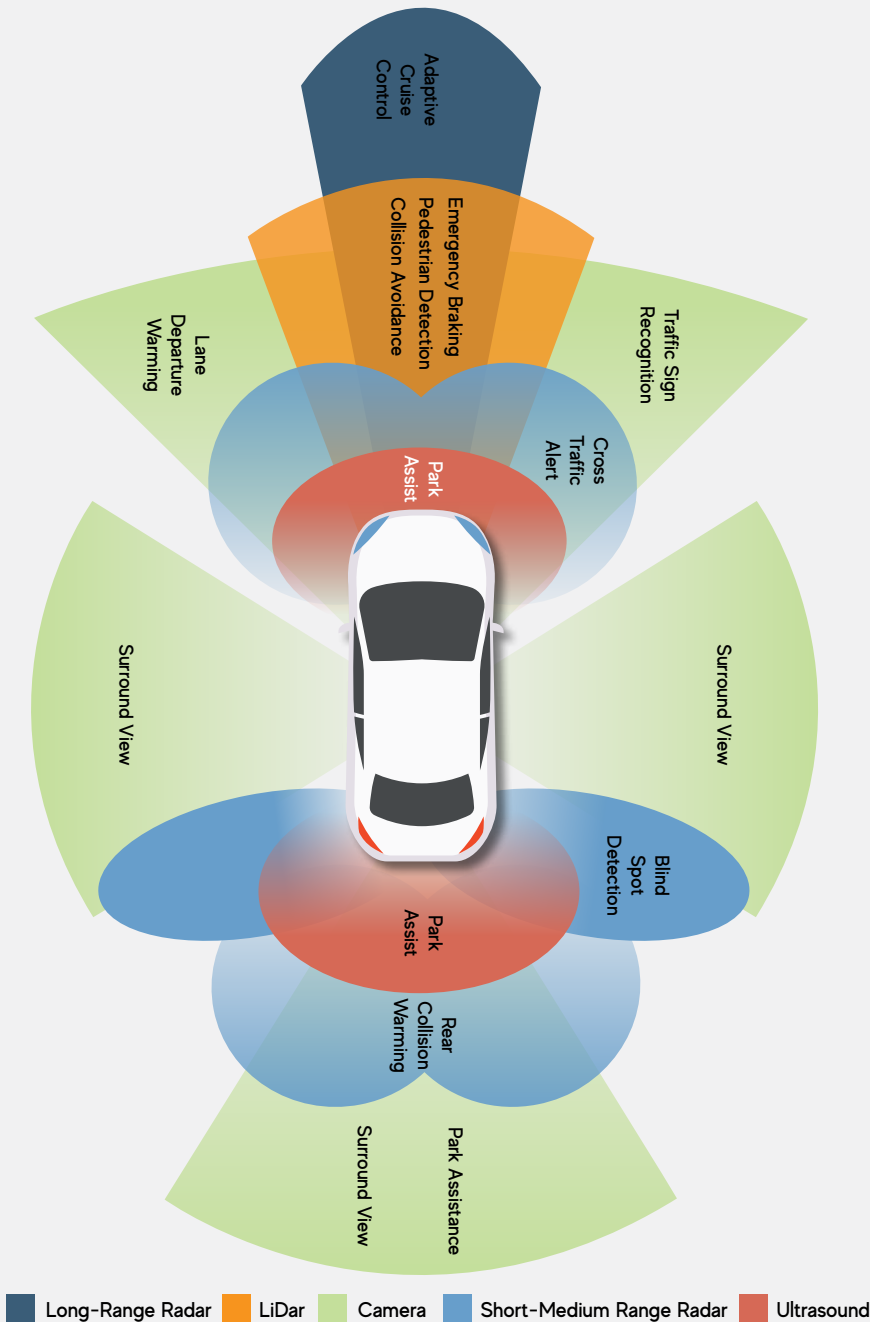
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Sophisticated sensors make autonomous cars think better

Autonomous vehicles use a combination of sensors that help in capturing the data required for creating HD maps. The main types of sensors include Cameras, Long Range Radar, Short & Medium Range LiDAR and Ultrasound.

What is the relevance of HD Maps in self-driving cars?

On a very high level, the software that runs the self-driving car consists of a software stack with four components, the first compo-

nent is the perception system; you can think of it as eyes of humans. It's trying to see what is on the road that the car is figuring out, for instance, do I see a human crossing the road or do I see a signal turning from red to green?

Another piece is called localization — and localization module tells the car where you are in the 3D space, and what's actually around you. Example, the system says that you are 150 centimeters from the next stop line, here is a cross-walk of this width etc.

That's when the Planning & Control module will kick-in and say, "Ok I am going to slow down, and then going to make a full stop at the next intersection."

The fourth component is the mapping component, and you can imagine the mapping system to having tentacles into the above three components, just mentioned earlier. Mapping and localization work very tightly together, constantly comparing where you are on the map. It needs to know which object was supposed to be here and tell the difference. So, if you know there is supposed to be an intersection and a crosswalk, and you see a moving object crossing it, that's probably a pedestrian.

How many cars do we need to create HD Maps?

A single car can't really map the entire world. The question is not only how the maps are created, but how a map is maintained to reflect the changes on the road. For this, multiple cars would need to drive on the same road, and that data would be aggregated from multiple drives on multiple cars together. The more the number of cars you have on the road, the more data gets collected, and the higher will be the quality of the HD maps.

What are the challenges in creating HD Maps?

The cost incurred in creating the HD Maps is a big challenge as we cannot send huge amounts of data over cellular networks. The way to address this challenge is to categorize the information to be shared in real-time vs the information that need not be shared in real time. So, things that really impact driving behavior needs to be shared and distributed with other cars that may be affected such as a known accident on the road, landslides during a rainy season, a road construction in progress etc.

How are HD Maps stored?

There is a lot of data being collected now and there will be more lot of data that will be collected in the future once we have more self-driving cars on the road. This is where the Cloud infrastructure comes into place, both for storage and computation purposes, and 99% of the computation is done over there.

However, each individual car will continue to have its own memory cells or storage that people call as edge computing. So, each car will carry its own storage and computing power so that each car can make its own decisions independently if it is offline it should be fully functional. In this case, the maps are being continuously called by rest of the software stack such as the perception system, planning and control system many times per second. The change detection module needs to kick in to check what looks different from the map the system already has, and identify if it is a really important change to be distributed in real time or send it to the edge compute process, and activate the active data collection process and share that data within the Cloud.

What does the car really see in an HD Map?

How we want to visualize depends on how we ultimately want to consume it. Unlike humans who need to see to visualize the data,

robots need to consume the data, which they do through APIs and so on.

So, why is there a need to have a visual representation at all then? The answer is; those are for humans! As part of the map creation and update process, we need to have human operators to check the computer output; to see, the ambiguities in the real world, for example, a complex intersection — that makes it even impossible for humans some time to interpret the traffic rules. So, we have these visualization tools that really help in the map creation and maintenance process.

Is it important for HD Maps to be visually aesthetic?

When it comes to creation and maintenance of HD Maps, functionality triumphs over beauty aspect, as it is important to ensure the quality of the map is really high. Otherwise, the human operators won't be able to work effectively. So, productivity and efficiency are above all than the design.

But when these maps are displayed for other purposes for simulation and virtual reality, then depending on the use case, the design choices of the maps are made.

What are the legal issues of HD Maps?

Maps have always carried this aspect of law of the land, issues with geographic names, legal issues such as where someone is allowed,



An autonomous car sharing real-time traffic information with other cars



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switchover at any time



Professional sounding module
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What does a self-driving vehicle see?

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CUBOIDS



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3D LIDAR POINT CLOUD

where someone is not, where the maps can be shown, where they cannot be.

Even though digital maps are widely available today, there are countries around the world that heavily regulate their geospatial data, and even forbid exporting geospatial data. This problem is inherent though from normal navigation maps.

When it comes to HD Maps, this is going to be a huge challenge, as government regulations are not clear. There is going to be all sorts of sensitivities as the cars have very high-resolution LiDAR and then the cameras are constantly scanning the streets and seeing into areas like private driveways etc. So, being able to protect people's privacy and also follow government regulations from a security point of view, and ensure that data is sufficiently encrypted so that it won't accidentally leak out are some key areas to be addressed.

In some countries, governments are getting active now where they are trying to both protect privacy aspects and also advance the self-driving technology. It will be few years before the dust settles and we see an action coming from technology and policy standpoint.

Aspects related to who owns the data are also to be addressed. Is the car owner who owns the data or the car maker or should the government own the data? These aspects were always there with maps and will be getting more powerful with the advent of dynamic maps.

How can we say that the maps are exploding in the era of HD Maps?

All these years, we had simplified the maps to the very extent possible. To the geographic boundaries, to the oceans to the

MORE ROBUST MAPS FOR SELF-DRIVING CARS WITH AI

NVIDIA offers an end-to-end mapping system for self-driving cars. The HD maps so created give information in near real-time. NVIDIA MapWorks leverages NVIDIA DRIVE™ PX AI super-computer, coupled with NVIDIA Tesla® GPUs to accelerate creation and updating of HD maps for autonomous vehicles. The full system incorporates deep learning algorithms to detect lanes, signs and other landmarks. For localization, structure-from-motion algorithms enable data from multiple cameras to be converted into detailed 3D mapping information. Data from various inertial sensors in the car is combined with GPS data to get precise position of key landmarks. LiDAR information helps in creating maps with greater detail.



SENSORS MAKE AUTONOMOUS CARS THINK BETTER

The HERE HD Live Map is a Cloud-based service comprised of various tiled mapping layers that are highly accurate and continuously updated to support connected ADAS and highly automated driving solutions. The layers are logically structured into Road Model, HD Lane Model, and HD Localization Model.

Road Model

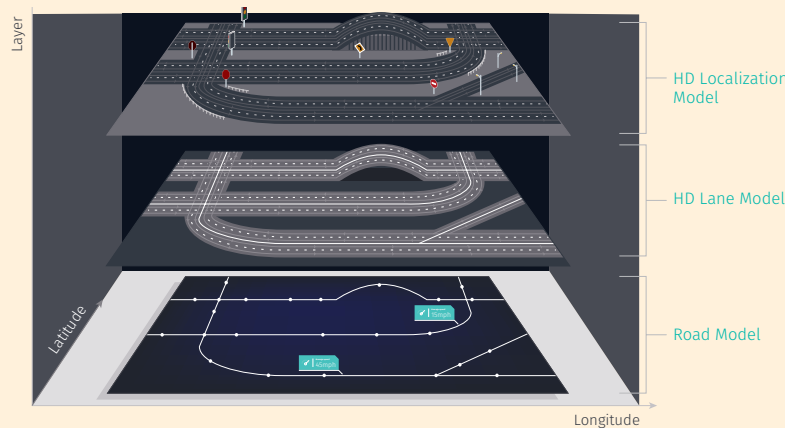
The Road Model has robust map content at a global scale, providing vehicles with local knowledge that goes beyond the visibility of onboard sensors.

HD Lane Model

The HD Lane Model provides more precise, lane level detail to assist self-driving vehicles in making safe decisions for a comfortable experience.

HD Localization Model

The HD Localization Model allows for utilization of multiple different localization approaches, to assist the vehicle in accurately locating itself within the lane it travels.



roads. But now, we are moving in a different direction where the maps are simply exploding in scale and dimension and maps have become reality.

And the real lag between consuming and creating a map is reducing, cars will have the capability to share information, which was not possible in case of mapping ever. Mapping will now become more of an organic process with a continuous collection capability in place.

What will be the unexpected consequences of getting HD Maps?

When we are creating HD Maps of a city, we are creating the digital infrastructure of a city's road network. And every city authority tries to do the same, as most are now having the GIS data for the city — which are created by sending out the surveyors. Public works departments often

do the same. These are mostly static, very labor intensive, very costly to do, and these kinds of surveys can't be repeated all the time.

On the other hand, when we have cars with the right sensors running on the road, they are constantly updating the road. So, the process where a central authority from the government maintains this digital infrastructure can suddenly be solved with people with cars or just with cars. And this information is really useful just beyond self-driving.

As everybody becomes a mapper, everybody contributes when they are driving, and thus people become an integral part of this knowledge creation, and it becomes part of empowering people. 🤖

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3D

DOCUMENTATION OF A VANISHING CIVILIZATION

*A race against time – FARO helps
preserve cultural relics*

When admiring historical sites of meticulously carved grottoes, pagodas, and temples, or a monument scattered with stone steles and statues, what one may not realize is the fact that, regardless of location, all the beauty is quietly, slowly, and irreversibly being worn away by the environment.

The digitization of cultural relics has enabled mankind to accurately record an artifact, in order to pass that information — as well as the historical, cultural, and technological value of an item — on to future generations in the permanent form of data.

The Cultural Heritage Research Institute of Zhejiang University in China was established on March 12, 2010. Since its inception, the institute has made outstanding achievements in areas such as digital archaeology, geophysical archaeology, and the research and application of cultural relic protection materials. In 2016, it received approval from the Government to set up the State Cultural Relics Bureau's Key Scientific Research Base (Zhejiang University), and took on the state's mission to digitalize and protect the cultural relics of the Grotto Temples.



Scanning the hull with the FARO Focus.

The institute's digitization team has long been committed to combining scientific research with archaeological practice, and has made outstanding achievements in high-fidelity digital archiving of cultural relics, employing the FARO ScanArm and FARO Focus to meet the requirements of various scanning projects.

Xi'an's Forest of Stone Steles — museum digitization project

The digitization team from the Cultural Heritage Research Institute of Zhejiang University first used the FARO ScanArm when it was called upon to digitize cultural relics from the collection at the Xi'an Forest

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of Stone Steles Museum. The 3D digitization project required the team to obtain data of the steles, so that a replica of the original relics could be produced. Because the surface of a stone stele often contains small and tightly spaced inscriptions – which can total hundreds upon hundreds of characters that are a mere 2 – 3 cm each, with additional features such as complex strokes and calligraphy style to capture, the outline and depth of carving had to be recorded to extreme precision.

As the use of a structured light scanner suffered from limitations, the project team decided to test the FARO ScanArm on a lease. Equipped with blue light scanning technology, the FARO ScanArm obtained

2,000 actual points on each scan, providing very high scanning accuracy, even across surfaces of different materials. While obtaining scans, the operator could instantly tell with real-time feedback whether any area of the relic had been left out. Using the ScanArm, a stone tablet only required two scans — front and back — to complete the digitized record.

With this positive experience, Cultural Heritage Research Institute of Zhejiang University officially purchased a FARO ScanArm in 2014. Since then, the team has used the equipment many times in digitization projects involving Buddhist stone statues in Shandong's Qingzhou Museum and with other cultural relics from various museum collections.

Professor Diao Changyu, Assistant to the Director, Cultural Heritage Research Institute of Zhejiang University, added, "For exquisite stone artifacts — such as inscriptions, epitaphs, and especially intricate Buddhist stone statues — we found it necessary to use a scanning device. The FARO ScanArm is able to provide a compre-



Obtaining measurements of the Seventh Cave in the Eastern Thousand Buddha Caves with 3D laser scanning.



Measurement data of the Seventh Cave, obtained by the FARO Focus.

Featured Product

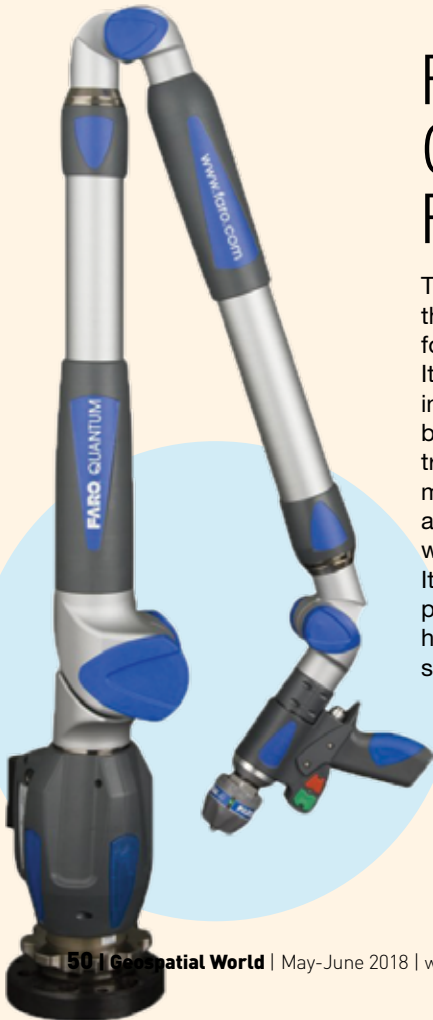
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hensive scan in just one scanning cycle, even capturing details in areas that are blocked or inaccessible. Overall, we get very good data consistency and it allows us to achieve a higher level of accuracy, which is impressive. Some stone statues have faint intaglio lines, which are very thin, shallow, and almost invisible to the naked eye. Yet, these show up clearly in the monochrome 3D model obtained by the scans. This is a very important technical means for archaeology.”

High-fidelity digitization of the Eastern Thousand Buddha Caves

Apart from the FARO ScanArm, the Cultural Heritage Research Institute of Zhejiang University also invested in a FARO Focus in 2015, to acquire 3D scans of large-scale facades.

Located in Guazhou Country in Gansu, the Eastern Thousand Buddha Caves is one of China's numerous grotto sites in the Dunhuang vicinity. In this project, the institute had two main tasks – to map and record the landscape where the grotto is located; and to gather images of the murals.

For the landform survey, the team adopted a method that combined aerial photography from an unmanned aerial vehicle, with data collected by the FARO Focus. Through the integration of 3D laser scan data, aerial images, and image-based 3D reconstruction, the team generated a color 3D model of the ground. The orthophotograph is based on the 3D model, and each point in the figure is based on data of precise elevation information and ground GPS coordinates.

For the high-fidelity digitization of the murals, the team employed a technology that combines photo-based 3D modeling with data obtained by the FARO Focus. The team earlier relied on a total station to collect the dimensional information of the caves. With that data, they made calculations to achieve a more accurate model, after going through thousands of photographs. A major shortcoming of this method is that the shape of a grotto can be well constructed from the total station's measurements of a few dozen points, but the number of points required for photographic calculation is as high as tens of millions or hundreds of millions. It would have been impossible to verify this against the few points from the total station. Because of the need for better authenticity, the team was prompted to look for a better solution.

The FARO Focus is a market-leading laser scanner with impressive scanning capabilities for capturing large-scale façades, digitizing the surrounding environment quickly at 976,000 points per second. For this project, the device accurately captured the curvature information of the wall surfaces in the grotto caves, and the point cloud data retained the gray values of the measured points. This gave the team very good support for data validation in the later stages of the project.

In the digitization of the mural, the team first used the data obtained by FARO Focus to construct accurate 3D models of the caves. After that, they used their self-developed software to enable the automatic mapping of photographs onto the 3D models, to obtain high definition digital documents of the murals in color. The resulting quality of the mural's digital images were much higher than 300 dpi.

Digitization of the Song Dynasty Ancient Ship of Quanzhou Bay

The Cultural Heritage Research Institute of Zhejiang University also used the FARO Focus widely in other archaeological projects. Another noteworthy project is the 3D digitization of the Song Dynasty Ancient Ship of Quanzhou Bay.

The Song Dynasty Ancient Ship of Quanzhou Bay was excavated in 1974 and is presently preserved in the Quanzhou Maritime Museum. Measuring 24.20 m in length and 9.15 m in width, the medium-sized seagoing wooden sailboat was built in Quanzhou during the Song Dynasty. After restoration, the ship now measures 34 m long and 11 m wide, and has an estimated displacement of nearly 400 tons and a carrying capacity of 200 tons.

It is an ancient shipwreck and one of China's most well-documented archaeological discoveries. The ship's hull had suffered serious damages and there was a pressing need to capture its current state to facilitate the laying of the scientific foundation for its protection.

In this project, the team first used the FARO Focus on the hull for large-scale, localized high-precision 3D point cloud data collection. After scanning from a dozen angles, the team successively obtained a relatively complete 3D point cloud data of the hull. With that data, they built a precise 3D model of the hull. At the same time, the team also took hundreds of photographs of the hull from various angles. When fed into the institute's self-developed software, the photographs were automatically mapped onto the 3D model of the hull, generating the final 3D digital documents of the ancient ship with rich detail and accurate shape. Professor Diao concluded, "We have been using laser scanners in archaeology since 2001, and have come across many different brands of scanners."



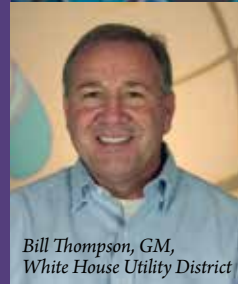
A team member uses the FARO ScanArm to perform scans on stone steles in the Xi'an Forest of Stone Steles Project.

When there is an urgent project, one person can take this equipment out to the field for data collection, which is unmatched by other equipment. At the same time, the device provides very good stability. Many of our projects are very time-sensitive, and many of them require scanning in harsh environments. For example, we once did an outdoor scan with the FARO Focus, under low temperatures of -10°C, where even SLR cameras could not operate normally. We have also managed to perform scans successfully at high altitudes. The device functions well even at elevation levels of 4,300 to 4,400 m."

Commenting on the future prospects of 3D digital technology in heritage preservation, Professor Diao stated, "The aging of cultural relics is irreversible, so it is imperative to record whatever information we have remaining today. The digitization of historical artifacts is a huge responsibility. Our goal for the future is to make holographic record a reality, along with the continual improvement of digital dimension and accuracy. I believe that technological advancement will provide us with the perfect solution to tackle these problems. The other issue is to improve on cost and speed – we need automated and cheaper options to speed up the digitization of cultural relics. The information needs to be recorded quickly, before they disappear forever. By then, it would be too late."

CHANGE MANAGEMENT SMOOTHS PATH TO MILLIONS IN SAVINGS

A water utility serving 90,000 customers embraces change by placing location intelligence at the center of its operations. **By David Schneider & Michael Green**



Bill Thompson, GM,
White House Utility District

Bill Thompson, general manager of the White House Utility District (WHUD) was anguishing over an ever-deepening problem that threatened the ability of one of Tennessee's largest water providers to effectively serve its customers.

In 1992, when geographic information systems (GIS) were a rarity in the water industry, Thompson recognized the potential of the technology and began the implementation of GIS. He hoped the location-based system — in conjunction with the customer information system (CIS) that governed WHUD's day-to-day operations and billing — would give his workforce the information and confidence they needed to make decisions.

That's when Thompson realized that the issue was not simply managing the growth — it was how WHUD was managing the growth. Technology had become a hindrance. The tools intended to empower employees were instead creating roadblocks, holding them back. So, Thompson

researched new CIS platforms and held discovery sessions with vendors, seeking a solution that would help the utility district manage the growth it was facing. Thompson quickly found that none sufficed. The type of solution he had envisioned was not available.

"I kind of got ill about the whole thing," Thompson says. Still, he kept turning the problem over in his mind.

Then, suddenly, the fog cleared.

Iconoclastic insights spur company-wide change

Thompson had two insights that would change the dynamics of the organization.

First, he realized that despite his hopes for sharing data across departmental lines, WHUD had developed silos of information. The text-based CIS billing software was on one side and the map-based GIS — containing information about the location and status of pipes, pumps, personnel, and other assets — was on the other side. Information exchange between the two systems rarely happened.

Employees tried to work around the issue, but their instinct to solve problems was stymied by a lack of connectivity and communication.

"The systems have to be working for the people, not the people working for the systems," Thompson says. "You don't want to hear, 'We can't do this because the system won't allow it.'"

The problem was affecting everything, starting with the utility district's ability to effectively manage growth, and extending to how it served customers. Thompson knew that the WHUD representative answering a customer's phone call was the face of the organization. "The person you get on the phone — that's the only person you know. That's the person who should be able to solve any service question or issue. In most instances, however, the customer service department is so detached from other parts of the organization they can't make decisions." As a result, employees felt limited in their ability to help customers and make decisions.



“Our GIS and our CIS were basically incompatible,” Thompson says. “That meant you had to extract data out of one, analyze it, then use it to make a decision over in another. And by the time we did that, we lost a lot of time and frustrated too many customers and employees.”

His second insight emerged when he looked at the system from the customer service point of view.

“All of our employees need real-time information about the operating conditions occurring in the system, as well as the physical location of our field crews,” Thompson says. “And then it hit me: we’re really going about this backwards. Everything we do is location based and asset based, so it only made sense that GIS should lead the way. It should be the driving force.”

Going against the grain yields huge gains in efficiency and savings

For most utilities, the customer information system is the dominant database — whether

user-friendly or not. But customer service reps need to know more than the current billing status to solve most problems. They should see a map of the customer’s location with details of its maintenance and repair history, as well as the location of field service reps in the area and when they will finish current appointments.

Field technicians and other personnel, who had been waiting hours for information before attacking potential problems, would be able to gather relevant data on equipment status and maintenance history in minutes. New leak detection software would integrate with the GIS maps, helping the utility discover small leaks and quickly fix them before they grew into large problems.

It took about three years to create and implement the user-friendly, GIS-centric system. Business executives who have overseen an enterprise software implementation understand the demands of such a transformation: sound planning, patience, and a dedication to change management.

For Thompson, WHUD, and the communities they serve, the effort paid off handsomely. With the new technology in place, WHUD no longer needed to consider an urgent overhaul of the physical assets or the issuance of debt in reaction to the growing population. That bond has been postponed for at least 11 years. Interest payments on it would have topped \$6 million during the same period. Perhaps more important, through the integration of these systems, WHUD gained data continuity across the organization, which enabled Thompson and team to perform more-proactive strategic planning.

Preparing the workforce for change

As WHUD planned for the overhaul of technology and business processes, Thompson knew there would be many concerns among WHUD’s 100 employees. Would they have a job? What if they didn’t have the right skills? What if they couldn’t learn quickly enough?

It was a moment when rumors could lead to low morale and further inefficiency, and that could be disastrous for a utility providing vital services. Thompson, however, had complete faith in WHUD’s team and was

guided by the same goal he had always held dear. “I wanted to give everybody... as much information as they needed to do their job and be their own decision-maker.”

As he prepared a change management strategy and training program, he showed an intuitive feel for the major points that professionals recommend: prepare for change; manage change; reinforce it. And be honest with employees.

As the implementation of the GIS-based system approached, he offered his team reassurance. “We’re going to change the way we operate,” Thompson told employees. “If you need education, if you need to get your skills shored up—whatever you need—we’re going to help you get there. But we need you to understand we are going to do this, and we’re going to turn this around in a different direction.”

Employees knew the system had become inefficient. Still, they worried about the changes.

Tammy Moses, who is a field operations assistant (roughly equivalent to a customer service rep) with 13 years at WHUD, wondered if a new system meant new barriers. Would it be timely, user-friendly, and help her satisfy customers? “Is it going to take me longer to do my job in an account?”

Levi Wyatt, a field technician supervisor (similar to a supervisor of work crews in the field) with five years at WHUD, was concerned about the new software. “How much time was it going to add to our workflow?” he wondered. “The field tech position can be hectic, with little time to waste.”

In keeping with change management strategies, Thompson repeated the message: “We must change; I must change. But we will help you.”

Shifting the workplace culture

Thompson had gone through other implementations; he saw what resistance and confusion did to the atmosphere. To fend it off, he and the executive team prepared extensively and over-communicated. For two years, in nearly every monthly meeting, he talked about it. “By the time we were ready to implement, employees were tired of hearing me talk; they were excited to get under way with it.”

As the technology overhaul got under way and the effort to change the workplace culture began to become more formalized, Thompson followed a key tenet of successful change: include stakeholders from all areas of the business in planning new workflows. He formed a committee that included representation from every department in the organization.

As they figured out the best way to build the new system, Thompson sought feedback from those who would rely on it daily. “If it doesn’t feel right or isn’t working,” he said, “tell us and let’s figure out what’s wrong with it, because it needs to be what’s best for you, not what I think, or the consultants think, is best.”

Field supervisor Levi Wyatt was impressed by the GIS trainers. “The team was patient and made sure to really understand what information we needed or wanted to see. They even did a ride-along in the field to make sure everything was operating smoothly.”

Wyatt also liked the gradual way the message of change became part of their daily lives. His own message to workers facing similar changes in their organization: “The learning curve and the extra time and effort put into this will greatly benefit all of us, and our customers, in the long run.”

Change management and ROI

Studies have shown that the more successfully a company manages change, the faster the return on investment in new technology or software. ROI of 135 percent is not uncommon with a good change management program.

The most important elements of success are engaged executives and senior leaders who remain visible, vocal, and accessible throughout the process, and Thompson was nothing if not engaged—but he also displayed empathy that his employees valued.

“If we were ever feeling overwhelmed, Bill always told us to hit the pause button and step away from it for a little bit if need be,” said operations manager Rocky Reecer.

Thompson put it even more bluntly. “I told all of our people, ‘Look, you’re going to get frustrated, you may get mad. You know what? I probably am too, but you can come in my office and get it off your chest and it’s

not going to bother me. You’re not going to get fired. We’re going to push, but we’re not going to push in a way that you can’t reach your potential.”

And, of course, even motivated employees will learn at different paces and in different ways. If one individual was having difficulty, WHUD managers would hold a group training session and use it as a way to quietly give that person individual attention. Even though it could mean more expense on the front end, Thompson thought it was the right thing and the practical thing to do. With success would come more efficiency, a more closely bonded team, and a grateful workforce.

“They were good enough for us to hire,” Thompson says. “They ought to be good enough to invest in.”

In bottom-line terms, Prosci research shows that potentially disruptive projects paired with a people-focused change management plan are up to six times more likely to achieve their goals.

Working in the new system

Placing GIS and location intelligence at the center of every employee’s workflow has produced dramatic changes at WHUD.

Reecer, who has worked for the utility district for 15 years, was very happy to see the new GIS produce more accurate maps.

“It has been nice to go out into the field with your iPad and be able to stand directly over something and it be right at your feet. An improved GIS has taken out a lot of the searching and potholing, and we have become more efficient.”

That efficiency has allowed managers to allocate more time to leak detection, an effort that has saved the utility hundreds of thousands of dollars per year.

And the GIS-dominant system has tapped the power of location intelligence in new ways at WHUD, according to Thompson. “We have all our vehicles tracked in real time via GIS, so the customer service reps [CSR] can see who’s the nearest if they need to dispatch somebody.”

When a customer calls WHUD now, the CSR taking the call sees the customer’s data on one screen and a GIS-based map of the customer’s location on a second screen. In other



When a customer calls WHUD, the service representative takes the call, sees the customer’s data on one screen and a GIS-based map of the customer’s location on a second screen.

words, the silos of information are gone—replaced by real-time location intelligence.

Lessons learned — change never ends

It took more than three years to implement the new systems and work processes, as well as finish the retraining of WHUD’s 100 employees.

As difficult as it was to face change and as happy as Thompson was to close this chapter, he knows the effort should not be set aside.

“It’s important to go through every single process,” Thompson says. “And when you finish doing that, you need to go back and revisit it about every two years because things will change, people change, and you need those processes documented so you know what’s going on.”

And when there are new changes to manage, he advises: “Be completely honest and don’t hide anything. Let them know what the goal is right from the very beginning. Because if a business isn’t agile—and that includes the water business—if it’s not flexible and can’t adapt quickly, then you become antiquated, and you’re effectively dead.” 🤖

Courtesy: This article was originally published on WhereNext, Esri’s digital magazine for organizational decision-makers.

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THINK CITY SMART



A smart city is all about providing better living conditions to the citizens, while making it more sustainable, resilient and livable, with technology as the backbone.

By Mahashreveta Choudhary

"A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement." —

Caragliu and Nijkamp 2009

The notion of a smart city is not new to the world. It all started in the mid-'90s when urbanization gained momentum with better employment opportunities and living conditions attracting people to cities. There was a pressure on the cities now to fulfill their aspirations and thus began the search for technologies that could increase efficiencies, bring down costs and generate value-added jobs and above all sustainable living conditions and economic growth in the cities. To put it simply, cities began their journey towards smartness. With the passage of time, these cities set an example to the rest of the world by being livable and technologically advanced cities.

Now this concept has become mainstream and is more popularly known as "smart cities". Every city is in the race to be smart and has come up with varied delineations and philosophies about how a smart city should be. While some say smart cities are all about technology which connects every nook and corner and provide intelligent solutions to its citizens, other consider that a smart city is nothing but about its citizens.

The debate can go on over the definition, but a look at different smart city visions all over the world makes one thing very apparent — a smart city is all about providing better living conditions to the citizens, while making it more sustainable, resilient and livable. The idea is to improve the quality of life of its citizens where technology is the backbone.

Technology – The backbone of a smart city

For building a smart city, which provides smart solutions to its citizens, technological literacy is the key. Smart solutions are conspicuously based on Internet of Things, geospatial and ICT technologies, sensors and location. These technologies are like a thread which channelizes all data from different aspects of the city, such as traffic, utilities, finance, health or waste management to monitor and deliver improved services, improve e-governance, and advance analytics and in result smart and intelligent solution.

“The idea of what is smart is connecting sensors with software, and then streamlining those together with enterprise workflow around the given solution. And, in all this geospatial provides the core ingredient needed to help facilitate and deploy smart city solution,” elaborates **Nigel Clifford, CEO, Ordnance Survey, UK**.

For example, a smart solution in waste management monitors the level of garbage in bins with the IoT sensors. When a bin is about to be filled to the brim, an alert is sent to garbage pickup vehicle passing nearby so that it can empty that bin. This would assist city administrators in maintaining the cleanliness of the city.

“Internet of things is like a neuron which spreads all across the city and senses beats of the city. IoT transmits data to the command and control center where human-based analysis, as well as machine analysis, helps to respond to the need of the city and its citizens,” says **Amit V Singh, Director, PwC India**, which is one of consultants for the Government of India’s ambitious 100 smart city project.

Because location is at the heart of Internet of Things, for delivery of good

governance in a smart city — ranging from smart safety to smart infrastructure to smart planning — geospatial technologies provide the underlying foundation and ultimately the fabric upon which solution can be built.

“Location data allows us to pinpoint exactly where we need to do what and at the right time. Location data is critical for planning as well as futurize with exact certainty,” says **Tan Boon Khai, CEO, Singapore Land Authority**. Singapore, which has embarked on a smart nation journey and could be considered to be most advanced in this aspect, has limited land resources because of its small size. “Whatever we build has to be right. To build right we need to plan right which is sustainable and recyclable and for that we need accurate and concise and detail data,” he explains.

Smart solutions for smart citizens

A recent Intel-backed study estimates that smart cities would save up to 125 hours of every urban resident each year and this can be done by providing them smart solutions such as smart parking, smart traffic management, smart health management, smart waste management and smart mobility. These solutions based on technology can ease their life with all information away by one digital touch.

Let’s take an example of mobility which is a key concern of any growing city. Here smart traffic solution can be a great help which can help commuters by giving them real-time traf-

fic information where. Smart parking will let them know where the parking place is available and so that they can park their vehicle without any hassle. And for travelers who use public transport information of travel modes can solve save their time by providing real-time information. **Iain Langlands, GIS and Data Manager, Glasgow City Council**, gives an example how in his city smart mobility is helping local citizens. Glasgow has a smart public transport system which gives regular information to the daily commuters about public buses, timings, seat availability, current location of the bus, time taken to reach a particular destination, next location of the bus and the density of passengers inside the bus for their ease.

“Bus operators in the city have the sensors in their buses. So, if the bus is going to be early to the next bus stop the bus is temporarily and very slightly is slowed down at the red light little longer than it should be to make sure the bus is on time and do not ahead of the schedule,” he explains. The system has been designed so smartly that passengers and even drivers are unaware of the delay as they are very little delays.

Singapore and Seoul are exemplary in providing smart health care solutions. Both the cities address health care service provision for elderly citizens through a range of technologies, including digital service platforms as well as remote monitoring devices. Meanwhile, London has applied a broad strategy that combines innovation like bicycle share schemes, telehealth and a strategy to reduce health care inequality in the city.

India, when started its ambitious journey towards smart cities, came up with pan-city solution. “Pan-city solutions are the application of selected smart solutions to the existing city-wide infrastructure. Its applications involve the use of technology, information, and data to make infrastructure and services better,” explains **Pratap Padode, Founder and Director, Smart Cities Council India**.

For instance, wastewater recycling and smart metering, which can make a huge contribution to better water management in the city, are part of pan-city solutions. These solutions are based on IoT and geospatial which also provides a better digital plat-

Because location is at the heart of the Internet of Things, for delivery of good governance in a smart city, geospatial technologies provide the underlying foundation and ultimately the fabric upon which solution can be built

SMART CITY INDEX 2017

The Intel-sponsored study conducted by Juniper Research ranked the top 20 global smart cities across four key areas: mobility, healthcare, public safety and productivity. The goal is to evaluate how they might deliver positive citizen outcomes in terms of time and quality of life.

Rank	Global City	Country
1.	Singapore	Singapore
2.	London	United Kingdom
3.	New York	United States
4.	San Francisco	United States
5.	Chicago	United States
6.	Seoul	South Korea
7.	Berlin	Germany
8.	Tokyo	Japan
9.	Barcelona	Spain
10.	Melbourne	Australia
11.	Dubai	United States
12.	Portland	United States
13.	Nice	France
14.	San Diego	United States
15.	Rio de Janeiro	Brazil
16.	Mexico City	Mexico
17.	Wuxi	China
18.	Yinchuan	China
19.	Bhubaneswar	India
20.	Hangzhou	China



form for integrating multiple subsystems. These may comprise of traffic management, parking, bus and paratransit operations, and Wi-Fi-projects etc.

One-stop platform for all data

For cities to provide smart services, data from all domains needs to be collected and correlated for better functioning. Smart City operations must be decentralized and serve areas with common needs where citizens can get all information of the city services at one touch, where they can interact with citizens local government and give their feedback too.

This requires a platform that serves as one-stop shop for all information which also acts as a two-way communication channel between citizens and governments and also between government to government so that they can take a smart decision.

Take for example the Singapore One platform. It is a GIS-based platform that has all the information about the city and enables citizens to look for solutions like information on land availability, parking availability, local transport system information etc. The platform also gives an idea to the government of the city in a holistic way so that they too can work towards smart of the city in a smart way.

“The ultimate goal of Singapore smart nation is to benefit its citizens. So once the data is available, we make sure that it is proliferated into public domain, which can then benefit the citizens in their daily lives,” adds Tan Boon Khai.

The Indian city of Bhubaneswar, which recently ranked among the top 20 smart cities in the world, has also designed a similar platform. The BhubaneswarOne portal has three level of openness and capability – first level is where citizens can download information like land use, second level is for department and agencies, and the third is for the Bhubaneswar Development Authority which is the nodal point for system integration.

“BhubaneswarOne portal has citywide geo-referenced data linked with each other and it gives government and citizens information about the city,” says **Dr Krishan Kumar, Municipal Commissioner, Bhubaneswar**. “If there is some sewerage work going on in some areas, the information is available to the citizens so that they are aware of the maintenance work, the disruption in services, and possible road blocks due to that. The information is available to local government bodies as well so that they are aware where the work is being done, or if a road cutting permission has to be given it will be keeping in mind the maintenance work etc.,” explains Dr. Kumar, who also functions as the Vice Chairman of the Bhubaneswar Development Authority and also the Managing Director of Bhubaneswar Smart City Ltd, a Special Purpose Vehicle (SPV) formed for the implementation of smart city proposal.

Citizens – the heart of a smart city

A city is nothing but its citizens. Therefore, while building a smart city it is very important to know about the needs of people of that city is. Then comes the task of educating them about the smart solutions and engaging them in the programs. The ultimate objective should be getting their feedback on how they want their city to not just be smart but sustainable too.

“A smart city is all about how we can do more with less resources. And this is where technology can help us – not only for efficient systems in governance be it delivery

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Information and Communication Technology (ICT)

ICT builds a bridge between citizen and government where citizens can interact with the government and in return the government builds the city as per the choice of its citizens.

Internet of Things

Internet of Things is like veins of the city spread all across and connecting each dot. All smart solutions in smart cities are based on Internet of Things where they are connected and smart enough to decide their action.

Sensors

Sensors are hidden but ubiquitous components of the urban landscape. Sensors are a crucial component of any intelligent control system. They are like converters that convert parameters of a physical nature to an electronic signal which can be interpreted by humans or can be fed into an autonomous system.

Geospatial Technology

Geospatial technologies provide the underlying foundation and ultimately the fabric upon which solutions for smart cities can be built. It provides location information which allows pinpointing exactly on the need so that better solution can be applied to it.

Artificial Intelligence

Smart city is a digital revolution generating huge amount of data. This massive amount of data generation brings the role of Artificial Intelligence that can make sense out of those data. AI allows machine-to-machine interaction by processing the data and making sense out of that.

Blockchain

Blockchain application is new to smart cities. Its integration into smart cities could better connect all city services while boosting security and transparency. Blockchain is expected to influence cities through smart contracts. It can also be used in smart grids to facilitate energy sharing, a concept which trending these days.



Six major technologies that define the smartness of a city

of public services or management of the city infrastructure where the citizens are at its heart,” says Dr Kumar.

Langsland of the City of Glasgow shares a very interesting story. “When Glasgow was developing the GIS and mapping division of the city, we decided to map all the ATM machines in the city for citizens. However, once the mapping was done and the information was available to citizens, they said the information was of no use to them since they didn’t want to know about locations of all ATMs, but only about those which had money.”

Now Glasgow has feedback kiosks at every 1 km where citizens can simply convey

to city administrators what they want or how they want their city to develop.

Agrees Dr. Krishan Kumar: “It is very important to know what citizens require. If citizens and government envision together, implementation will be more impactful”.

For example, the city of Milton Keynes runs a scheme for promoting citizen-led sustainability issues in the city. The scheme provides funds and support to engage citizens and help turn their ideas around sustainability into a reality. Citizens are skilled to operate effectively in a smart city. There is an online platform called Urban Data School to teach students about data

skills as well as informing citizens about what a smart city is. In the process, their feedback and information about their requirements are also collected through various channels like social media, mobile app platforms, volunteered information and solicited information.

A city becomes a favorite when it fits the need of its citizens and provides them affordable housing, quality education, economic perspective and better job opportunities. It should also provide cultural space, entertainment, and of course clean and safe environment. Such a city becomes smart when it learns how to utilize the available resources optimally, technology becomes an intrinsic part its persona. By adopting technology, a smart city gets equipped with smarter governance and management, leading to better lives and thus happier citizens. 🌐

A city becomes smart when it learns how to utilize the available resources optimally, and technology becomes an intrinsic part of its persona. By adopting technology, a smart city gets equipped with smarter governance

Mahashreveta Choudhary, Assistant Producer, mahashreveta@geospatialmedia.net

MOVING BEYOND INFORMATION SERVICES

With organizations now focusing on the where of things, the integration of spatial analysis and business intelligence is on everyone's mind. This integration is leading to more informed decisions, and advanced geospatial technologies are facilitating this integration. **By Atanu Sinha**

Where does that happen? Addressing this fundamental question in understanding the world around us has led to an increasing demand for readily available, accurate, and current location information. By incorporating location, geospatial applications have become a primary tool for analyzing sophisticated data. These technologies are currently growing at a fast pace, building a smarter world using geospatial intelligence. What used to be a niche market is exploding into all fields and sectors. We can now access geospatial processing on the Web through client applications that make it openly available to all types of people.

Although data processing and analysis has become more affordable over the years, organizations still struggle to develop robust solutions and workflows for effective data

acquisition and management. Organizations need cutting-edge innovations for managing big data to provide accurate information through location intelligence. From cloud platforms to mobile laser scanners, we are in the midst of a paradigm shift in all aspects of geospatial applications. It is all about moving from the sense, process, analyze, and create a static map workflow to real-time and mobile mapping that delivers smart, accurate information enabling organizations to quickly sense, decide and act as the earth changes.

Apps on Cloud platforms

As the buzz around cloud computing grows, we hear phrases like 'build your apps using maps' and 'crowd on cloud'. With the smartphone revolution, millions of people have access to instant connectivity. With this access comes, both an expectation of instant

answers and a need for more power to process the deluge of data provided by the mobile devices. Innovative apps on cloud platforms for Smart Governance, such as crowd-sourced feedback and notifications, present powerful opportunities and challenges. Once you have empowered the citizen to report incidents, they expect the local or state government agencies to respond with detailed information in less than a minute. For Smart Transportation, drivers and commuters do not understand that the basic spatial network of all roads and their properties need to be tagged and made intelligent. They need to access applications such as Intelligent Traffic Management Systems, Advanced Driver Assistance Systems, and Telematics.

Transitioning to analytics with Smart Maps

Leveraging geospatial information is critical to an organization's continued success. Every action has a geospatial element attached to it – everything happens somewhere. Traditionally, we gathered data, processed it, analyzed it, and then created a static map that reflected our research. This meant not only a huge expense in time and money, but the answer we presented was weeks to months out of date. Not only that, but the information we could glean from the map was limited to that which was included – the map was not flexible – and building a new map meant starting over again.

Now, maps have changed. With the internet and the Internet of Things, we have access to real-time data feeds to fuel our analysis. By connecting directly to the data and building flexible "views", we empower users to visualize and analyze the breadth of the information stored about the object and not just its geographic location. This dynamic experience provides an ongoing information service that not only reflects what was, but what is, what can be, and what 'should be' in an intuitive manner, so that one can spot trends and relationships that are not always apparent in a spreadsheet. 🌐

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Indian geospatial economy valued at \$3.07 billion

The Indian geospatial industry has great potential, but feels constrained due to lack of integrated strategy with a myriad of restrictive, often outdated policies. **By Anusuya Datta**

The Indian geospatial economy's value is INR 20,629 crore (\$3.07 billion: 100 crore is 1 billion) and it employs over 250,000 people across the country. Of this, the domestic market is estimated at INR 7,670 crore (\$1.14 billion) in FY 2017-18 growing from INR 5,338 crore (\$0.79 billion) in 2014-15 at a compound annual growth rate (CAGR) of 12.9%. It may be noted that this growth rate is greater than the global average of 11.5% CAGR during the same period. Further, the growth rate is likely to be 13.8% during FY 2017-18 and FY 2020-21, as per the Indian Geospatial Economy report by Geospatial Media..

The report also found that the Indian geospatial industry is strong in the services domain. A number of Indian companies cater to overseas markets, servicing geospatial data capturing, data processing and integration, applications and solutions development across multiple sectors. A number of global geospatial leaders have established their R&D centers in India. While India currently exports nearly INR 6,659 (\$0.99 billion) worth of geospatial services, there is broad consensus that it is capable of delivering more on the exports front, says the study.

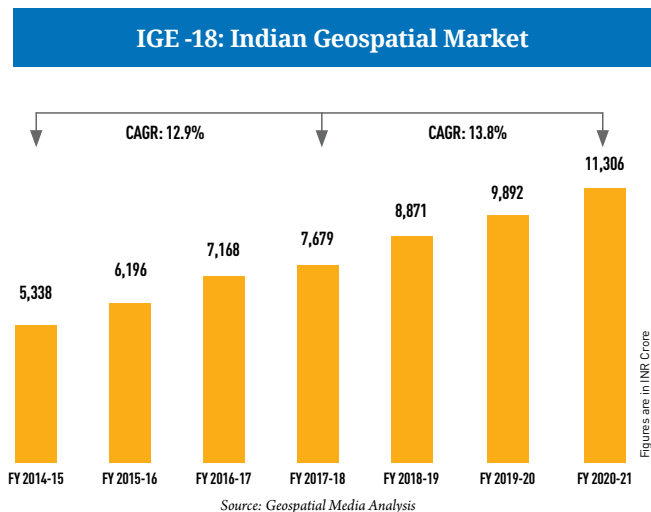
The government expenditure on national geospatial agencies is estimated at INR 6,291 crore (\$0.94 billion).

Despite its great potential, the study found that the sector feels constrained due to lack of integrated strategy with a myriad of restrictive, often outdated policies – as many as 15 geospatial-related policies under five ministries/ departments – holding it down.

The Indian geospatial economy comprises of a market size through commercial procurement of equipment, software, data, services; exports of geospatial equipment, software, data and services; and public expenditure on creation and maintenance of geospatial data, infrastructure and institutions.

Of the 2.5 lakh odd people employed in the geospatial sector, nearly 67,000 are engaged in exports-related services. The report also reveals that there are huge employment generation opportunities in India for basic services such as surveying, map digitization, content development, APIs, data analysis, etc.

As was expected, the report found that the major growth drivers for the geospatial industry have been the push by federal and state governments for robust physical infrastructure, effective governance delivery including e-governance and digital economy initiatives,



- In terms of the four technology segments, the geospatial market is found to be dominated by GNSS and Positioning segment, and GIS/Spatial Analytics segment in FY 2017-2018 with a market share of 72.8% and 23.1% respectively.
- Earth Observation and 3D Scanning and Surveying segment accounted for 2.1% and 2.0% respectively

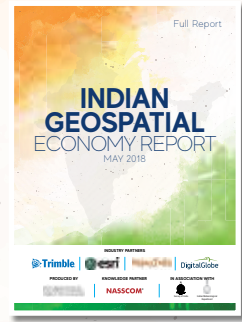
integrated programs on urban and rural development initiatives such as Smart Cities, RURBAN clusters etc.

Naturally in terms of end-user sectors, the study found that the geospatial market is dominated by infrastructure, urban development and utilities. Together, these three sectors had an estimated market share of 22.1%, 13.9% and 15.7%, respectively, representing nearly half of the total geospatial market of India. Mining, Education and Research, Water Resources and Irrigation sectors are the next three major user segments contributing nearly 5.5%, 5.3% and 4.9%, respectively, during the period.

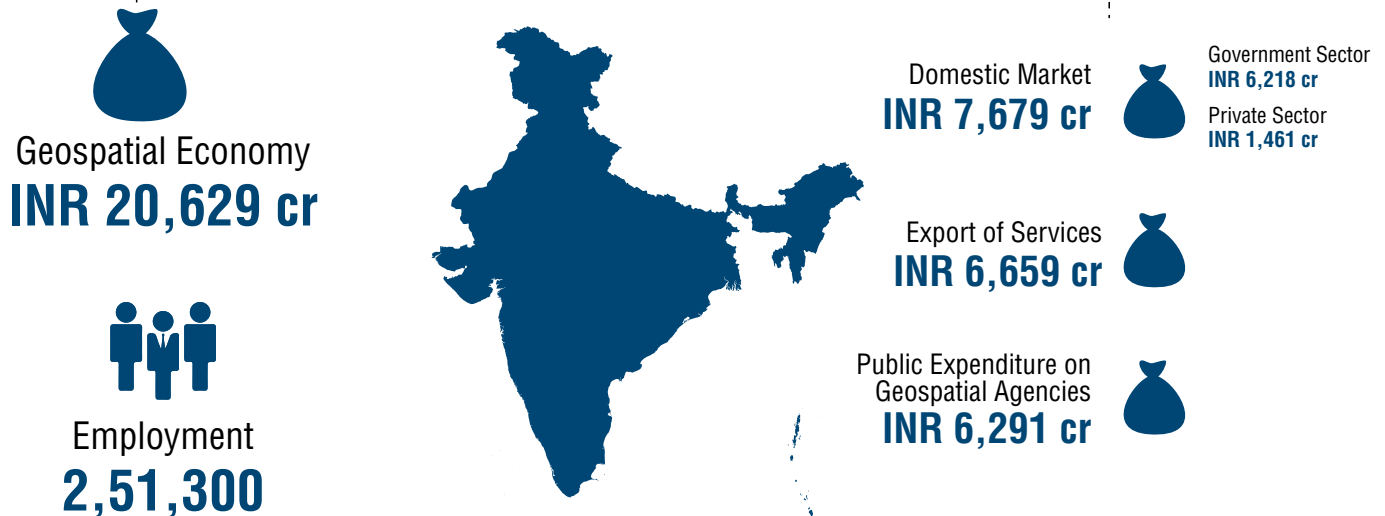
The study found that the GNSS and Positioning segment dominates the market with a market share of nearly 72.8%, with GIS and Spatial Analytics coming a distant second with 23.1%. Earth Observation and 3D scanning and surveying segments were neck and neck for 2.1% and 2%, respectively. 🤖

Anusuya Datta, Executive Editor, anusuya@geospatialmedia.net

Indian Geospatial Economy Report-2018



INDIAN GEOSPATIAL ECONOMY IN 2017-18



"Indian Geospatial Market during **FY 2017-18** is estimated to be approximately **INR 7,679 crore** growing at nearly **13.8% CAGR** to reach **INR 11,306 crore** in **FY 2020-21**"

- What are the key drivers of geospatial economy in the country?
- What are the challenges at the user adoption level?
- What is the policy and governance structure, technology integration, national geospatial agencies landscape in india?
- How the geospatial market in india is distributed across technology (GNSS, GIS/Data Analytics, EO, LiDAR & 3D Scanning) and user segments such as infrastructure, Utilities, Urban Development, Retail & Logistics, BFSI, Rural Development etc?

Discover answers to many such questions in the India Geospatial Economy 2018 Report.

Order your copy online at www.geobuiz.com. For details and queries, contact: info@geobuiz.com

GIS-POWERED IRRIGATION:

Accurate mapping of geographic and geologic features of farmlands is enabling scientists and farmers to create more effective and efficient farming techniques, leading to production of higher quality crops and food. **By Patty Chen**

the secret ingredient for yummy Thai food



SOFTWARE AND APPS USED IN THIS CASE

SuperGIS Desktop

SuperGIS Irrigation Analyst

SuperGIS Server

SuperSurv for Android

Tom Yum Goong (spicy shrimp soup), spicy green papaya salad and Pad Thai (Thai fried noodles), these typical Thai foods have successfully conquered billions of peoples' stomachs. Thanks to dynamic farmers, fertile lands, rich spices, fantastic food culture, we can have a good Thai meal almost everywhere around the world today.

What leads to these delicious meals? Of course good quality crops, and thus it is necessary to use technology to maintain high quality in irrigation. Geospatial technology provides convenient tools to achieve higher yields.

Born this Way — Every Field is Unique (Challenge)

The year-long warm weather makes Thailand a Neverland of farming. Managing the plantations also becomes an issue since the starting date of planting varies paddy by paddy. One may have just been planted, while the neighboring field is already waiting for harvest. Each type of crop has its growing curve, and the required water volumes in different growing stages are distinct, too.

For example, while rice has 6 growing stages, and each stage needs different water

volumes, mango has only 4 stages. The difference between each crop and stage makes water calculation complex, and add to this the existence of million paddies with various growing status, and The Royal Irrigation Department (RID) has a highly complicated counting job to do.

Although it had been investing in expensive GIS software for years, the task couldn't be done efficiently.

RID as the largest department in Thailand government structure, has enough resources to find tools and solutions to solve issues related with irrigation, however, they need to ensure that the tool is reliable and suitable for their requirements. This is the reason they decided to go with the SuperGIS Irrigation Solution.

GIS in Irrigation, a Global Demand (How the solution took birth)

Taiwan Agricultural Engineering Research Center (AERC) and Taiwan Agricultural Irrigation Association (TAIA), the long-term partners of RID truly understood the difficulty as this problem has been bothering the Taiwanese authority for a long time.

The experts from AERC and TAIA knew how to do the calculation, but needed a bet-

ter way to have more efficiency. That's when they decided to combine the systems with GIS, and an integrated solution was brought by Supergeo Technologies Inc.

Supergeo is one of the main GIS software developers in the world. It provides off-the-shelf GIS software and also customization based on it. What RID analysts needed to do was the calculation and present it on the digital map for easy sharing. Also, a convenient tool to update field status and replace paper on the wall was also needed. Therefore, AERC, TAIA and Supergeo worked closely to integrate each other's strength to achieve the SuperGIS Irrigation Solution.

Watering Lands by SuperGIS (Detail of the solution)

To solve the issues, Supergeo provided its SuperGIS Desktop and developed a brand new analyst extension, SuperGIS Irrigation Analyst. The extension is designed to count water volume by providing planting date, crop type, temperature data, and the most important, paddies saved in SHP.

SuperGIS Irrigation Analyst includes the water requirement index of common crops, called Kc Values. Users are also able to define values according to environment conditions in different regions. RID analysts only need to launch SuperGIS Irrigation Analyst and input data, and the water requirement of each paddy can be calculated easily with few clicks

and presented on the map with different color levels or in form.

Preparation of data

- Land data (.SHP or .GEO)
 - Regional weather data (max, min & average temperature and radiation)
- Kc value of crops (support .CRO file from FAO Cropwat)

After the water requirement was counted, RID Analysts published the result through SuperGIS Server so that the directors, officers and staffs in the working stations can check land info by internet browsers, like IE, Chrome, Firefox.

Less Sun Exposure for First Line Surveyors

The implementation of SuperGIS Irrigation Solution also means a smoother and lighter work for working station staffs in the first line.

Previously, they needed to check the latest crop growing status and record it on papers. And then, brought the survey result papers back to working station, filled it on the map on the wall and keyed it field by field into computer for reporting to RID headquarter. The weekly routine tasks took at least 1-2 working days to update the land status.

But, with the GIS app for Android, Super-

Surv 10, the workers can simply install it in their Android phone or tablet, and import existing .SHP. When they go on the fields, no internet connection is required, just use the internal GPS signal, and SuperSurv 10 will locate to the current position. Staffs can query and measure the paddy in front of them. Of course, they are also able to add new paddy field as .SHP, edit its border, move its position, add new vertex, manage the content of table with various info, such as land owner, land number, crop type, crop growing status, reporter, special situation or any other self-defined info.

Now, the first line workers do not have to go far around his managed areas and stand there under hazardous sunlights, bearing humid air over 30 Celsius degrees (86 Fahrenheit degrees). He can shorten the survey process from 1-2 days per week to half day or less. Also, the data key-in job is simplified by importing data via cable or cloud service like GoogleDrive and Dropbox at the same time. RID headquarter is planing to open part of their land data for authorized staffs to access with mobile phones so that they can use browsers to view or use SuperSurv for Android for advanced editing.

Fluid GIS Workflow, Yummy Thai Dishes

Since Royal Irrigation Department upgraded their GIS with SuperGIS Irrigation Solution, not only the processing time of data collecting, updating and counting and purchase cost are greatly saved, but also water resources can be precisely utilized as the tool provides better solution for decision makers to also consider the spatial factors while distributing water. And, the most important thing is, make sure rice and crops production is well-irrigated and we all can enjoy the great yummy Thai dishes in the every corner of the world. 🍽️

Patty Chen, Regional Manager, Supergeo Technologies Inc. supergeopatty@gmail.com



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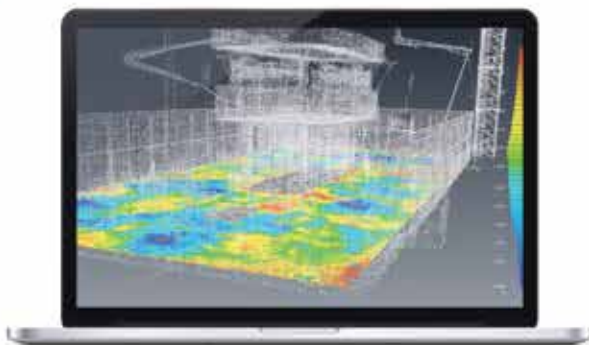
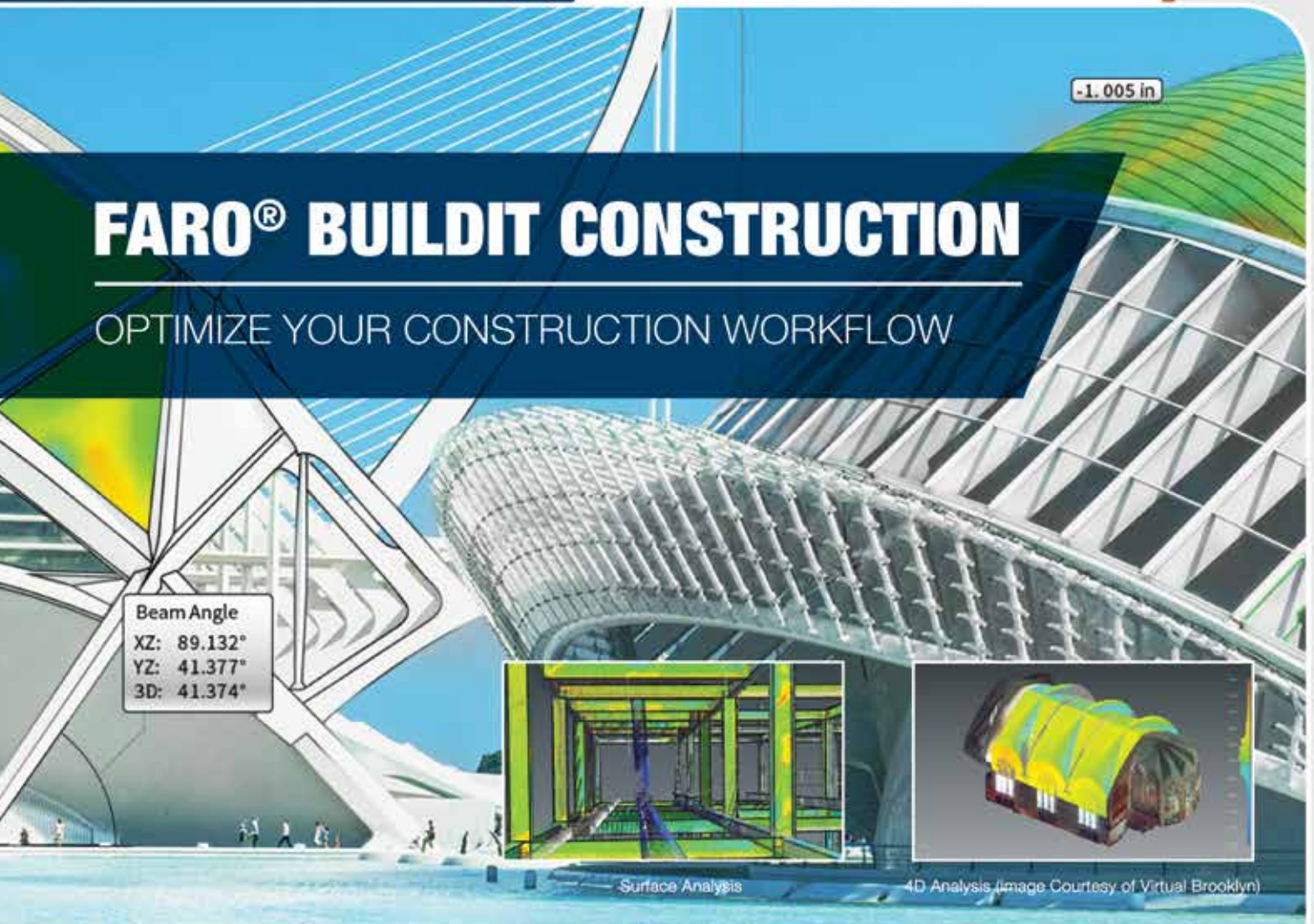
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