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Coordinates

Volume III, Issue 12, December 2007

THE MONTHLY MAGAZINE ON POSITIONING, NAVIGATION AND BEYOND

A Jack and Jill story

Acknowledging the role of LBS

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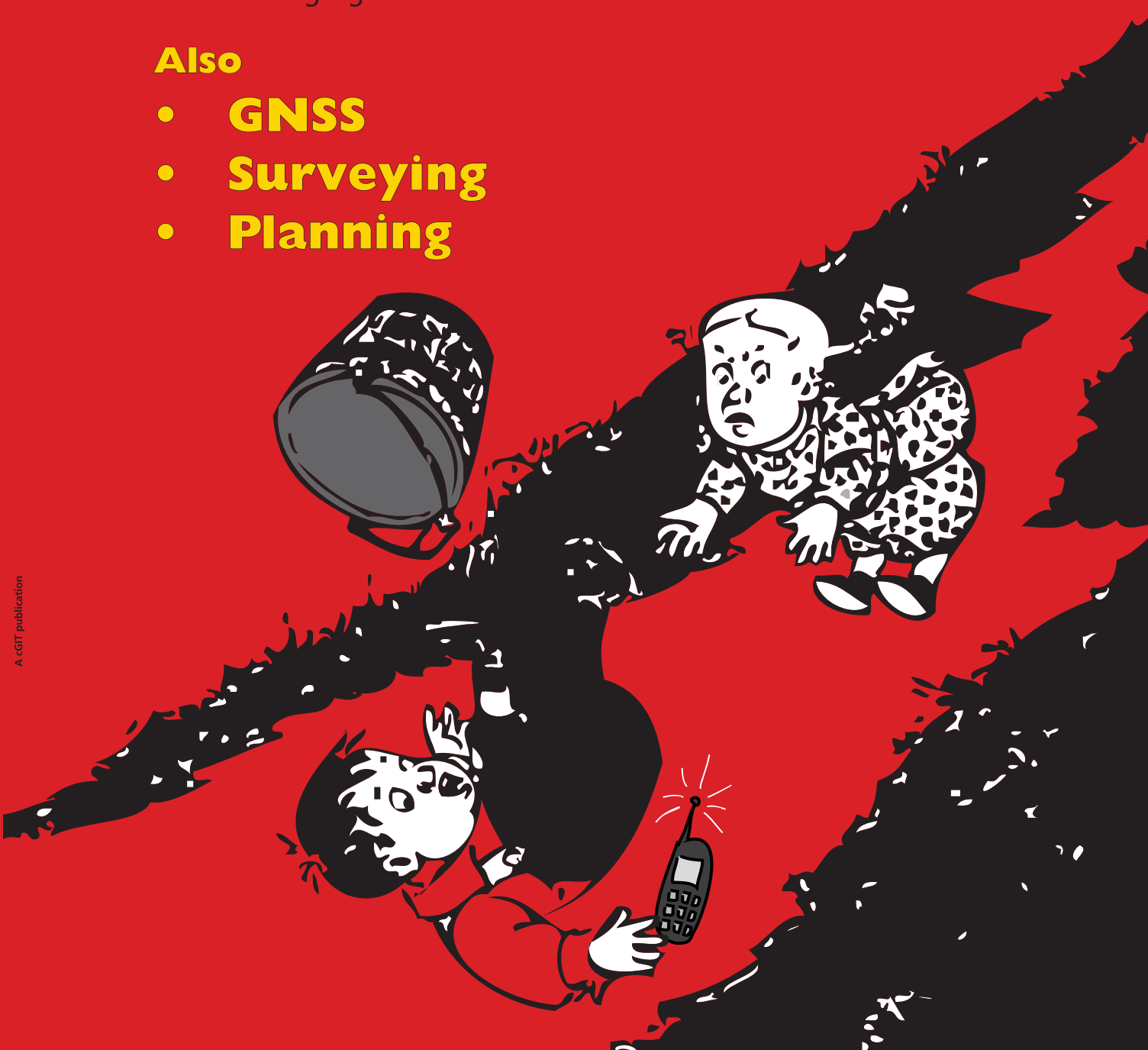

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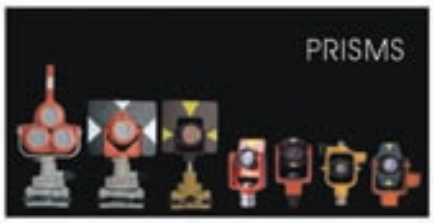

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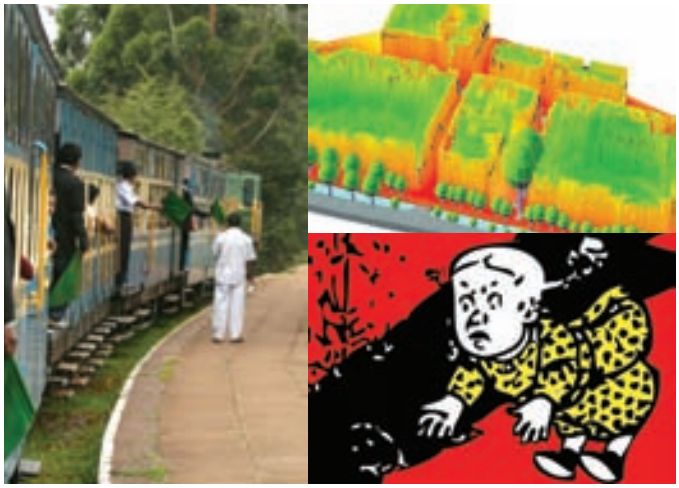

In this issue

Coordinates Volume 3, issue 12, December 2007

Articles

Columns

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The LBS stream

It's integral to the day-to-day functioning in the developed world.

In Asia, Japan and Korea lead the way.

The undercurrents are becoming visible in India.

First, it was the state-owned BSNL to join the LBS bandwagon.

Later, the private player Bharti Airtel followed suit.

Market dynamics indicate positive trends for LBS.

With the mobile phones holding the pulse of the nation,

Location based service is the logical next step.

Service and technology providers stand poised to lead.

The government will hopefully provide necessary support.

Although the common man is not an avid map user,

Exposing them to new technologies is a welcome beginning.

Hopefully in the New Year, the strong currents will have pushed

LBS into the main stream.

Bal Krishna, Editor
bal@mycoordinates.org

A Jack and Jill story

Acknowledging the role of LBS

Satyashree
gsatyag@gmail.com

THEY went up a hill to fetch a pail of water. Jack fell down and broke his bone and Jill came tumbling after… And now they need medical attention and must locate a medical center soon. How far is the nearest hospital? How do they get there from the accursed hill? What is their current location? They need location-based services (LBS). "What is LBS?" asks Jill.

Location based services are location-specific information, such as restaurants, ATMs, hospitals, traffic conditions, and weather information, provided to mobile users within a measurable radius from a specific location. This 'mobile content' is obtained using GPS (Global Positioning System) which utilizes a constellation of satellites in Earth's orbit that transmit precise microwave signals, enabling a GPS receiver in a mobile device to determine its location, speed, direction, and time. LBS has its roots in GIS (Geographical Information System) technologies, communication technologies, and the Internet with all its information. Its architecture consists of five basic components: mobile devices, positioning, communication network, service providers, and content providers, all of which interact in the processing chain of the service request sent by the user. If Jill had a GPS-enabled cell phone, it is capable of establishing her location (positioning) such that when she seeks emergency services (communication network) from that location, the agent providing the voice telephony service (service provider) directs the request to a database (content provider) containing the emergency services information for that location, which is then returned to the cell phone along with the corresponding navigation instructions.

How huge is the hill?

According to the recent press release by ABI Research, GPS-enabled handset market is expected to generate over $100 Billion in revenues in 2012.

The recent spate of acquisitions and mergers in the LBS market is a sign of an increasing commercial and popular interest in location-awareness. Nokia, a mobile device manufacturing major, has acquired Navteq, one of the leading providers of comprehensive digital map information for automotive navigation systems, mobile navigation devices, internet-based mapping applications, and government and business solutions. Tele Atlas, another popular mapping data provider has been acquired by TomTom. ABI Research industry analyst Shailendra Pandey observes, "The ongoing consolidation in the mobile industry … gives a clear indication of the plans and commitment of industry players to address the GPS-enabled handset market."

"But I do not have GPS on my phone," says Jill

There has been a parallel swell in the development of various location based technologies. Google has launched "My Location" which uses information

broadcasted, not by satellites through GPS but, by cell towers to find the location of a mobile device using the triangulation method. SiRF, a manufacturer of GPS chipsets for navigation systems, has licensed Skyhook's WPS (Wi-fi Positioning System), a single positioning system based on the Wi-fi network for wireless carriers that combines the best of GPS and Wi-fi technology.

First services are already available for mobile phone users, such as Family Finder, weather information, and city events. Phone makers now support GPS phones for social networking and mobile gaming. GyPSii Symbian is a geo-location and social networking platform that combines location-based news and services, such as search and friend-finder, and user generated content-creation and sharing. Nokia has given its official authorization to the Symbian application for its N95 and 6110 Navigator mobile phones.

The Universal Address System developed by NAC Geographic Products Inc. has introduced a highly impressive unified representation of an address, such that the entire Earth can be digitized using the latitute, longitute, and altitude information of any given place. An eight character universal address can uniquely specify every building in the world and a ten character universal address can uniquely specify any square meter. MLBS is a comprehensive wireless LBS powered by Natural Area Coding (NAC) technology and Microsoft's MapPoint web service.

"Where are we?" cries Jack, "How far away?"

The telecom industry in India, as in the rest of the world, is currently surging a record high in power and reach and witnessing a burgeoning of allied technologies. Mobile devices have reached the lowest common social denominator acquiring millions of new subscribers every month. With the progressive

Mere applications, not services

ACCORDING to a report by ABI Research, there will be over 240 million GPS-enabled mobile phones in 2008. Many of these phones will find their way into India, which translates into a huge opportunity for the Indian GPS/GIS industry. But will these millions of GPS enabled handhelds be used for navigation alone? The probability is low.

To illustrate our point, let's do a status check of consumer-oriented GPS services in India. Currently, brands like Airtel, Google, MapmyIndia, Nokia and Yahoo! provide navigational maps for Indian cities. Some of these maps cover almost four dozen cities and close to half-a-million Points of Interests (PoI). But try searching the route to a residential address and the navigation software will return no results. The problem with the current GPS services is their inability to give last mile navigation directions to the user. While GPS application developers claim that a user won't have to roll down a window to ask for directions again, the harsh reality is that is exactly one has to do after veering off from the main road.

Another aspect, which holds true in the Indian scenario, is the current offerings are mere 'applications' and not 'services'. When we say GPS as a service, we include things like live traffic updates, which would come handy for a user to avoid traffic jams and take a detour instead. At present, we use GPS only for navigation, that too when we are headed to an unknown place, an occurrence that doesn't happen frequently to justify the need. We appreciate the effort that has gone in putting together detailed digital maps of Indian cities but we fear that isn't enough.

Unlike a couple of years ago, when consumer oriented GPS enabled devices were expensive and rare, in 2008 there will be many mid-end cellphones (and not forgetting Bluetooth enabled GPS receivers) available to choose from. Don't be surprised if you get to hear a statement by the end of 2008 that indicates more number of GPS -enabled cellphones were shipped that stand-alone personal navigation devices. After all, it has happened with digital cameras, portable music players and PDAs, there is no reason why it shouldn't be the same with personal navigation devices. Most of the consumers of such cellphones will be the youth, who at this point aren't the typical end-users that the GPS industry caters to. These rather sudden developments require a change in the perspective of how the industry looks at the GPS market. We believe that instead of mere navigation, GPS based social networking and user generated content sharing applications will be more popular in 2008.

The benefit of having a GPS in a cellphone is the fact that anything and everything can be tagged with a precise geographic location that is as accurate as 10 metres. An application that geo-tagging places (restaurants, night clubs, coffee shops, malls) with user generated reviews might become popular with users registering themselves to get reviews via text messages when they are around that location. Or location based social networking that let's you meet friends or friends-of-friends, who can ping you and meet, when you are nearby can take the likes of Facebooks and Orkuts to a different level.

With the emergence of high resolution cameras in cellphones, there is no dearth of user generated content in the form of videos and photographs. If users geo-tag them, upload them to a common application, we can have almost every conceivable part of the globe captured in prints and video footage. The possibilities are endless. Let's give the consumer something more to do with his GPS-enabled cellphone. And of course, let's find new avenues to generate revenues with existing technology.

Rajat Agrawal
The author has been writing about cellphones and cellular technology for over three years now. You can read his take on the mobile world. *www.cellpassion.com*

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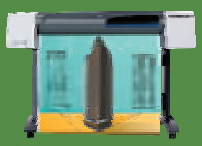

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Personal Navigation Devices will surpass 100 million Units by 2011

The consumer navigation market has seen unprecedented levels of activity and growth in 2007, mainly driven by PNDs (personal navigation devices) which offer a compelling mix of ease of use, features, portability, and affordability. As an established mass market CE category, PND markets will continue to grow strongly to reach a global sales volume of more than 100 million units by 2011. Dedicated PNDs will remain the preferred form factor for use in the car but will be complemented by handset-based systems for pedestrian navigation and new use cases such as outdoors. New form factors such as portable media players, ultra mobile PCs, Internet tablets and mobile Internet devices will also appear.

Europe is currently the leading navigation market, but strong growth is expected in developing countries such as China and India. By 2012 more navigation systems will ship in Asia-Pacific than in any other region.

The high levels of competition and price pressure will result in continued consolidation and vertical integration, as evidenced by the acquisition of the two main digital map providers, NAVTEQ and Tele Atlas. An important driver for consolidation is the need to aggregate user communities under strong brands to take advantage of the potential of user-generated map and POI (point of interest) content. Navigation vendors are looking to differentiate their offers by adding speech technology, multimedia features and 3D map content, and by targeting specific segments. **www.abiresearch.com**

subscriber not satisfied with mere voice communication, their increasing demand for more value-added, multimedia-rich data exchange has led to a virtual war among telecom companies for a broader radio frequency 3G spectrum to support such content. One happy outcome of this situation is the dissemination of relevant information that is made accessible with mobile devices through the mobile network by using the location information of the mobile device and the recent developments are positive indicators.

Personal navigation devices (PND) have gained considerable amplitude in India. With more private firms offering advanced features in the PNDs, such as MapMyIndia Navigator and SatGuide, while keeping the costs affordable, the corporate competition is leveraged to consumer advantage.

India's state-owned telecom giant, Bharat Sanchar Nigam Ltd. (BSNL) is the first operator to launch LBS on Telenity's Canvas® LES, Location Enabling Server. Catching up with the latest innovations in the industry, the enterprise will now offer real time fleet and asset management, friend finder alerts, location based advertisement, and location based chatting service. Capitalizing on the rich and varied language base in India, Mahanagar Telephone Nigam Ltd (MTNL) is offering multilingual short messaging service (SMS) in 11 regional languages. This vibrant layout is generating tremendous interest for giant internet portals, such as MSN, who are investing in the Indian telecom companies to provide location-based search.

Bharti Airtel Limited, one of India's leading private sector providers of telecommunications, joined Fixed-Mobile Convergence Alliance (FMCA) to share the developments in convergence of fixed-line and mobile wireless technologies such that they can seamlessly blend all the services they have to offer over a unified framework. This Fixed Mobile Convergence (FMC) will thus enable the service provider to become a one-stop shop for purchase as well as support. For FMC to make subscriber-centric multiple offerings a closer reality, broadband and Wi-Fi networks need to be aggressively expanded, and the process of its entry in India has already started with Telecom Regulatory Authority of India (TRAI) framing the last recommendations for 3G spectrum services.

Jill says, "I suppose we have to deal with broken bones sometimes."

In addition to technological developments, policy level developments have been taking place in parallel setting up India as a global player in the industry. One of the recent landmark developments is the New Map Policy brought out by the Ministry of Science and Technology, Government of India, which promises better access to the maps generated by Survey of India. Survey of India is the central agency in charge of surveying, publishing, maintaining and dissemination of the topographic map database of the country. Although encumbered by a few regulatory issues, it is nonetheless a significant step forward in the direction of making all new Open Series maps to be made available in the public domain.

Another conducive development has been the recent reclassification of GPRS phones by the Central Board of Excise and Customs as radio navigational devices incurring a reduced excise of 4%, going back on their earlier classification as satellite phones which incured an import tariff of 34%. Although this development makes it difficult to keep the cost of GPS applications on standalone units affordable in a price-sensitive economy, LBS providers dependent on GPS have worked around this impediment to their advantage by bundling GPS with GPRS phones. A GPS-enabled mobile device, essentially a GPRS phone, now becomes affordable by including GPS as a 'value-added' offering (a secondary feature), thus doing away with the additional 34% taxes. Ashutosh Pandey, Managing Director, SiRF India speaks to Coordinates in July 2007: "In doing so, the government gave relief to the privileged – those that could afford to purchase a mobile phone costing more that 20,000 Rupees. At the same time, it kept the much needed products in the census, safety, security, and even pure navigational category at the high rate of duty (34%), out of reach of average users".

"This is crazy," says Jack, "let's just get a driver."

In a culture-vibrant and language-rich country, such as India, all technology is subject to cultural and linguistic nuances. This is a friendly nation where a mere act of seeking navigation assistance help is a welcome mode of social interaction and any attempt introducing technology as a replacement amounts to bringing about a cultural change. Add to that the variety of Indian languages and dialects that technology has to cater to reach a critical mass. Consequently, it becomes a mammoth task to arrive at a common conventional nomenclature for addresses of locations which may run into several long words, given the Indian propensity to name their roads after their heroes and leaders. Besides, most roads that have a formal name and a commonly used name do not make the task of nomenclature any easier.

By virtue of the booming economy and real estate, there are several new retail outlets, multiplexes, apartment complexes, high-capacity bus and rail ways springing up even as we speak. Extremely systematic and methodical procedures need to be in place to record and update the increasingly volatile topography. This entails a very high cost of investment and maintenance of equipment used to document and update geographic data. Besides, being expensive, LBS is a fancy technology targeted more towards the upper middle class, who are most likely to have drivers who are expected to know the way.

"How did they know we need help?" Jill wonders

LBS technology comes with its own array of inherent imperfections, which, if not appropriately guarded, may transform itself into a certain invasion of location-related personal privacy. The knowledge of a certain satellite constantly tracking and monitoring one's movement is as unnerving as the knowledge of that information being used by analysts to predict behavioral patterns and by advertisers to interpret consumer preferences. Such technology may restrict or dictate movement, a phenomenon lucidly termed as 'geoslavery'. Countries, such as the US, which are extremely sensitive to the concept of personal freedom, may be able to avoid the most serious abuses of this technology, but it may take a little longer for India to enforce stringent laws to protect personal privacy.

Jack and Jill finally fetch their pail of water

2008 holds a promising future for the LBS industry as seen by the major portals and corporations looking for business opportunities in India. Portal providers, such as Google, Yahoo, and MSN have placed location at the core of their offers pairing communication services with maps and local mobile search and mobile advertising. On the other hand, individual vendors are using location-based services to turn mobile search services into profitable value propositions.

"We are developing an ecosystem of players in the LBS and navigation space – software and solution providers, mobile operators, handset manufacturers, automobile companies and PND manufacturers, to offer consumers high quality and pan India LBS applications … on the internet, on the mobile phone, and in-car." Says Mr Rakesh Verma, CEO, MapMyIndia, CE Systems It is a win-win situation where customers will have more personalized information and network operators will address discreet market segments based on different service portfolios. In the US, the Enhanced 911 (E911) requirements enforced by the Federal Communications Commission was primarily responsible for propelling LBS, and later, the car and aircraft navigation experimented with and embraced the technology. In India, the fondness for information and the fascination with social networking appears to be the driving force behind the popularity of LBS. Opening up a few policies, tightening a few others, and pairing up location information with emergency services, as did E911, may perhaps be just the catalyst that is required to bring LBS in India into the mainstream.

So the next time Jack and Jill fall from a hill, they will know exactly how close the nearest hospital is as well as the directions down to the last mile and around the nearest corner.

Global market worth $48.8 billion by 2012

According to a new technical market research report, from BCC Research, the global market for mobile location technologies will be worth $23.2 billion in 2007. This is expected to increase to over $48.8 billion by 2012, a compound annual growth rate (CAGR) of 16.1%. The market is broken down into applications of vehicle navigation, surveying and mapping, machine control and others. Of these, vehicle navigation has the largest share of the market. Valued at nearly $15.5 billion in 2007, this segment is expected to be worth $38.2 billion by 2012, a CAGR of 19.8%. The second largest segment, surveying and mapping, was worth an estimated $2 billion in 2007 and will reach $3.2 billion by 2012. Machine control is currently a $1.1 billion segment that will be worth $2.1 billion in 2012, a CAGR of 13.4%.

While it was the Global Positioning Systems satellite system that launched the mobile location market, today nearly 75% of all applications use either augmented GPS technologies such as the Wide Area Augmentation System (WAAS) or hybrid systems like wireless assisted-GPS (WA-GPS). By 2012, augmented and hybrid satellite location technologies' share is projected to reach 84.1%.

The U.S. is expected to retain its position as the world's largest market for mobile location technologies through 2012. Otherwise, Western Europe (i.e., the EU plus EFTA nations) should replace Japan as the second-largest geographical market. As a group, markets outside the U.S., Western Europe, and Japan are projected to increase their global market shares to 20% by 2012. *www.businesswire.com*

"We are very bullish about LBS"

Rakesh Verma
CEO, MapMyIndia, CE Systems on navigation market in India

How do you see the success of the Navigator in India where we culturally depend on word of mouth for directions?

There is a significant need for a GPS navigation device for all India . Depending on word of mouth for directions has set in as culture in India, because people felt they had not option, and so factor in an added 15 min – 30 min every time they set out for a new destination as the extra time it will take you to find the place. With availability of a GPS navigation device like the MapmyIndia Navigator, people can have more convenience, knowledge and safety on the roads, and we believe it is just a matter of using and trying this product before people start demanding it seriously. The situation is very similar to mobile phones when they were first introduced – before their arrival, we were all doing fine, and now we can't do without them.

What makes the product different from other navigational devices available in the market?

The major differentiator for the MapmyIndia Navigator is the map inside. Comprehensiveness and accuracy of the maps drive the experience of using a navigation device, and this is our major advantage over any other navigation device not using our maps in the market today. MapmyIndia maps allow for seamless turn-by-turn navigation from any point to any point in the country – for e.g. nariman point, Mumbai to koramangala, Bangalore . The depth of our maps, covering all streets, localities, sub-localities and points of interest in 52 categories combined, with the seamless pan India breadth, covering towns and villages connected by national and state highways, allows our customers to use the MapmyIndia Navigator for turn-by-turn navigation to their destination anywhere in India, while other products do not.

The pricing is competitive given the 34% import duty on GPS navigation devices (versus 4% import duty on mobile phones equipped with GPS), and given the initial stage of the market and associated volumes. Remember the quality and quantity of map coverage we offer is unparalleled, and we believe that customers will pay a premium for that.

How accurate and authentic are the maps that Navigator uses?

MapmyIndia maps are the most comprehensive and accurate navigable maps available for India today, and are 100% our intellectual property. These maps are driving over 500 large enterprises including Coca Cola, HLL, Maruti, General Motors etc. including leading navigation players such as Airtel GPS Navigation, Yahoo! India maps portal, with more to be announced soon.

MapmyIndia Maps have all the necessary clearances from the Government of India.

What is the reason behind the choice of 2 hardware models?

Our objective is to provide consumers with complete options and choice of using MapmyIndia maps on the internet, on the mobile phone, or in-car. Specifically for in-car GPS navigation, we have released 2 hardware models to provide consumers with different form-factor and aesthetic options, and will be offering various other hardware models in the coming time, either on our own, or in conjunction with our partners.

Who are your target customers?

Broadly, anyone has a use for the MapmyIndia Navigator, as the GPS navigation device tells you where you are at all times, giving you safety and comfort, and guides you turn-by-turn to your destination. In the early stage of the market, we believe adopters would be technology enthusiasts, those who have seen these devices in US and Europe, and premium car owners would be most likely to buy the product.

For reference, in the US, 20 million PNDs (portable navigation devices) were sold last year, and in Europe over 30 million PNDs were sold last year.

How do you see the growth of LBS in India?

We are very bullish about LBS in India, and have been doing our best to drive this market with the availability of highly comprehensive and accurate maps for India.

We have also created a complete set of web-based APIs that can power any LBS application, be it for the internet or for the mobile phone.

We are developing an ecosystem of players in the LBS and navigation space – software and solution providers, mobile operators, handset manufacturers, automobile companies and PND manufacturers – to offer consumers high quality and pan India LBS applications using MapmyIndia maps – on the internet, on the mobile phone, and in-car.

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WHEN electromagnetic waves pass through the ionosphere, the dispersion of waves takes place, and we must consider two kinds of the propagation velocities, that is, the phase and group velocities. The phase of the carrier of the signal wave transmitted from the satellite propagates with the phase velocity. However, the code modulated by the carrier travels with a velocity called the group velocity. Since the phase velocity becomes faster in the ionosphere than in vacuum, the phase range measured by using the phase of the carrier is estimated to be shorter. On the other hand, the pseudo range measured by using the code signal is estimated to be longer, since the group velocity becomes slower. When we start a study on GNSS, we encounter this phenomenon and here is an easy explanation beginning from an example in water waves (or gravity waves travelling on water surface).

Dispersion of waves

Let us consider a water region Ω_0 of constant depth h with a free surface S_{F0} and bottom S_B. The water region extends infinitely in the horizontal direction. We take x and y axes on the free surface, and z axis vertically upward. The time is referred to by t. The velocity potential ϕ satisfies a boundary value problem:

$$\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}+\frac{\partial^2\phi}{\partial z^2}=0 \quad in\ \Omega_0, \tag{1a}$$

$$\frac{1}{g}\frac{\partial^2\phi}{\partial t^2}+\frac{\partial\phi}{\partial z}=0 \quad on\ S_{F0}, \tag{1b}$$

$$\frac{\partial\phi}{\partial z}=0 \quad on\ S_B, \tag{1c}$$

where g is gravitational acceleration.

This boundary value problem has a solution expressing a progressive wave:

$$\phi(x,y,z,t)=\frac{ig}{\omega}A\exp\{i[-k(x\cos\theta+y\sin\theta)+\omega t]\}\frac{\cosh k(z+h)}{\cosh kh}, \tag{2}$$

where A is the amplitude of the wave, and the wave number k and the circular frequency ω satisfies a dispersive equation:

$$k\tanh kh=\omega^2/g, \tag{3}$$

The progressive wave travels to θ direction with the phase velocity ω/k. The surface elevation ζ is given as

$$\zeta(x,y,t)=-\frac{1}{g}\phi_t(x,y,0,t)$$
$$=A\exp\{i[-k(x\cos\theta+y\sin\theta)+\omega t]\} \tag{4}$$

The phase velocity is defined as a velocity at which the equiphase line:

$$-k(x\cos\theta+y\sin\theta)+\omega t=const \tag{5}$$

travels. In case of θ = 0, π/2, it may be easily understood. The wave travels keeping its form.

If we write the wavelength and phase velocity as λ and c, we have

$$\lambda=\frac{2\pi}{k}, \tag{6a}$$

$$c=\frac{\omega}{k}=\sqrt{\frac{g}{k}\tanh kh}\le\sqrt{gh}, \tag{6b}$$

According to equation (3), k decreases and λ and c increases, when ω decreases. Hence, a water wave consisting of multiple frequency components disperses in a way that the component waves with longer wave length go ahead of those with shorter wave length. The dispersion is determined by equation (3). So, this equation is called dispersive equation.

In case of a deep water wave ($h/\lambda >>1$), we have

$$k = \omega^2 / g, \quad (7a)$$

$$c = \frac{\omega}{k} = \sqrt{\frac{g}{k}}, \quad (7b)$$

And in case of a very shallow water wave (or tidal wave; $h/\lambda \approx 0$),the following equations are obtained:

$$k = \omega / \sqrt{gh}, \quad (8a)$$

$$c = \frac{\omega}{k} = \sqrt{gh}, \quad (8b)$$

With respect to a tidal wave, the phase velocity does not depend on the wave length and the wave does not disperse. So, in case of a very long wave such as generated by a tsunami, for example, the wave due to Chili Tsunami in 1960 traveled to the Japanese coast from the wave source off the shores Chile over Pacific Ocean without changing its shape. In this case, the wave trough arrived at the Japanese coast first. It is said that the wave crest is replaced by the wave trough because of the dispersion effect due to Colioli force, when the tsunami wave passed the neighborhoods of Hawaii. The velocity of the tsunami is calculated by $\sqrt{gh}$. So, if we assume the average depth of the ocean as 4000*m*, the velocity is 200*m/s* or 700*m/h*.

In case of a tidal wave, the wave travels without changing its form, since the phase velocity c that transmits the phase of the wave is equal to the group velocity c_g that transmit the energy of the wave. However, the phase and group velocities are different in case of a dispersive wave. When you observe a swell surging against a beach, the peak disappears at the wave front. You may observe this phenomenon more clearly in a wave tank. If you run the wave generator for a short period of time, you can make a wave packet. If you watch a wave peak, the peak moves faster than the wave packet and disappears at the front of the wave packet. At the front, waves disappear one after another. If you observe the tail of the wave packet, waves emerge one after another. However, the wave packet advances with a constant speed or a group velocity. The velocity of the packet or the group velocity is slower than the velocity of the peak or the phase velocity in case of gravitational water waves.

The wave energy transmits into the direction of the wave propagation. A part of the wave energy becomes the kinematic energy and the rest is potential energy. In case of a deep water wave, both energies per wave length are equal. Hence, the group velocity should be half of the phase velocity for the balance of the energy.

Let's consider this phenomenon mathematically. We consider a wave composed of two component waves. One is a wave with the circular frequency ω and the wave number k, and the other is a wave with the circular frequency ω' and the wave number k'. The amplitudes of both waves are assumed equal, that is, A. So, the surface elevation ζ of the synthesized wave is given as

$$\zeta(x,y,t) = A\cos(kx - \omega t) + A\cos(k'x - \omega' t). \quad (9)$$

If the difference between (ω, k) and (ω', k') are small, the above equation can be approximated as

$$\zeta(x, y, t) = 2A\cos\left(\frac{k+k'}{2}x - \frac{\omega+\omega'}{2}t\right)\cos\left(\frac{k-k'}{2}x - \frac{\omega-\omega'}{2}t\right)$$
$$\approx 2A\cos(kx - \omega t)\cos\left(\frac{k-k'}{2}x - \frac{\omega-\omega'}{2}t\right) \quad (10)$$

Hence, a low speed wave with the velocity $(\omega - \omega')/(k - k')$ is modulated by a high speed wave with the velocity ω/k. Namely, the peaks and troughs of the wave advances fast, and the whole wave advances slow. The faster velocity ω/k is the phase velocity c, and the slower velocity is the group velocity c_g. We now have

$$c_g = \frac{\omega - \omega'}{k - k'} = \frac{d\omega}{dk} \quad (11)$$

Substituting the dispersive equation (3), we obtain

$$c_g = \frac{d\sqrt{kg\tanh kh}}{dk} = \frac{1}{2\sqrt{kg\tanh kh}}\left(g\tanh kh + \frac{kgh}{\cosh^2 kh}\right) \quad (12)$$

In case of a deep water wave, we have from equations (11) and (7b)

$$c_g = \frac{1}{2}\sqrt{\frac{g}{k}} = \frac{1}{2}c \quad (13)$$

For a tidal wave, the group velocity is

given from equations (11) and (8b) as

$$c_g = \frac{1}{2\sqrt{kg\,.\,kh}}\left(gkh + \frac{kgh}{1}\right) = \sqrt{gh} = c \quad (14)$$

The velocity potential and the surface elevation of a deep water wave advancing into x -axis (or θ = 0) direction can be written as

$$\phi(x, y, z, t) = \mathrm{Re}\left[\frac{ig}{\omega} A \exp\{i[-kx + \omega t] + kz\}\right] \quad (15a)$$

$$\zeta(x, y, t) = -\frac{1}{g}\phi_t(x, y, 0, t) = \mathrm{Re}[A \exp\{i[-kx + \omega t]\}] \quad (15b)$$

Substituting the above expressions into the kinetic energy T and the potential energy U per unit width and wave length:

$$T = \frac{\rho}{2}\int_0^{\lambda}\int_{-\infty}^{0}\left[\left(\frac{\partial\phi}{\partial x}\right)^2 + \left(\frac{\partial\phi}{\partial z}\right)^2\right]dxdz\,, \quad (16a)$$

$$U = \frac{\rho g}{2}\int_0^{\lambda}\zeta^2\,dx, \quad (16b)$$

we have

$$T = \frac{\rho}{2}\int_0^{\lambda}\int_{-\infty}^{0}\frac{k^2g^2}{\omega^2}A^2\exp(2kz)\,dxdz = \frac{\rho g}{4}A^2\lambda, \quad (17a)$$

$$U = \frac{\rho g}{2}\int_0^{\lambda}A^2\cos(kx - \omega t)\,dx = \frac{\rho g}{4}A^2\lambda \quad (17b)$$

Hence, we know that the kinematic energy is equal to potential energy in case of a deep water wave.

Dispersion of electric magnetic waves in ionosphere

Let (x,y,z), t, $\mathbf{E}=(E_x,E_y,E_z)$ and $\mathbf{H}=(H_x,H_y,H_z)$ be the coordinates, time, electric field and magnetic field. Maxwell equation for the electro-magnetic field is given as

$$rot\,\mathbf{E} = -\mu\frac{\partial\mathbf{H}}{\partial t} \quad (18)$$

$$rot\,\mathbf{H} = \mathbf{J} + \varepsilon\frac{\partial\mathbf{E}}{\partial t} \quad (19)$$

where μ, ε and **J** are the magnetic permeability, dielectric constant and current density.

When the current density is equal to zero, we obtain the vector wave equation by operating *rot* and $\partial/\partial t$ and on both side of equations (18) and (19) respectively and by eliminating **H**:

$$\nabla^2\mathbf{E} - \frac{1}{c^2}\frac{\partial^2\mathbf{E}}{\partial t^2} = 0 \quad (20)$$

$$c = \frac{1}{\sqrt{\varepsilon\mu}} \quad (21)$$

where a formula:

$$rot\,rot = grad\,div - \nabla^2 \quad (22)$$

is used. We also assumed the charge is distributed homogeneously and used

$$grad\,div\mathbf{E} = 0 \quad (23)$$

As one of the solutions of equation (20), we have a plane wave:

$$E_y = Ee^{i(-kx+\omega t)}, \quad E_x = E_z = 0 \quad (24)$$

$$k = \frac{\omega}{c} \quad (25)$$

where c, ω and k are the phase velocity, circular frequency and wave number. Now, **H** is obtained from equations (18) and (19) as

$$H_z = He^{i(-kx+\omega t)}, \quad H_x = H_y = 0 \quad (26)$$

$$H = E\sqrt{\frac{\varepsilon}{\mu}} \quad (27)$$

We now consider a situation when the plane wave given by equations (24) and (26) passes through an ionospheric layer with the electron density N. The equation of motion due to the electric field $Ee^{i\omega t}$ is given as

$$m\frac{dv}{dt} = eEe^{i\omega t} \quad (28)$$

where m, e and v are the mass, charge and velocity of an electron. So, we have

$$v = \frac{e}{i\omega m}Ee^{i\omega t} \quad (29)$$

From this, the current J_c due to the motion of the electron:

$$J_c = Nve = \frac{Ne^2}{i\omega m}Ee^{i\omega t} \quad (30)$$

is generated. Hence, the displacement current J_i is given as

$$J_i = J_d = J_c = i\omega\varepsilon Ee^{i\omega t} + \frac{Ne^2}{i\omega m}Ee^{i\omega t} = i\omega\varepsilon\left(1 - \frac{Ne^2}{\omega^2\varepsilon m}\right)Ee^{i\omega t} \quad (31)$$

where J_d is the displacement current in vacuum. So, an equivalent dielectric constant ε_p can be defined as

$$\varepsilon_p = \varepsilon\left(1 - \frac{Ne^2}{\omega^2\varepsilon m}\right) \quad (32)$$

Hence, the refractive index n_p can be defined as:

$$n_p = \frac{c}{c_p} = \sqrt{\frac{\varepsilon_p}{\varepsilon}} = \sqrt{1 - \frac{Ne^2}{\omega^2\varepsilon m}} \quad (33)$$

We rewrite equation (33). Let f be the frequency, that is, $f = \omega/(2\pi)$. Now, we have

$$\frac{Ne^2}{\omega^2\varepsilon m} = \frac{Ne^2}{4\pi^2\varepsilon m}\frac{1}{f^2} \quad (34)$$

If we define the plasma frequency f_p as (→ Appendix A)

$$f_p = \frac{e}{2\pi\sqrt{\varepsilon m}}\sqrt{N} = 8.979\sqrt{N} \quad (35)$$

n_p can be approximated as

$$n_p = \sqrt{1 - \left(\frac{f_p}{f}\right)^2} \approx 1 - \frac{1}{2}\left(\frac{f_p}{f}\right)^2, \quad when \;\; f_p/f << 1 \quad (36)$$

The phase velocity c_p of the electro magnetic wave in the ionospheric layer is obtained as

$$c_p = \frac{c}{n_p} = \frac{c}{1 - \frac{1}{2}\left(\frac{f_p}{f}\right)^2} \approx c\left[1 + \frac{1}{2}\left(\frac{f_p}{f}\right)^2\right] \quad (37)$$

where c is the phase velocity in vacuum. The wave number k_p is now given as

$$k_p = \frac{\omega}{c_p} = \frac{2\pi f}{c}\left[1 - \frac{1}{2}\left(\frac{f_p}{f}\right)^2\right] \quad (38)$$

Hence, the group velocity c_{gp} is derived from equation (11) as

$$c_{gp} = \frac{d\omega}{dk} = \frac{2\pi}{\frac{dk}{df}} = \frac{c}{1 + \frac{1}{2}\left(\frac{f_p}{f}\right)^2} \approx c\left[1 - \frac{1}{2}\left(\frac{f_p}{f}\right)^2\right], \quad (39)$$

From equations (37) and (39), we know that the phase velocity c_p in the ionosperic layer is faster by $0.5cf_p^2/f^2$ than the phase velocity c in vacuum. On the other hand, the group velocity c_{gp} is slower by $0.5cf_p^2/f^2$ than the phase velocity c_p in vacuum.

Appendix A. Physical constants

Mass of an electron:
$m = 9.1093897\text{x}10^{-31} kg$
Charge of an electron:
$e = 1.60217733\text{x}10^{-19} C$
Dielectric constant in vacuum:
$\varepsilon = 8.854187817 \text{ x } 10^{-12}\ F/m$

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New Glonass satellite comes online

One of the three Glonass satellites launched into orbit last month was put into operation, bringing the current number of usable satellites in the constellation to 10, according to the Russian Space Agency. Another two satellites will be put into service very soon. *sidt.gpsworld.com*

US plans GPS satellite navigation upgrade to rival EU

The US military is working on super-powerful updates to its GPS satellite navigation technology to try to trump the rival European Galileo project which just received key funding. In July it made a 1.8 billion-dollar call for offers for companies to make the first installment of eight satellites in the GPS III range. According to Lockheed Martin, one of the firms manufacturing the GPS devices, the Air Force was expected to award this contract early in 2008. *afp.google.com*

China targeting all 'enemy space vehicles' including GPS satellites

China's anti-satellite and space warfare program includes plans to destroy or incapacitate 'every enemy space vehicle' that passes over China. The annual report of the U.S.-China Economic and Security Review Commission, listed among Beijing's goals that of ensuring that Chinese space weapons are "conducted covertly so China can maintain a positive international image." The Chinese also plan to attack U.S. GPS satellites through various means, including anti-satellite weapons, high-energy weapons, high-energy weather monitoring rockets and ground attacks on earth-based stations. One section of the report said, there was a need for more information about Chinese activities and intentions. *www.worldtribune.com*

ICG providers forum

A report of the first meeting in Bangalore, 4 September 2007

THE International Committee on Global Navigation Satellite Systems (ICG) met in Bangalore, India, from 4 to 7 September, 2007, to review and discuss Global Navigation Satellite Systems (GNSS) and their promising applications. The ICG addressed the use of the applications to promote the enhancement of universal access to, and compatibility and interoperability of global and regional navigation satellite systems and the integration of these services into national infrastructures, particularly in developing countries. The meeting was hosted by the Indian Space Research Organization (ISRO). Attendees included China, the European Union, India, Japan, the Russian Federation, the United States, Italy, and the following international organizations: BIPM, EUPOS, EUREF, FIG, IAG, IAIN, IGS, UN OOSA, and URSI. Malaysia, and the United Arab Emirates also attended and were recognized by the ICG as new members.

The International Committee recalled that, in 2006, in its resolution 61/111, the United Nations General Assembly noted with appreciation that the International Committee on Global Navigation Satellite Systems had been established on a voluntary basis as an informal body to promote cooperation, as appropriate, on matters of mutual interest related to civil satellite-based positioning, navigation, timing and value-added services, as well as the compatibility and interoperability of global navigation satellite systems, while increasing their use to support sustainable development, particularly in developing countries. It was agreed that the Committee made substantive progress in furthering its work plan approved at the first meeting of the ICG organized by the Office of Outer Space Affairs in Vienna in 2006.

A major development at this meeting was the establishment of a Providers Forum to enhance compatibility and interoperability among current and future system providers, as a mechanism to continue discussions on important issues addressed by the ICG that require focused inputs from system providers. Members of the Providers Forum that convened on the first day included China, the European Union, India, Japan, the Russian Federation and the United States. The Providers Forum addressed key technical issues and operational concepts such as compatibility and interoperability, the protection of GNSS spectrum, orbital debris/orbit de-confliction, and other matters related to the work of the ICG. The report of the Providers Forum is attached.

The second day of the meeting was devoted to expert presentations made by India, GNSS service providers, State Members, intergovernmental organizations, and non-governmental organizations dealing with GNSS applications. On the third day, the International Committee addressed its work plan through the working groups focused on: A. compatibility and interoperability; B. enhancement of performance of GNSS services; C. information dissemination and coordination; and D. interaction with national and regional authorities and relevant international organizations. Suitable recommendations and plans to address the current and future work under each group were presented to the ICG.

The International Committee accepted the invitation of the United States to host the third meeting, to be held in 2008. The Committee also noted the offer of the Russian Federation to host the succeeding meeting in 2009. Acting as the Secretariat for the ICG and the Providers Forum, the United Nations Office for Outer Space Affairs will assist in the preparations for these meetings and interim planning and working group activities.

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INDIA has long coastline of 7517 kms with 12 major ports and 187 minor & intermediary ports. Major ports all together handled 423 million tones traffic & non–major ports all together handled 519 million tones traffic during the year 2006-07. Traffic at Indian ports has been growing at the rate of over 11% during last 5 years and with continuing rapid growth in trade, port traffic is expected to grow further. Lack of port infrastructure has been one of the major problems (i.e. low draught & inadequate back up services) in our maritime development. Shippers prefer shipments by large size & deeper draughts vessels, which is more economical in cost of operation. So, to accommodate such bigger vessels, the required depths should be available. Accordingly there is huge demand for dredging & quality hydrographic services at the Indian Ports as the channels to be widened & deepened to accommodate bigger vessels. Almost all the major ports in India have plans to widening & deepening their approach channels in order to accommodate bigger ships. Further, the maintenance-dredging requirement of ports is substantial considering the siltation problem at the ports.

Summary of Minimum Standards

Order	Special	1
Typical Areas	Harbours, berthing areas, and associated critical channels with minimum under keel clearances	Harbours, Harbour approach channels, recommended tracks and some coastal areas with depths up to 100 m
Horizontal accuracy (95% confidence level)	2 m	5m + 5% of depth
Depth accuracy for reduced depths (95% confidence level) (1)	a=0.25 m b=0.075	a=0.5 m b=0.013
100% Bottom Search	Compulsory (2)	Required in selected areas (2)
System Detection Capability	Cubic features > 1 m	Cubic features > 2 m in depths up to 40 m; 10% of depth beyond 40 m (3)
Maximum line spacing (4)	Not applicable as 100% search compulsory	3× average depth or 25 m, whichever is greater.

International regulation for hydrographic services

A completely new situation has risen after the total revision of chapter V of the annex to SOLAS that maintains that hydrographic services are binding to Governments under international law.

- For the first time, international law makes it mandatory to operate hydrographic services. This obligation applies to all states that are parties to SOLAS.

International standards for port surveys

IHO published the 4th edition of special publication No.44 in April 1998 of IHO standards for hydrographic surveys. The principal aim of this publication is to specify **minimum** standards for hydrographic surveys in order that hydrographic data collected according to these standards is sufficiently accurate and that the certainty of data has to be adequately quantified to be safely used by mariners.

The new edition of IHO standards for hydrographic surveys describes a very important change. The accuracy of a survey is no longer dependent on the scale of the analogue chart. The accuracy as well as resolution of a survey depends on the type of the area to be surveyed. The preface of IHO standards recognises that hydrographic data is also

important for coastal zone management, environment monitoring, resource development, legal and jurisdictional issues and coastal engineering works etc.

1) To calculate the error limits for depth accuracy the corresponding values of 'a' and 'b' listed in above table to be introduced into the formula $\pm\sqrt{[a2+(b*d)2]}$
   With
   'a' = constant depth error, i.e. the sum of all constant depth error
   'b*d ' = depth dependent error, i.e. the sum of all depth dependent errors
   ' b' = factor of depth dependent error
   ' d' = depth
2) For safety of navigation purposes, the use of an accurately specified mechanical sweep to guarantee a minimum safe clearance depth throughout an area may be considered sufficient for above order surveys.
3) The value of 40 m has been chosen considering the maximum expected draught of vessels.
4) The line spacing can be expanded if procedures for ensuring an adequate sounding density are used.

For ports & harbours, and especially for those where the underkeel clearance is small, 100 % coverage of the seafloor is required during the sounding process in order to make sure that all potential hazards are mapped. It is not possible by single beam echosounder alone. So alternative technologies available are as follows:

- Mechanical sweeping is best but time consuming and therefore expensive.
- Towing side scan sonar is often impractical in confined areas such as ports.
- Compact high frequency multibeam echosounders, probably most viable alternative for the future, which can comply with the requirement of SP-44.

Minimum underkeel clearance implications on hydrography in port

Most ports have restriction on the depth available for navigation. This depth is referred to as 'declared depth' and is determined from hydrographic information from recent hydrographic survey. Ports which operate with minimum underkeel clearance for shipping use this declared depth in determining the loaded draught of vessels using the port.

Minimum underkeel clearance can be determined from the following factors.

- The vessel squat and settlement (related to speed)
- The vessel manoeuvring characteristics
- Increase in draught of vessel due to vessels roll, pitch & heave movement
- Accuracy in the predicted or measured tide
- Accuracy of declared depth
- Allowance for possible siltation since last survey.
- Information about wave heights, direction & tidal stream

The hydrographic surveyor contributes to the measurement of factors of tidal height, accuracy of declared depth and frequency of hydrographic surveys and he may contribute to the measurement of vessels squat and roll, pitch & heave movement.

With increase in competition to attract

business towards the ports and reduce the operating costs, the stakeholders are questioning the allowance factors in the determination of underkeel clearance. Some ports have developed a dynamic underkeel clearance that measures wave heights, wave direction and actual accurate tide heights to determine the maximum draught in which the vessel can load.

The technologies that available to hydrographic surveyor now have greatly increased the surveyor's ability to provide highly accurate depth & position. These includes motion sensors, multibeam echo sounders, radio tide gauges, RTK GPS, Survey software for on-line data logging, computing, huge data managing power & processing the result in required format. Because of this available technology, the surveys could be made repeatable. With this degree of repeatability it is then possible to place a high degree of accuracy of depth on the published chart.

If surveys are carried out at a suitable frequency to determine the underkeel clearance for the port, it would then be possible to eliminate allowance for siltation from underkeel clearance.

Port dredging survey

The National Maritime Development envisages the capital dredging of major ports and navy to the tune of Rs.6,304 crores in addition to maintenance-dredging requirement.

To select suitable dredgers, equipment, methodology for dredging, quantity to be dredged and cost estimation, it is very much essential to carry out pre-dredging hydrographic, geo-technical & seismic survey in order to know the precise seabed profiles as well as sub-surface strata which is supposed to be dredged out.

In order for optimum deployment of costly dredgers, it is very essential to provide on-line progress of dredging works to dredgers by means of providing them dredging monitoring sounding charts.

Port authorities should adopt existing internationally accepted standards for surveying as set out above referred publication SP-44 and produce charts, which confirms IHO chart specifications for pre & post dredging survey so that cost of dredging can be worked out precisely as well as make it possible to declare a dredged route/ channel 'cleared' to required depth.

The hydrographic survey and other associated tasks shall be carried out by or be directly supervised by suitably qualified and experienced hydrographic surveyors. The resulting information shall be certified by this surveyor and shall state the order to which the information can be assigned.

Port management using ECDIS technology

ECDIS, or Electronic Chart Display and Information system, has been developed for navigational purposes but is in reality a full-fledged Marine Information System (MIS). Its data structure makes it useful for GIS, Port or Coastal Management.

The web-based port management package developed by Port Of San Diego offers new possibilities through real-time navigational & environmental data inputs and access to the land-based databases for ECDIS presentation through Internet. The data is presented on top of ENC in the form of thematic overlays using ECDIS technology. The real time information from environmental sensors includes weather, tidal stream and tidal heights above CD. Tidal height data is used to provide the dynamic underkeel clearance information in the ship manoeuvring area. The data is supported by web-camera images with zooming and panning capability. Updated ship movement information included together with static data show the relevant regulatory information, emergency response information, list of facilities, fees, and marine events etc.

Conclusion

To make all Indian ports more competitive & safe, it is very much essential that Port authorities should adopt the existing internationally accepted standards for surveying as set out in the above-referred publication SP-44 and produce charts that confirm IHO chart specifications

In order to comply with the IHO **minimum** standards for hydrographic surveys in Ports/Harbours/Harbour approach channels in India, the National Hydrographic Office, which is the national authority for hydrographic surveying, and the Ministry Of Shipping should address the following issues:

- Regulation for strict compliance of SP-44 & SP-57
- National Hydrographic Office should arrange courses on QA/ QC & international standards for Hydrographic surveys in Ports/Harbours for Port Hydrographic Surveyor.
- Set up a central certification agency for this work. That may be the National Hydrographic Office or other dedicated survey organisations, such as Minor Ports Survey Organisation
- Creation of quality resources required for this work.
- Regulation for hydrographic survey and other associated tasks shall be carried out by or directly supervised by a suitably qualified and experienced hydrographic surveyor.

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2) Technical paper on Hydrography in Port- Rod rIdley, Maneger HS, Queensland Dept. Of Transport presented in Australian Surveyors Congress.
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4) Theme paper on Indian Maritime Transport Services-Global opportunities and challenges –presented on 44th National Maritime day celebration-2007
5) Extending the ECDIS Technology towards port & coastal zone management-Hydro 2000
6) Technology for efficient mapping of ports and port entrances-Hydro1999.

FOR SUCCESS IN PLANNING USE RELIABLE CENSUS 2001 INFORMATION

Books

- Slum Population (First time in Census on actual count)
- Primary Census Abstracts – 2001 Census (State volumes)
- Tables on Houses, Household Amenities and Assets (State volumes)
- Analytical Report on Housing Amenities

Atlas (Book)

- Administrative Atlas (State volumes showing district, tahsil and village boundary maps)
- India Administrative Atlas, 1872–2001 India (A Historical Perspective)
- Housing Atlas–India 2001
- Language Atlas – 1991 – India

GIS Products

- Census Info India ver 2.0 (with data and maps)
- Administrative Boundary Map (on paper) showing India, State, District, Sub–district, Town
- Sub–district map showing village boundary

Available In Print, CD-Roms at Census Office, New Delhi & all state capitals

CENSUS 2001

Data CDs

- Tables by Industrial Classification of main and marginal workers
- Tables by Occupational Classification of main workers
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Other Recent Releases on Census Data (CD)

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  - Household
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Reaching out for informed decision making…

3D noise models

A methodology to improve noise modelling and 3D visualisation of noise in urban areas

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NOISE pollution in large urban areas is considered as a serious environmental problem. Studies have shown that more than 20% of the world population lives under unacceptable noise levels. The problem is mainly caused by road traffic.

To assess the impact of noise, noise levels need to be predicted by noise computer models and represented on noise maps. GIS functionalities are commonly used to map and assess the impact of noise. An example of a noise map is shown in Figure 1 (Kluijver and Stoter, 2003). This figure shows noise levels along a road and railway. Current noise maps are in 2D representing noise levels, mostly as noise contours, on one selected height (for example at a height of four meters) from the surface.

A disadvantage of this method is the lack of insight in the three dimensional character of noise. In many situations noise levels at four meters do not represent the level at higher floors of a building correctly. The difference is especially large when the building is located close to the noise source or when a noise barrier is present. People living on lower floors of an apartment building benefit more from a noise barrier than people living on higher floors. 2D noise maps are insufficient to represent these situations. Consequently, 3D representations of the noise levels are needed. Several examples of 3D noise maps are known. Paris and Honk Kong already produced 3D noise maps (see Butler, 2004; respectively Wing and Kwong, 2006).

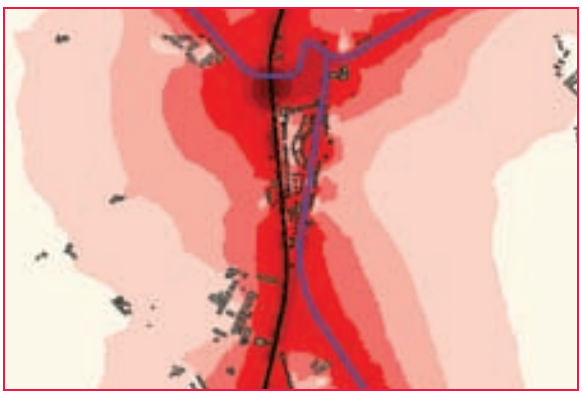

Figure 1: 2D noise map (Kluijver and Stoter, 2003)

The research presented in this paper is focused on a methodology to improve noise modelling and 3D visualisation of noise in urban area by applying 3D GIS. In our research (executed within the MSc programme 'Geo-information Science and Earth Observation for Environmental Modelling and Management', see http://www.gem-msc.org/), 3D GIS functionalities were incorporated in the noise prediction phase as well as in the phase of generating noise representations in 3D and using these representations in the noise assessment phase. For the 3D approach we studied both 2D interpolation methods to produce 2.5D representations - representing noise levels at a surface following the height of the terrain including buildings - and 3D interpolation methods to produce a full 3D voxel model of noise levels. It also reports on the methodology to generate the 2.5D and 3D representations using 3D city models. The results of the 2.5D and 3D noise representations are also presented. The 2.5D noise representation is applied to a real world noise application in order to show the improvements of a 2.5D approach compared to 2D noise maps.

3D GIS supporting 3D noise prediction

The area chosen for this research is located in the centre of the city of Delft, the Netherlands. Delft is a city of around 95,000 people in the densely populated South Holland province of the Netherlands. The population density in Delft is about 1,179 in-habitants per square kilometres. The study area is a small part of the city centre of approximately 30,000 m^2 and contains about 185 residential buildings with an average height of 15 meters.

A 3D city model covering the study area containing details of the buildings was provided by Vosselman et al., 2005. The city model, shown in Figure 2, is constructed based on an interactive segmentation of the parcel boundaries

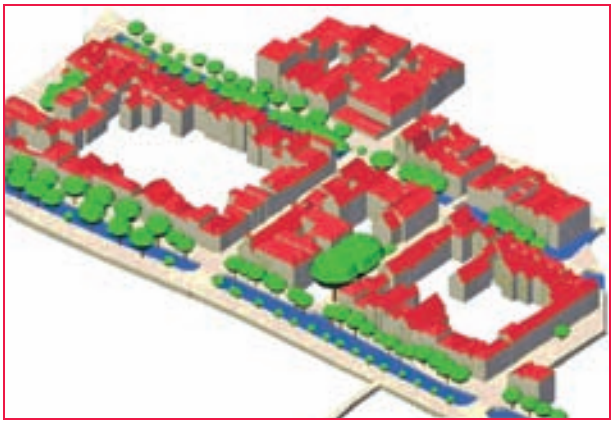

Figure 2: 3D city model of study area (Vosselman et al., 2005)

using several tools for splitting the polygons along height jumps edges. The roads, canals and trees were also reconstructed from the combination of parcel boundaries and laser altimeter data.

The 3D city model was used to build a 3D noise computer simulation model. Computer simulation models are used in most cases to determine noise levels. Computer simulations are preferred to noise measurements. There are several reasons for this. First of all, field measurements are time consuming since the noise levels concern the yearly averaged values and can only be done under the right weather conditions. In practise, it is impossible to execute an adequate number of measurements in order to produce reasonable noise maps. Furthermore, it is impossible to determine future noise levels by measurements except with noise simulation models to deal with future situations. In addition, models can predict noise levels within an acceptable level of uncertainty for most situations. Therefore noise calculation software, implementing standardised and approved calculation methods, is widely accepted to provide reliable information on noise levels. These noise computer models calculate noise levels at 'virtual microphones' each of which is a point that re-ports what the noise level would be at a certain location under given circumstances. Heights of buildings, of roads and of other topography are taken into account in calculating the noise level at a certain x,y,z location.

We selected Standard Calculation Method 1 (a standardised Dutch method) to predict noise levels in our research since it takes into account the obstruction of noise by objects (such as buildings) but it is still relatively simple to use and can be easily integrated with GIS software. At the same time, it meets the requirements for our research (to see how 3D GIS can improve 3D noise applications). In the computer model, noise levels are computed on 3D data points based on:

a) information on the noise source (roads in our case): traffic intensity, maximum speed, road surface type, average emission of different vehicle types;
b) information on aspects that influence noise propagation such as noise obstruction by objects (like buildings or noise barriers) and noise absorption (like open areas with grass or bare soil);
c) distance and direction of the data points with respect to the location of the noise source.

A 2.5D noise representation was build by the following steps:

1) Positioning of observation points in the noise simulation software. The points were located in 3D on a surface following the terrain and buildings located on the terrain (see Figure 3 (a). Figure 3 (b) shows how points were positioned leaning slightly towards the buildings. This to avoid points that have same x,y,z coordinates which is not possible for 2D interpolation method (see step 3).
2) Calculating the noise level on the observation points (Figure 4);
3) Determining 2D noise contours with a 2D interpolation method using the levels on the 3D observation points (Figure 5). The z coordinate of these points was not taken into account during this 2D interpolation but is reintroduced in the next step;
4) Introducing the third dimension by draping the 2D noise contours on the city model. The 3D analyst tools of ArcScene were used to generate these 2.5D representations.

The 3D noise representation was built by the following steps:

1) Positioning of observation points in a 3D raster. In this raster of points, points may have same x,y but different z coordinates. The points are distributed evenly with equal intervals in both horizontal and vertical directions (2

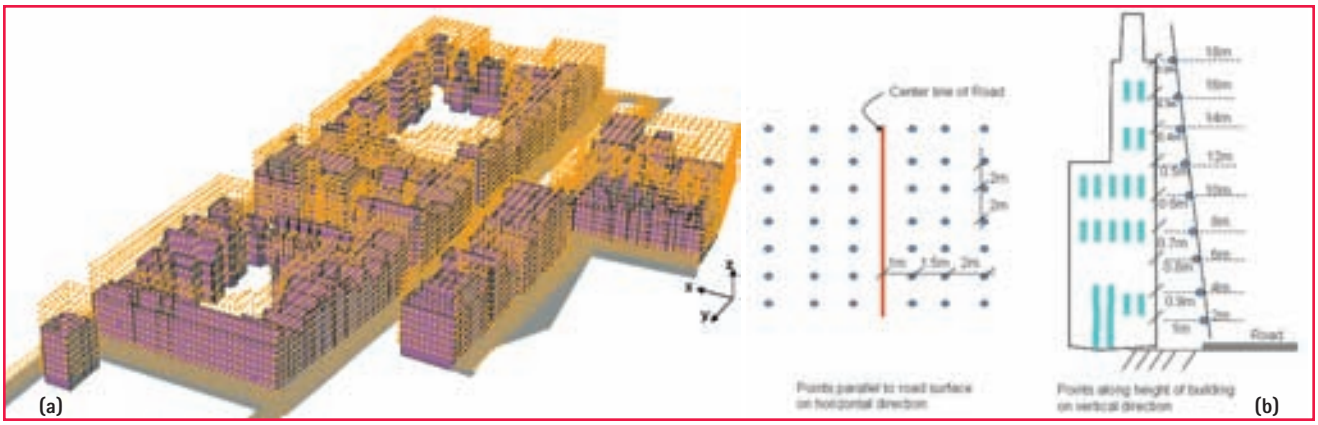

Figure 3: (a) 3D location of observation points for 2.5D representation in test area (b) spacing of points on horizontal and vertical direction on front side of buildings

m) in 'lines' parallel to the roads.
2) Calculating the noise level on the observation points.
3) Determining the 3D solid noise model with a 3D interpolation method. With this method an extra step to reintroduce the third dimension is not necessary.

For both methods, the positioning of the points was based on the following considerations:

- Noise contours are expected to be parallel to the roads and points located in a pattern parallel to the road can reflect this behaviour most optimally.
- Care was taken not to place points inside buildings, because buildings act as blocking objects in the model and these points would produce low levels which are not representative for the levels on the façades of the buildings.

Results of a 3D approach for the representation of noise levels

The result of 2.5D representation of noise levels is shown in Figure 6. Although current noise simulation models predict noise levels in 3D, the output of the models, being a point data set with computed noise levels, cannot be used directly for meaningful 3D visualisation or 3D analyses. In order to utilize the 3D information of noise software output, noise levels need to be visualised understandably using the third dimension of the observation points. From Figure 7 it can be seen that the 2.5D approach is able to add this extra dimension to the output of noise models. The 2.5D representation offers insight into the effect of noise at any particular height on the terrain surface and on façades of buildings: high noise levels occur on road surfaces and low noise levels occur on top and backside of buildings.

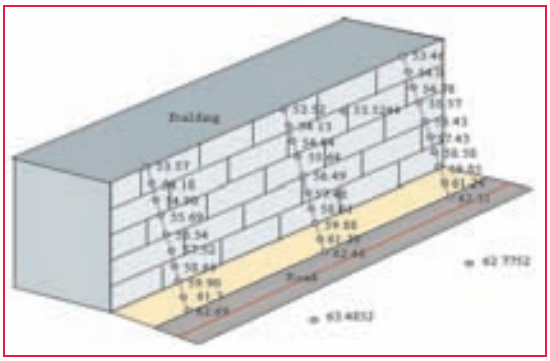

Figure 4: Observation points near buildings with computed noise levels

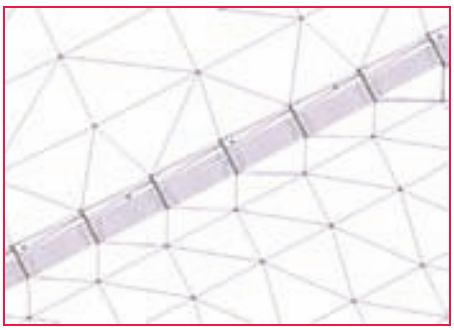

Figure 5: TIN interpolation on the points leaning towards a building (top view)

For this 2.5D representation, different interpolation methods were applied and compared to conclude on the best suitable method for generating 2.5D noise representation. In our research, TIN (Triangulated Irregular Network) was indicated as the most suitable method for the generation of 2.5D noise representations. The explanation for this is that TIN can deal very well with the irregular distribution of observation points as present in our point data set when looking from above (Figure 5). More triangles with relative small sizes are generated at locations with higher point density. The other methods considered in our research (Inversed Distance Weighted interpolation, Natural Neighbourhood Method and Kriging) are all based on a weighted-average method resulting in a grid structure with equal cell sizes for the whole area. However, more trials with different approaches for point densities should be made to be able to draw thorough conclusions.

The 3D noise representation is a solid model representing attribute values in the form of 3D grid cells, called voxels. These attribute values are the result of spatial interpolation in three dimensions based on the calculated values on the observation points. Currently very few commercial GIS software provide tools for 3D interpolation for 3D point data. Most existing tools are for hydrology, geochemical, geophysical, geotechnical or lithology studies and they are based on borehole data. Examples are GOCAD, Environmental Visualization Systems (EVS), Rockworks, and GRASS. Only the FIELDS software (Field Environmental Decision Support tools, extension of ArcView 3.5; FIELDS, 2007) was applied successfully in our research. GRASS can also be used for interpolation of 3D point data but had a limitation concerning amount of input points.

In the 3D IDW method implemented in FIELDS, the searching ellipsoid-body is used to find the known points that will contribute to the interpolated value. The true, 3D distance between points is used to determine the weights of the known points. The user has to define parameter values to define the shape and size of the ellipsoid-body. It is obvious that compared to 2D it requires more expertise to guide the 3D IDW process.

The result of the 3D interpolation is presented in Figure 7. Due to limitation of software it was not possible to display the 3D city model together with the 3D solid noise model. However, it was possible to clip the model using the polygon layer of roads. Figure 8 shows that noise levels on the main as well as on the interior roads can be analysed in 3D using the solid model. This representation clearly shows the pattern of noise levels above the road surface in all directions. It shows high noise levels at the middle of the road and gradually reducing noise levels with increasing 3D distance from the centre line of road.

From our experiments we can conclude that true 3D interpolation looks promising, since it reflects the three dimensional character of noise. Therefore the 3D model offers good possibilities for noise experts to improve insight into 3D noise propagation and the way this behaviour is implemented in current noise computer models.

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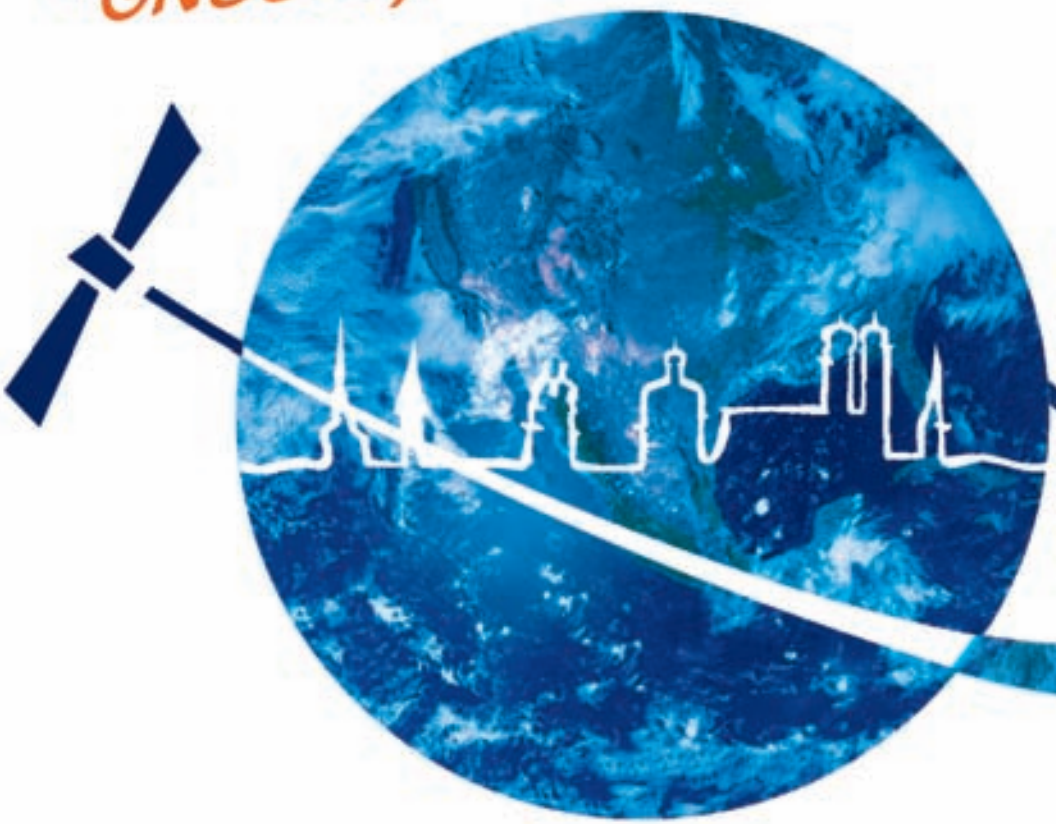

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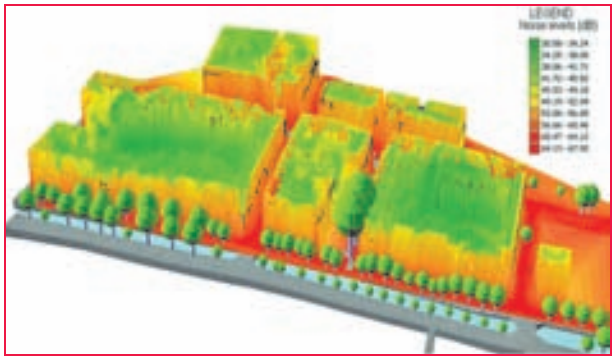

Figure 6: 2.5D noise representation obtained with TIN interpolation

However, 3D modelling of attribute values is still in developing stage. For example, the following are the limitations in the FIELDS software:

- The software does not have tools for spatial analysis. It is difficult to identify noise levels at a particular height.
- It is not possible to generate 3D contours.
- The 3D noise representation cannot be presented together with the 3D city model. Consequently, it is difficult to locate and orient oneself.
- The solid model requires specific interaction functionalities (e.g. slicing) to be able to analyse the values at all locations.

Although these findings indicate limitations specific to this software, the last three can be indicated as more general limitations that currently apply to solid models representing at-tribute values in 3D.

Application of 2.5D noise representation

In our research, the possible benefits of a 2.5D approach compared to 2D noise maps were tested by applying it to the assessment of the reduction of noise levels by noise barriers.

Figure 8 shows the effect of seven different noise barriers varying in height, width and distance from the road. The details of the different barriers are shown in the bottom left corner of the figure.

The first three barriers (a), (b), (c) are of height 3 m and located at a distance of 3 m, 6 m, and 9m, respectively, from the edge of the road. As can be seen in Figure 13, the effect of the barrier reduces when the distance of the barrier to the road increases. Furthermore, it shows that there is no effect of the barriers on higher floors.

The next three barriers (d), (e), (f) are of different heights (2 m, 3 m, and 4 m respectively) and located at an equal distance of 5 m from the edge of the road. Figure 13 shows that noise reduction due to the noise barriers increases when the height of the barrier increases. Still no effect of the noise barrier is found at the higher floors.

Barrier (g) is located where there is no building. Barrier (g) shows therefore the effect on the ground surface.

This case study shows that a noise barrier should be high enough and sufficiently close to the road to have a reducing effect for all floors. A 2D map representing the noise level for only one height (close to the surface) cannot provide this information. Noise levels on lower floors could be overestimated and on higher floors underestimated.

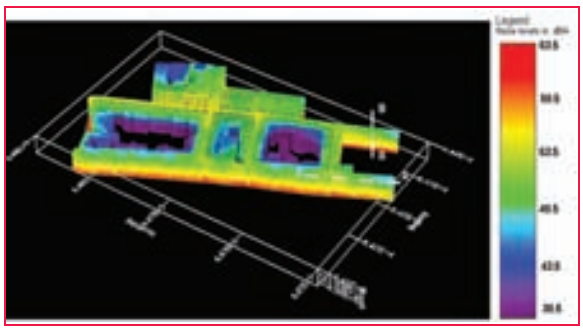

Figure 7: Volumetric view of noise levels on the road surface of study area.

Conclusions and future work

As can be concluded from this paper, 2.5D noise representations offer many improvements compared to traditional 2D noise maps. A 2.5D representation provides insight into noise behaviour with respect to height. As a result, more accurate assessment of noise impact is possible in particular when different floors of a building or noise barriers are concerned. Since 2.5D representation is easy to 'understand' they are beneficial for communication purposes in city planning processes with the broad public.

The study presented in this article showed that general available 2D interpolation methods in combination with 3D GIS can be used to produce 2.5D representations of noise levels.

An advantage of a 3D noise representation is that even more accurate information can be given on the three dimensional character of noise which is the propagation of noise in all directions. However the studied 3D software do not provide the desired performance. The software could not handle the large number of observation points that are common as output of noise simulation models and could not provide the required integrated visualisation of noise levels and contours with the 3D city model. In addition, 3D spatial analysis functionalities were lacking. Further development of functionalities is needed concerning 3D interpolation, 3D visualisation of continuous data and 3D analysis. If major progresses in these areas are achieved, 3D representations provide more thorough understanding of noise propagation and 3D noise effects.

Improvement in visualisation suggests an improvement in accuracy. Although this article shows that this is certainly the case in studying noise on different floors or behind a noise barrier, a warning is appropriate. The accuracy of noise models is dependent on the whole noise modelling process starting from available data. Accuracy is influenced at each operation such as during generation of observation points, spacing of points, noise calculation, spatial interpolation and analysis. Ambitions for further improvement of visualisation are obviously supported by the authors but not without emphasising the need for error assessment

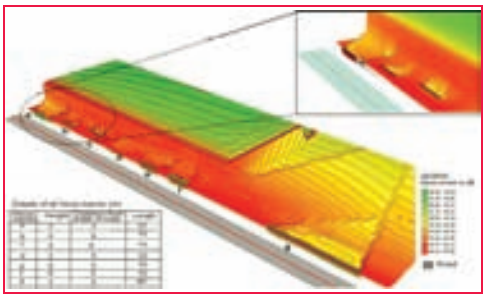

Figure 8: Effect of noise barriers.

and presentation of the uncertainties.

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Galileo update

Partial funding through EU farming subsidies

Following months of disagreements, the EU has reached a funding compromise and resolved the crisis around its Galileo satellite navigation system. Two thirds of the missing 2.4 billion euros will be provided from EU farming pots alone. This was announced by the Portuguese Chair of the European Council in Brussels on Friday night following more than 12 hours of budget negotiations for 2008 by the EU Ministers of Finance or their representatives.

Germany could not uphold its reservations against fully funding Galileo from the EU budget, reported EU diplomats. Berlin didn't want to put the EU's long-term financial plan on the line, which runs until 2013. According to German Minister of Finance Peer Steinbrück, the German government was also apprehensive of straining its national budget by an additional more than 500 million euros.

European Commissioner for Financial Programming and Budget Dalia Grybauskaite spoke of an "important decision". As she had suggested, farming subsidies would for the first time be used to improve the EU's competitive position. The current Chairman of the Council of Ministers, Portuguese State Secretary of Finance Emanuel Augustos Santos, said that farming subsidies had not been exhausted this year, and that therefore nothing would be taken away from anybody.

This compromise has also finalised the EU budget for the coming year. Payments are to increase by 4.2 percent to 120.346 billion euros. The funding compromise also includes the European Institute of Technology (EII). The EIT's intended purpose is to connect the research departments at top European universities and in industry from next year. *http://www.heise.de/english/newsticker/news/99568*

EU Commission modifies Galileo tender rules

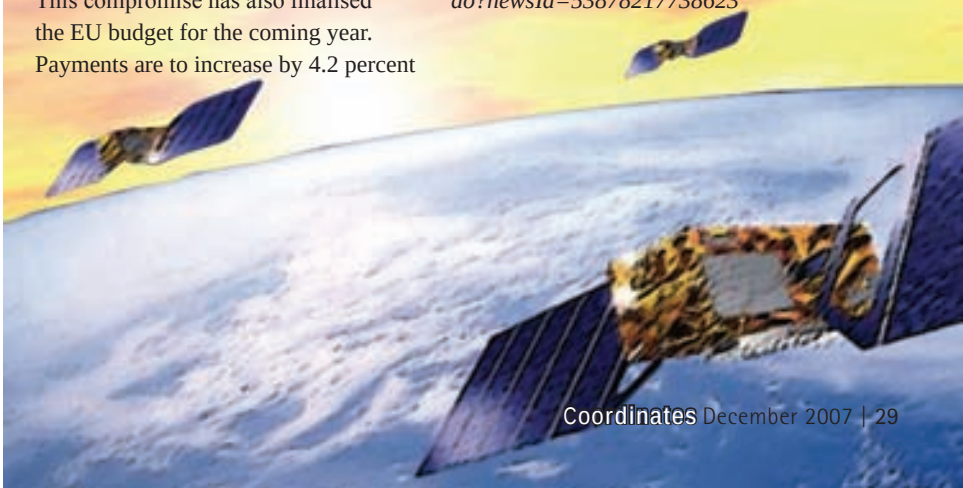
The EU Commission will make a new call for tenders for the Galileo project that will limit each bidding company to two segments of the project, Handelsblatt reported, without saying where it got the information.

The planned European satellite navigation system will be split into up to seven different segments in a move to help appease the German government's concern domestic companies may be at a disadvantage in the bidding process, the newspaper said.

The Commission also said in an internal document the newspaper obtained it will take into consideration the fact that Germany made considerable contributions to the project's test and development phase.

The EU and a consortium of companies that is to develop Galileo will still need to agree on funding of the 3.4 bln eur project.

The consortium -- which includes EADS, Alcatel-Lucent, Thales, Inmarsat and Finmeccanica SpA -- is reluctant to sign a contract requiring it to fund two-thirds of the project. *http://www.hemscott.com/news/latest-news/item.do?newsId=53878217738623*



MapmyIndia launches In-car GPS navigation

MapmyIndia - India's navigable map data provider announced the launch of MapmyIndia Navigator, a GPS-based in-car navigation device that promises to revolutionize the way we travel in India. Navigator uses satellites to determine current location. Navigator guides, turn by turn, with visual map instructions supported by voice prompts. It can either be mounted on the windshield or dashboard while driving or carried in hand while sitting in the backseat. The Navigator utilizes the maps of India, provided by CE Info Systems. The device is currently available in two hardware models, Delphi Nav 200 and AMAX 06GP5A. Both the personal navigation devices have built-in GPS (SirfStar III), 3.5" colour touch-screen, Samsung 400 MHz processor and additional multimedia features to play movies, music, photos, games etc. It is priced at Rs 21,000 in Delhi and Rs 22,000 in other states.

Yahoo ties-up with nine mobile operators in Asia

Yahoo has partnered with nine Asian mobile operators to provide internet search services, bringing its oneSearch distribution partnership to 20 operators worldwide. It also launched Chinese language version of Yahoo! Go 2.0 for Taiwan, an application for mobile internet access with a suite of widgets. The application has a selection of widgets including oneSearch, Flicks photos, weather, news e-mail and GPS integration for devices that have GPS.

NAVTEQ expands NAVTEQ transport

NAVTEQ has announced an expanded version of NAVTEQ Transport with new coverage in the Netherlands, UK, Belgium and Luxembourg, new data types and a harmonized global specification to enhance the functionality of truck routing and logistics planning applications across North America and Western Europe by plannig truck-specific routes using the NAVTEQ(R) map to improve efficiency and reduce costs. *www.lbszone.com*

1m fleet management units in Europe in 2008

According to Berg Insight report, the number of fleet management units deployed in commercial fleets in Europe will exceed 1 million in 2008. It cites customer awareness of the benefits of telematics as the main driver behind growth. *www.berginsight.com*

Google provides non-GPS LBS service

Google has released version 2.0 of Google Maps for mobile, with a beta version of Google's "My Location" technology, a new feature which uses cell tower ID information to provide users with their approximate location in the absence of GPS capability on their phones. *www.gpsbusinessnews.com*

New Nokia N-Series Phone unveiled

Nokia has launched the new Nokia N82, a phone with the 'latest multimedia computer optimised for photography, navigation and internet connectivity.' It will feature a 5 mega pixel camera, assisted GPS (A-GPS), and Internet connectivity. *www.nokia.com*

Trimble Outdoors Apps Made Available for BlackBerry

Trimble has announced three of its GPS phone applications for GSM-based, GPS-enabled BlackBerry smartphones: AllSport GPS, Geocache Navigator and Trimble Outdoors. BlackBerry models that incorporate GPS include the 8800, 8820 and Curve 8310. *www.trimble.com*

MSN talking to Indian telcos to develop LBS

Microsoft Corp., MSN, is in talks with Indian telecom operators to develop LBS for mobile users in the country. It will also launch maps on mobiles, which, combined with LBS, can help users with road navigation.

Launch of another vehicle tracking system in India

Dhanus Technologies, Chennai announced the launch of its vehcile tracking system, FleeTrac. According to reports, the firm had invested Rs 100 crore on the project and was targeting four million vehicles in the coming years. The system would use existing mobile airways and GPS to track fleets of cars and trucks, to monitor their movement. *www.hindu.com*

BSNL, India plans four new services for its mobile subscribers

State-run telephone operator BSNL shall be finalising four new LBS as part of its strategy to augment the bouquet of new offerings to its mobile subscribers. It will comprise of Fleet Management Service, Track Your Buddy, Advertisement Services and Chatting. *www.hindu.com*

Ashok Leyland, India to launch telematics fleet of CVs

Ashok Leyland would soon be equipping its trucks with telematics that would be GPS and GSM enabled, facilitating coordination of their fleet. On a test basis, it is currently making available its equipment known as 'Alert', to customers. *www.thehindubusinessline.com*

Hertz gearing up to navigate India

The rise in popularity of self-drive in the country has made the world's leading car rentals company, Hertz to bring global GPS to their Indian fleet. According to officials, Hertz is looking at giving the self-drive business a boost, by providing navigation systems in cars for the travellers by the end of this year. *www.expresstravelworld.com*

SatNav develops GPS for mobiles

SatNav Technologies Ltd, India has brought changes in its software design to enable even smaller mobile handsets to handle GPS. It has now made a compressed version to suit smaller screens and even match mobile phone needs. *www.thehindubusinessline.com*

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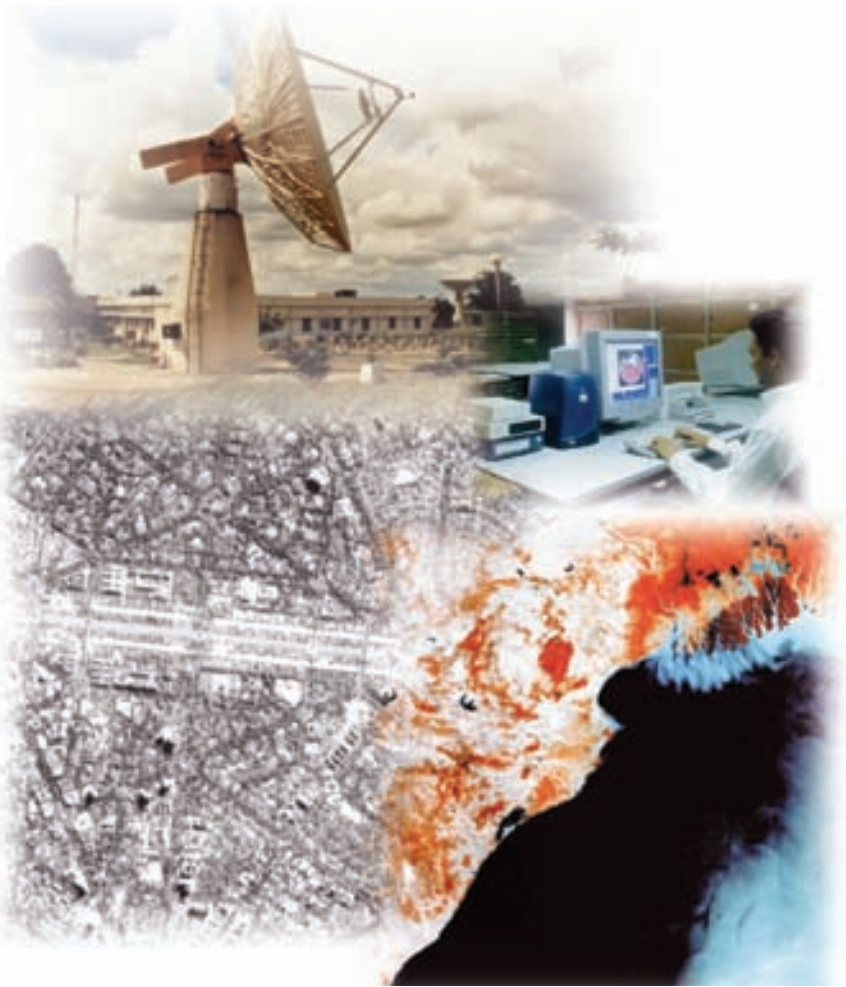

Our Thrust Areas

Applications

- Agriculture & Soil Resources
- Water, irrigation
- Forestry and Ecology
- Land use
- Oceanography
- Infrastructure Planning
- Urban Resource Information System

Disaster support and environment

- Support towards disaster mitigation
- Environment impact assessment

Technology

- Deployment of satellite/ground based systems for data reception and processing from Indian satellites anywhere on globe
- Satellite and aerial data services

Capacity building

- Training & education

NRSA Data Centre
National Remote Sensing Agency
Department of Space, Balanagar
Hyderabad - 500 037
Phone + 91-40-23884423/22/25
Fax + 91-40-23878158/23878664
Email sales@nrsa.gov.in

Geneq introduces submeter GPS mapping receiver

Geneq, Inc., the pioneer in WAAS-based submeter GPS mapping systems, introduces the SXBlue II, a next generation submeter, Bluetooth™ wireless GPS mapping receiver that allows to use off-the-shelf Bluetooth™-enabled PDA/notebook computers to collect GPS map data. *http://www.geneq.com.*

Chronos Technology partners with Septentrio Satellite Navigation

Chronos Technology and Septentrioare working together to bring Septentrio's products into the OEM and professional precision GNSS receiver markets in the UK and Ireland. *www.chronos.co.uk*

Blue Marble Geographics releases Geographic Calculator 7.0

Blue Marble Geographics announces the release of Geographic Calculator 7.0, a major version upgrade of the Geographic Calculator that features many new enterprise-wide collaboration tools and core library enhancements. *www.bluemarblegeo.com.*

Trimble acquires UtilityCenter Assets from UAI

Trimble has acquired the UtilityCenter® assets from privately-held UAI, Inc. of Huntsville, Alabama, USA. UAI is a leading provider of GIS based workflow automation and outage management solutions for electric and gas utilities. *www.uai.com.*

New Leica FCMS 2.2 Flight & Sensor CMS released

Leica Geosystems has released FCMS 2.2. The Flight & Sensor Control Management System (FCMS) enables the most efficient Leica Geosystems sensor (ADS40, ALS50 or RCD105) survey flights. It also supports any other sensor, as well as multi-sensor payloads of up to four sensors bringing significant enhancements to users including vector data and ground control points as a backdrop, simplified views for the pilot and a more flexible, multi-language configuration. *www.leica-geosystems.com*

Hemisphere GPS offers superior handheld mapping

Hemisphere GPS' new XF100 series DGPS receivers with Crescent® GPS technology for ruggedized handheld computers provides an integrated solution for the collection of position data with superior accuracy over other handheld solutions. It is designed to work with TDS Recon™ and the Juniper Archer Field PC™ models, this receiver is ideal for entry-level surveying and professional GIS applications such as mapping utility infrastructures or municipality assets. It includes SBAS (WAAS, EGNOS, MSAS, etc.) differential support capable of providing sub-meter positioning accuracy, and its COAST™ technology that maintains accuracy during temporary loss of differential signal. An optional external antenna is available for additional accuracy and allows for more precise antenna placement. The receiver also consumes low power. Crescent receiver technology provides higher update rates, improved raw measurements, more memory, and greater processor capacity. Its more accurate code phase measurement and superior multi-path rejection translates into an extremely accurate and stable receiver.

Cameron Baird, Director Business Development, Hemisphere GPS spoke to Coordinates on the uniqueness of the products.

What is the USP of XF100?

The USP would be the fact that it is designed for existing users. The users of either the Juniper Archer or the TDS Recon can now add sub-meter level DGPS to their existing handheld WinCE device. This is the first precision level DGPS product designed for these products.

What is the user segment this product is targeted at?

The product is geared to the data collection market and users who may require a higher level of precision than found in commercially available GPS receivers. In addition, as it utilizes existing rugged handhelds as the platform, we are targeting those who may have these units and can now add the GPS without having to purchase a new handheld.

How affordable is the product, given the price-sensitivity of the markets of developing countries?

As to affordability, this can be answered in two ways. i) The user who currently has either a TDS Recon or a Juniper Archer can now purchase the X100 or XF101 at a price considerably less than the competitors, and would now have a product which can be utilized for many applications. ii) Although more expensive than consumer level GPS, the product will compete with any other similarly priced product in the market. In addition, the product will utilize SBAS in areas where SBAS is available and also the raw observables can be logged to either the TDS Recon or Juniper Archer for post-processing. *www.hemispheregps.com*

THEOS Capability from Leica

Leica Geosystems Geospatial Imaging has embedded orthorectification capabilities for the Thailand Earth Observation System (THEOS-1) in both its Erdas Imagine and Leica Photogrammetry Suite.

50-channel LEA-5 GPS module series by u-blox

u-blox AG, announced the launch of two GPS modules that set new benchmarks in terms of speed, sensitivity and ease of integration. The LEA-5 GPS module series is based on u-blox' fifth generation positioning engine, u-blox 5, which boasts an acquisition performance of less than one second. *www.u-blox.com*

TomTom-Tele Atlas merger falls under scrutiny

The European Commission (EC) is taking a closer look at TomTom's planned acquisition of TeleAtlas. The EC only initiates a second review in about 3 percent of the mergers it reviews, so it's a bit of an extraordinary step. The probe will examine whether the deal would push up the price of digital maps for rival portable navigation device makers or limit their access to these maps. According to TomTom and Tele Atlas, they expect to have a clearer idea about whether the deal can go through by early next year. *cp.gpsworld.com*

Magellan Maestro PND, Triton handheld win CES Award

Magellan has been named an International Consumer Electronics Show (CES) Innovations 2008 Design and Engineering Award honoree in two categories. Magellan Maestro 4250 for In-Vehicle Navigation/Telematics/ ITS product category and the Magellan Triton 2000 for Personal Electronics product category. *cp.gpsworld.com*

Leica Geosystems Geospatial Imaging India Pvt. Ltd. opening

Leica Geosystems Geospatial Imaging announced, Leica Geosystems Geospatial Imaging India Private Limited, with its headquarters in Gurgaon (New Delhi), India. Leica Geosystems India plans to deploy technical support, business development, marketing, software development and professional services throughout the region. It will also build customized and localized geospatial solutions, meeting the needs of this rapidly expanding market.

"Leica Geosystems India brings the industry's most complete and powerful collection of remote sensing, photogrammetry, enterprise, data sharing and visualization solutions to this part of the world, with added services and localized implementations," said Kaushik Chakraborty, Vice President India, Middle East, and Africa, Leica Geosystems Geospatial Imaging. *http://gi.leica-geosystems.com*

Sokkia New SET X Total Station

Sokkia (Japan) has released the new total station SET X featuring the highest environmental protection rating for Windows CE- based total stations, onboard SDR software and a flexible, long-life battery system. An

environmental protection rating of IP65 makes SET X the highest in class for Windows CE total stations, allowing it to withstand the harshest conditions on the most demanding jobsites.

AAMHatch acquires African aerial mapping company

AAMHatch has acquired of AOC Geomatics, Africa which was formed in 1931 as the Aircraft Operating Company. AOC provides spatial information services throughout Africa and AAMHatch will continue to use the AOC brand. As the principal shareholder, AAMHatch brings global capabilities and resources to AOC. *www.aamhatch.com.au*

DAT/EM delivers 1000th Summit Evolution System to Woolpert

DAT/EM Systems International recently sold its 1000th Summit Evolution digital stereoplotter mapping system to Woolpert, Inc, an engineering, architectural, geospatial firm.. The company has become one of the largest users of Summit Evolution in North America.

Amaryllo and APMCOMM to provide state-of-the-art in TMC solutions

Amaryllo, a GPS product developer and solutions provider from the Netherlands, and APMCOMM, a main Taiwanese wireless SiP (System-in-Package) module manufacturer, announced to create and deliver integrated RDS/ TMC and GPS/RDS/TMC modules today available on the market. This series of modules is the first product cooperation between Amaryllo and APM.

Hoya to absorb Pentax

Hoya Corporation (Japan) is to absorb Pentax Corporation. The merger will become effective on 31st March 2008. Hoya, which acquired a 90.4 pct stake in Pentax through a tender offer earlier this year, concluded that speedy management and the appropriate use of resources of Pentax's operations would be better ensured by the merger.

Raytheon completes final system test for Indian SBAS

Raytheon, USA has completed the final system acceptance test to augment standard GPS signals over India. The latest test of the GPS Aided GEO Augmented Navigation-Technology Demonstration System, or GAGAN-TDS, is a milestone in the worldwide transition to satellite-based navigation for civil aviation. When completed, GAGAN will join other space-based augmentation systems in providing worldwide, precise navigation, substantially boosting safety, efficiency, and capacity across India and the surrounding region. *www.prnewswire.com*

Install GPS in cabs, says ASSOCHAM

Expressing concern over the recent rape and murder of a call centre employee in Pune allegedly by the cab driver, the Associated Chambers of Commerce and Industry (ASSOCHAM) in India has suggested that the Government make installation of GPS mandatory in all the cabs being employed by industries where women work in night shifts. *www.hindu.com*

Tokyo Police soon receive GPS-equipped mobile phones

Tokyo police officers working at "koban" police boxes will have GPS-equipped mobile phones by next year to keep track of their location, allowing for faster response times to emergencies. The plan comes after an incident last August where a policeman in Tachikawa City shot an acquaintance and himself to death after he went missing while on duty. *www.allheadlinenews.com*

GPS navigation used by 37% of drivers in Taiwan

According to IDEAS-FIND survey, GPS navigation is used by 37% of all car drivers in Taiwan, the highest proportion among three types of in-car electronic devices. The survey shows that GPS navigation and digital TV channels or video on demand have considerable market potential in Taiwan. *www.digitimes.com*

Korean launch for Immersion-powered tactile GPS units

CTT-Net of Korea is launching the first navigation devices to use Immersion's TouchSense technology, which offers tactile feedback for touchscreens. These products for the Korean market include the CSN-7040, a handheld navigation device, and the CIN-7000, a built-in car navigation device. Both feature a 7-inch touchscreen and a direct multimedia broadcast (DMB) receiver for accepting satellite downloads. These products help improve usability and reduces 'glance time' whilst driving. *techdigest.tv*

SLA mobile services

Singapore Land Authority has developed a new service called SLA Mobile Services - a suite of mobile solutions to cater to surveyors who are constantly on the move. This service gives them instant access to survey control point information through their mobile phones on location wherever they are, without having to access the internet.

Hemisphere GPS awarded two new GPS technology patents

Hemisphere GPS, has been recently awarded two new patents for innovative technology.

The 'Method and System for Synchronizing Multiple Tracking Devices for a Geo-Location System' patent (U.S. Patent No. 7,292,186). 'Attitude Determination Exploiting Geometry Constraints' patent (U.S. Patent No. 7,292,185)

SUUNTO appoints distributor for India

SUUNTO Finland have given the distribution rights for INDIA of SUUNTO range of products to M/s A&S CREATIONS, New Delhi who are in business of selling GPS and other location based devices to Military and Civil customers. Suunto remains the world's largest compass manufacturer.

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Staking-out


Application of network RTK


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Email: export@southsurvey.com
Website: www.southsurvey.com/english/index.asp

Satellite imaging for rail navigation

Indian Railways have sanctioned a pilot project, Satellite Imaging for Rail Navigation (SIMRAN), for real time passenger information system by utilizing GPS. This project is being carried out jointly by Research Designs & Standard Organization, Lucknow and Indian Institute of Technology (IIT), Kanpur. The pilot project is sanctioned for development for hardware and software for providing Real Time Train Running Information to the passengers. *http://pib.nic.in*

Delhi Chief Minister urges local agencies to implement GIS

Chief Minister Sheila Dikshit called for better coordination among all the agencies engaged in providing civic amenities in the Capital's unauthorised colonies recently. She also directed that application of GIS mapping technology should be implemented soon for urban development. Ms. Dikshit directed the Municipal Corporation of Delhi, Delhi Jal Board, private power distribution companies, Delhi State Industrial and Infrastructure Development Corporation, Irrigation and Flood Control Department and Delhi Development Authority to work in tandem. *www.hindu.com*

GIS helps multiple agencies respond to southern California fires

GIS software and services from ESRI are helping local, state, and federal agencies with multiple tasks surrounding the recent firestorms in Southern California. GIS is being used at each incident command post as well as multiple command centers including Southern California operations centers and the Federal Emergency Management Agency (FEMA) joint operations center. It provides an integrated common operational picture for comprehensive, map-based situational awareness. Agency personnel take advantage of the analysis and visualization capabilities for collaboration among federal, state, and local agencies; prioritization and utilization of manpower and resources; and monitoring events on the ground in near real time.

NRDMS to launch resource map website in Sept, 2008

Natural Resources Data Management System (NRDMS) would launch a website in September, 2008 in which resource maps with all information would be available district-wise for the public, according to Karnataka State Council for Science and Technology. Maps prepared with the help of GIS and remote sensing would be provided to the district administration, ZP, government departments and NGOs for planning developmental works. *www.newindpress.com*

WorldView-1 reaches full operational capability

WorldView-1 is now fully commissed, meets all its requirements, and is delivering imagery to the National Geospatial-Intelligence Agency (NGA) as part of the NextView program. DigitalGlobe will begin taking orders for WorldView-1 imagery from its global resellers, partners and customers on 3rd January 2008.

China launches new RS satellite

China has launched a new remote sensing satellite; the "Yaogan III" from the Taiyuan Satellite Launch Center in north China's Shanxi Province recently. The 2,700-kilogram satellite will be used for scientific research, land resources surveying, crop yield estimate and disaster prevention and relief. The satellite is developed by the Shanghai Academy of Space flight Technology affiliated to the China Aerospace Science and Technology Corporation. Source: China View

Award for KR Sridhara Murthi

KR Sridhara Murthi, the executive director of Antrix Corporation, has won the International Institute of Space Law's Life Time Achievement Award. The award was announced on 28 September. The Institute was founded by the International Astronautical Federation in 1960. It replaced the Permanent Committee on Space Law, which was created by IAF in 1958. The award recognises Murthi's service to the space community. Antrix is the commercial arm of the Indian Space Research Organisation. *www.isceindia.com/speakers.htm*

Forest fire monitoring system established in India

The Indian Forest Fire Response and Assessment System (INFFRAS) has been established under the Decision Support Center, (DSC), under Disaster Manage Support Programme, to facilitate forest fire management. INFFRAS integrates multi sensor satellite data with GIS data bases to address forest fire management relevant to pre, during and post fire scenarios. INFFRAS website is developed in open source environment with the capabilities of daily fire alert (day and night time) with location information, burnt area assessment, users feedback etc; inputs on fire proneness mapping, ecological damage assessment and mitigation planning. *http://pib.nic.in*

K Radhakrishnan appointed new VSSC Director

K Radhakrishnan, Director of National Remote Sensing Agency, India took over as Director of Vikram Sarabhai Space Centre (VSSC) succeeding B N Suresh. Mr. Suresh will continue as Director of the Indian Institute of Space Science and Technology, recently started by ISRO in Thiruvananthapuram. *http://economictimes.indiatimes.com*

ISPRS 2008 BEIJING

Silk Road for Information from Imagery

The XXI Congress of the International Society for Photogrammetry and Remote Sensing

3-11 July 2008 Beijing, China

Visit www.isprs2008-beijing.org

Invitation to the ISPRS 2008 Beijing

The XXI Congress of the International Society for Photogrammetry and Remote Sensing (ISPRS) will be held in Beijing, China during 3-11 July 2008. The theme of the ISPRS 2008 Beijing is "Silk Road for Information from Imagery". The ancient Silk Road was a well-known trade route between China and the west. It also contributed a lot to information exchange and spread of scientific knowledge around the world. Now we are in the age of information. How should the useful information be provided and shared? It has been a challenge and hot topic. ISPRS has been devoted to the development of international cooperation for the advancement of photogrammetry, remote sensing, spatial science and their applications. Through the cooperation, we can create a new silk road for information from imagery. The road will connect users, scientists, researchers and decision makers etc. The ISPRS 2008 Beijing will be a milestone of the "Silk Road for Information from Imagery". It will comprise keynote speeches and plenary sessions featuring distinguished scholars, parallel oral and poster sessions presenting the latest developments in a broad range of topics, a user forum showing successful solutions and new requirements from the community of users, and a commercial exhibition demonstrating state-of-the-art equipment, devices, software and high resolution images. Technical visits, social program, sightseeing during the Congress, pre- and post-Congress tours will be organized.

The ISPRS 2008 Beijing will be a good opportunity for scientists, scholars, researchers, planners, decision-makers, students to exchange information on new technology, applications and innovative ideas, and for research institutions, universities, companies, governmental agencies etc to present their products, service, activities related to the fields of ISPRS advantage.

Please visit the Congress website at http://www.isprs2008-beijing.org to prepare your participation.

Look forward to meeting you in Beijing, 2008.

CHEN Jun
ISPRS Congress Director
President
National Geomatics Center of China

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January 2008

ESRI Asia Pacific User Conference
17-18 January 2008, Tokyo, Japan
www.esri.com/events/apuc

Institute of Navigation National Technical Meeting
January 28-30, 2007, San Diego, California, USA
www.ion.org

February 2008

Mobile World Congress 2008
February 11 - 14, Barcelona, Spain
www.mobileworldcongress.com

Munich Satellite Navigation Summit
19 - 21 February 2008, Residenz München, Germany
http://www.munich-satellite-navigation-summit.org/

GSDI-10 St. Augustine, Trinidad
February 25-29, 2008
http://www.gsdi.org/gsdi10/

NavtechGPS Seminars
February 25-29, 2008
New Orleans, LA
PWitt@NavTechGPS.com

March 2008

CeBIT
March 4-9, Hannover Germany
www.cebit.de

WALIS Forum 2008
March 12-14
Perth, Western Australia
forum@walis.wa.gov.au
http://www.walis.wa.gov.au/forum

April 2008

GEO-SIBERIA 2008
April 22 – 24, 2008, Novosibirsk , Russia
strutz@sibfair.ru
http://geosiberia.sibfair.ru/eng/n

Space Show 08
Toulouse, France
22-25 April, 2008
contact@toulousespaceshow.eu

May 2008

IEEE/ION PLANS 2007
Co-sponsored by IEEE and Institute of Navigation
May 5-8, 2007
Monterey, California, USA
www.plansconference.org

June 2008

International Conference: "Studying, Modeling and Sense Making of Planet Earth"
1 – 6 June, 2008
Department of Geography, University of the Aegean, Mytilene, Lesvos , Greece
http://www.aegean.gr/geography/earthconference2008/ en/main_fr.htm

August 2008

ESRI's 28th annual International User Conference
August 4-8, 2008 in San Diego, California
www.esri.com

Septemeber 2008

Institute of Navigation's Satellite Division ION GNSS 2008
September 16-19, 2008
Savannah, Georgia, USA
www.ion.org

ISPRS2008

3 – 11 July, 2008
Beijing, China

www.isprs2008-beijing.org/

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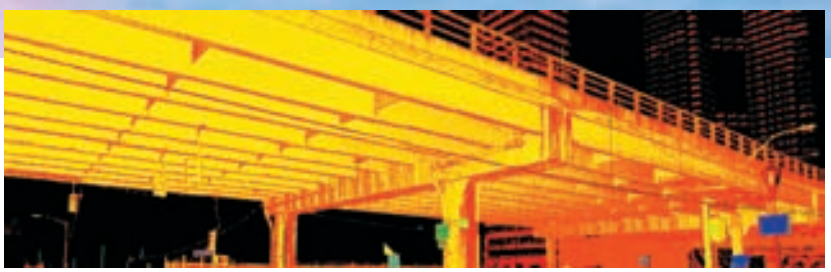
ScanStation 2 adds a whopping 10-fold increase in scan speed to the landmark ScanStation instrument category– the industry's most versatile and popular laser scanner. This huge increase – from 4,000 to 50,000 points/sec, max – combines with ScanStation's four fundamental total station features to take High-Definition Surveying™ (HDS™) to the next level for as-built & topographic surveys.



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