

Report on the deliberations of Indo-Tunisian workshop on " Geospatial Science and Technology "

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Venue: New Biological Sciences, IISc., Bengaluru - 560012

Supported by

International Bilateral Cooperation Division (IBCD)
Department of Science & Technology
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**Indo-Tunisian workshop on
"Geospatial Science and Technology"**

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A report on the deliberations of Indo-Tunisian workshop on "Geospatial Science and Technology"

1.0 Background:

Indo-Tunisia Workshop on " Geospatial Science and Technology"

Under the Indo-Tunisia S&T Cooperation Agreement between India and Tunisia, International Bilateral Cooperation Division (IBCD), DST- GOI proposed to organise a workshop on 'Geospatial Science and Technology' . The workshop envisages to identify areas of mutual interest for specific collaborations between India and Tunisia in the domain of Geospatial Information Science and Technology. Department of Science and Technology, Government of India and Karnataka State Council for Science and technology, Indian Institute of Science, Bengaluru are jointly organising this workshop.

The workshop is divided into a number of sessions in order to capture the state of geospatial technology development currently positioned in India and Tunisia and the upcoming applications. Proposed Broad topics for deliberation are listed below.

Session 1 – National Mapping, National GIS and Geospatial Policy: This session will have reps of National Mapping Agencies from both the countries talk about the current state of NMAs, the key projects and their vision for next 5-10 years. They will also touch upon the policy environment that is supporting their service delivery.

Session 2 – Space and Earth Observation Programmes: This session will involve presentations by heads of Space and Earth Observation Agencies from both the countries who will talk about the Space Programmes, various application areas they are catering to, the upcoming projects they are investing on and the ways that the nations can collaborate for Space Programmes in coming years.

Session 3 – Land Management Initiatives: The session will delve into the Land Management practices that are currently in use and how it is helping them achieve economic growth. The road blocks they are experiencing in this direction, modern technologies and systems that they are using to address Land Administrative challenges and possible cooperation strategies.

Session 4 – Institutional Mechanism and Capacity Development & Training: Various technical institutions offering training in geospatial technologies will present on the courses and programmes they offer for students interested to take up geo-information science, their key challenges, ways to address these challenges and their connect with the government agencies and private sector.

Session 5 – Industry Engagement: Any talk on governmental collaboration will be incomplete without the engagement and involvement of the private sector industry. As already mentioned, both the countries have many private sector agencies within the geospatial domain that create their own unique products, services and solutions for their own governments, private users as well as those from other countries. This session will involve their participation and deliberations on their unique offerings, their key challenges and their vision for the industry in next 5-10 years.

Session 6 – R & D Collaboration: Both the nations have a strong R & D base for pursuing specific R & D projects relating to Geospatial Technologies and related innovation. Some of the areas include Spatio-temporal Data Modeling, Interoperability, Geo-visualisation and Analytics, Spatial Decision Support Systems, Geo-spatial Uncertainty & error-modeling etc.

2.0 Proceedings of Indo-Tunisian Deliberations

Session I

Dr. Tounsi Kais presented about the National Mapping, National GIS and Geospatial policy of Tunisia and highlighted the status of mapping situation. He briefly explained about the major ongoing projects and explained about the life cycle topographic maps. The present focus is to take of user needs and stake holder requirements because of the obsolescence of some of the large scale maps prepared earlier which do not reflect the reality on the ground and heterogeneous in nature. Some of these issues are getting addressed through National Geospatial Information Infrastructure established by the state.

Dr. Valli Manickam from ASCI, Hyderabad talked about National Map Policy 2005, Remote Sensing Data Policy [RSDP – 2011], National Data Sharing and Accessibility Policy [NDSAP - 2012] and Geospatial Governance [NGIS]. She advocated for a Comprehensive National Geospatial Policy to empower citizens and Communities by providing access to seamless, integrated, adaptive geospatial data and serving the public good within the policy framework.

Session II

Dr. Thouraya Sahli Chahed from Space Affairs Department, Tunisia talked about the utilization of space technology in the socio economic areas mainly in the areas of flood management, desertification, marine pollution, urbanization, coastal protection, forests and agriculture. The areas of intervention using spatial technologies dealt broadly in major sectors where technology made definite impact. Further discussion on utility of time-series space data for land use classification was

Dr. K S Rajan from IIIT, Hyderabad presented about the utility of satellite imageries in land use classification, agriculture etc., and clearly showed the impact of different techniques in improving the visualisation of classified images. Since accuracy is the major factor in accepting spectral classification appropriate choice could be made to identify homogeneous and heterogeneous class occurrences.

Session III

Dr. Thouraya Sahli Chahed from Space Affairs Department, Tunisia presented about the Research and development experience and explained about the current research programs pursued in Tunisia. The themes for the programs are based on the priority of the country and is consultation with the end users and the scientific community. The present focus is on forest inventory, water resources, soil mapping and urban extension. A well laid out objectives, work plan and expected deliverables for the proposed themes was also presented.

Dr K S Rajan talked about geospatial R&D and use of open source technologies in the development of applications. He talked about current areas of research taken up by his institution and are mainly on GML compression, cartographic visualisation, data mining and disaster management. Dr Rajan further elaborated on many initiatives taken up by his institution in the areas of software development, capacity building, entrepreneurship using open source geospatial technologies.

Prof. N L Sarda presented the R&D activities pursued at IIT Bombay. The R&D areas include data integration and interoperability, Big Data, modelling, predictions and technology from desktop, to web-based, to cloud, mobile, social media, and Big data, to 4th science paradigm. He iterated that the tools and technologies founded in computer science are gaining momentum as geospatial technologies is playing a major role in managing earth resources and recently more focus is on providing geospatial services to end users.

Session IV

Prof. Rached Boussema presented the Geo-Information sciences and technologies curricula in Tunisian universities. He emphasised the need to fully realize the growing possibilities geospatial technologies; develop Geospatial capacity building policies; to identify the critical curricula needed to enhance the high level appropriate spectrum of geospatial skills through effective advancements in the implementation of geospatial technology and expertise and finally to review educational strategies to improve the awareness and “literacy” levels of stakeholders

Dr Ramesh Hooda presented about the activities pursued by the Haryana Space Applications centre and in particular he talked about the national land records modernisation program implementation in Haryana. The NLRMP's objectives is to build a transparent and integrated system of online real-time land records to mirror the ground reality and automatic mutation. He explained the technologies adopted and the methodology applied to develop such an automated system to ensure high value cadastral maps for governance. The process adopted is less time consuming and economical and could be adopted in other states as well to map the spatial information at cadastral level.

On behalf of Ministry of Higher education Prof. Rached Boussema, talked about the Tunisian system of R&D and innovation to realise an efficient national STI policy. He informed that at present Tunisia's major research collaborator is France and recognizing the role of international cooperation in scientific and technological progress of the country, the present focus is on strengthening and diversifying its bilateral and multilateral partners.

Dr. Ghosh presented the activities being pursued at IIT Kharagpur. In particular he made reference to activities relating to capacity building of different NSDI participating agencies on Spatial Data Modeling using Unified Modeling Language (UML), Enterprise GIS, and utilisation of GeoSMS standard specifications for topographic data updation. On-line integration of interoperable services pertaining to geo-referenced data from NSDI server with

services for demographic or statistical data was demonstrated. SDIs require integration of such interoperable services from multiple sources to support use of geo-spatial data by end users for decision support. The present focus of the activities at the Institute has been on building the technical capacities of the partnering agencies of NSDI and State SDI to facilitate domain data modeling, standardization and interoperability.

Session V

Dr. Riadh Tebourbi presented an overview of the use of Geospatial Technologies in agencies in Government, Academia/ Research, and Industry/ Businesses in Tunisia. French Satellites (SPOT 6 and &) provide the key remote sensing data on a regular basis. Fields of applications of Geospatial Technologies are Defence & Security, Utilities and Telecom Services, Natural Resources Management, Agriculture and Environment etc. Important applications include Management of Fibre Optical Network, Precision Agriculture, and Vehicle Tracking and Logistics etc. Geospatial Technology plug in to Cloud Infrastructure and Business Intelligence (BI) Tools are the future thrusts of Tunisia in the area.

Prof Sami Faiz presented an overview of the academic activities pursued by his university. His research areas mainly focuses on modelling, visualisation, enrichment geospatial database and GIS integration strategies. He welcomed the idea of collaborating with Indian universities.

Mr. Mahesh Reddy from M/s Intergraph spoke about the "Use of State-of-art Geo-spatial Tools in the development and provision of Standardised Geo-Information Services". He mentioned the importance of OGC standards and the kind of products and services offered by his company benefits the users by completely adopting an Open Architecture Solution for easy Integration. During his presentation a glimpse of many projects implemented by M/s Intergraph both in India and around the world were shown.

Mr. Raghu Ganesan from M/s Avineon spoke on "Experiences, challenges and recommendations for delivery of Geospatial Data and Information Services" and shared his perspective about the implementation of several projects in India and specifically SDI projects. He spoke at length about his experiences i spatial data delivery and the role of industry in achieving this objective. he mentioned data accuracy, quality human resources, good infrastructure, tools for providing services are some of the important factors in achieving success in implementing GIS projects.

Session VI

Prof. Abdelfattah from SUPCOM – Higher School of Communication presented the activities pursued by University of Carthage. In particularly in the areas of fire detection and management through multi-sensor network; potential of InSAR Coherence for multi-temporal change detection – desertification monitoring and soil salinity mapping. He talked about

nano-satellite and listed the GIS applications, water resource management and food security could be the areas for collaboration.

Dr. T V Ramachandra, IISc., Bengaluru presented about "Geo-Visualisation of local hotspots of biodiversity conservation and sustainable management of western ghats" He said that western ghats is rich in bio-diversity but is under threat and the hot spots are being mapped. He informed that Open source GIS software's and tools are being extensively used for modeling and visualisation. He explained how the centre is extensively using GIS and RS data for classifying forest fragmentation; eco-sensitive zones; forest cover; fragmentation analysis; Linkage between forest and water, forests and rainfall etc.

In the absence of Dr. Fatma Trabelsi of University of Jendouba a collaborative study on Medjerda watershed was presented by Dr. Thouraya Sahli Chahed. The investigators extensively worked on Hydro geomorphology and groundwater vulnerability, flood risk mapping for the middle valley section of the watershed – between two dams at Sidi Salem and Laaroussia. Satellite images used to determine morphological evolution, laduse. hydraulic modelling adopted to simulate flood from flow rate. The encouraging results could be used to reduce the risk of flooding.

Mr. H Hemanth Kumar presented the activities pursued by Karnataka State Council for Science and Technology, Bengaluru since 1992 through Natural resources Data Management System (NRDMS) program to provide spatial data, information and services that are relevant to planning and administration for informed decision-making using geospatial technologies at micro level. He said such an arrangement of spatial data centres to provide geospatial services exist only in the state of Karnataka at district level. The NRDMS program now has been institutionalized in the state. He informed that the strength of Karnataka NRDMS program formed the basis for setting up of 1st State Geoportal of the country in Karnataka and in the year 2009 a web based geo-portal was developed to acquire, process, store, distribute and improve the utilization of geo spatial data in the state of Karnataka. This portal provides access to a seamless geospatial data to the user community, namely, government, non-government and general public. In the 2nd phase of the program the focus is on demonstrating the utility of the Geoportal and its services in various Geo Spatial application requirements of two State Line Departments/Sectors.

3.0 Recommendations of the Workshop

Keeping the above presentations and deliberations in view, the Indo-Tunisian Workshop at IISc., Bengaluru made the following recommendations:

- i. Possible areas of cooperation include both thematic and technical topics:

Thematic Areas

Natural Resources Management

Disaster Management with focus on flooding, desertification etc.

Climate Change

Land Records

Smart Cities

Technical Areas

a. Space Technology for Natural Resources Management

b. Spatial Decision Support Systems

c. Big Geo-Data Management and Cloud

d. Cadastre and Photogrammetry

e. Open Source Technologies for Geospatial Applications and services

f. Geospatial Portal Development

g. GIS Integration and Interoperability Strategies

h. Spatial Data Mining, spatial OLAP and warehouse

i. Capacity Building in Geo-spatial Technologies and Standardisation etc.

- ii. Course module content for a multi-disciplinary domain like Geospatial Technologies should be defined in a consultative mode between both the Nations particularly considering the challenges involved in building faculties and training students in this complex area. This is useful in launching Masters level courses in Geo-Information Science & Engineering. This may be further deliberated in the next workshop.
- iii. Details of the proposed workshop and a few pilot projects in the identified areas for follow up discussion therein may be worked out as soon as possible by both the sides.
- iv. Considering the availability of a huge potential for collaborative initiative in Geospatial Technologies between both the Nations, joint call for proposals in the identified sub-areas should be taken up in the near future.
- v. A follow up workshop, preferably in February 2016, should be held in Tunisia, thus initiating a series of workshops that could be held alternately in the two countries and focus on geospatial science & technology related themes. In order to further fine tune the sub-areas for collaboration and to facilitate training

programmes in both countries in areas of respective strengths, visits of research scholars, scientists and experts from the Indian side to the related institutions and end users agencies in Tunisia and vice versa should be considered.

- vi. Research questions/ issues are recommended to be further refined in the identified areas/ subareas in the next workshop in Tunisia. Identification of specific products/ deliverables covering application of open source technologies in thematic areas like floods, desertification, and mountain ecosystem management may be taken up during the workshop.
- vii. A formal cooperation agreement framework between India and Tunisia in the area of Geospatial Technologies may be firmed up, if necessary. The proposed agreement document may be proposed to the Joint Committee on Science & Technology of both countries in its forthcoming meeting for approval in order that the joint Call for Proposals (CFPs) could be invited in the identified thematic and technical areas for fund support.
- viii. Possibility of acquiring and exploiting Indian Satellite Data for applications in Tunisia may be explored and establishing agreements to that effect be concluded.
- ix. In order to facilitate collaboration between Industry/ Business partners in India and Tunisia in the context of research and development in the identified areas, it is recommended that a common platform be provided in the prevailing agreement framework.

Annexure I:

Indo - Tunisian workshop in the area of Geospatial Science and Technology

Venue: New Biological Sciences, IISc., Bangalore - 12

Program Details

Date	Sessions	Themes	Participants	Title of presentation	
19/01/2015	Inauguration (9.30 - 10 am)				
	Open session (10 - 11 am)	Mr. H. Hemanth Kumar - Indian Delegation Coordinator			
		Prof. Mohamed Rached Boussema - Tunisian Delegation Coordinator			
		Dr M. Prithviraj - Executive Secretary, KSCST, Bangalore.			
	Session 1 (11 to 1 pm)	National mapping, National GIS and Geospatial policy	Dr. Tounsi Kais		Global Geospatial Information Management (GGIM) in Tunisia Situation and Future prospect
			Dr Valli Manickam		Overview and Key Concepts – Indian Context
	Session 2 (2 to 4 pm)	Space and Earth observation programs	Mrs. Thouraya Sahli Chahed		Research and development: use of space technology in the socio economic areas
			Dr. K S Rajan		Improving utility of satellite imagery - should it be data or user perspective driven
Discussion panel (4 to 5 pm)	Sessions 1 & 2	Dr Valli Manickam, Dr. Tounsi Kais, Dr. K S Rajan Mrs. Thouraya Sahli Chahed			
20/01/2015	Session 3 (9.30 to 12 am)	R & D collaboration	Mrs. Thouraya Sahli Chahed		Research and development: use of space technology in the socio economic areas
			Dr. K.S.Rajan		Open Source Technologies for Geo-spatial Applications
			Prof. N L Sarda		Recent Trends in Research & Development in Geo-Information Science & Engineering (GISE)
	Discussion panel (12 to 1 pm)	Session 3	Dr. K.S.Rajan, Prof. N L Sarda, Mrs. Thouraya Sahli Chahed		
	Session 4 (2 to 4 pm)	Institutional Mechanism and Capacity development & Training	Prof. Mohamed Rached Boussema		Geo-information sciences and technologies curricula in Tunisian universities
			Prof. Mohamed Rached Boussema on behalf of Prof. Zohra Lili Chabaane		The guidance and experience of the National Agronomic Institute of Tunisia in RS and GIS
Dr. Ramesh Chandra Hooda			National Land Records Modernization Programme – Case Study of Haryana State		
Prof. S K Ghosh			Capacity Building and Training for the development of Spatial Data Infrastructures (SDIs) at National and State levels		
Discussion panel (4 to 5 pm)	Session 4	Dr. Ramesh Chandra Hooda, Prof. S K Ghosh, Prof. Mohamed Rached Boussema			

21/01/2015	Session 5 (9.30 to 12 am)	Industry Engagement	Dr. Riadh Tébourbi	Present and future industrial applications of geospatial technologies	
			Prof. Sami Faiz	Geographic information system integration strategies	
			Mr. Mahesh Reddy	Use of State-of-art Geo-spatial Tools in the development and provision of Standardised Geo-Information Services	
			Mr. Raghu Ganeshan	Experiences, challenges and recommendations for delivery of Geospatial Data and Information Services	
	Discussion panel (12 to 1 pm)	Session 5	Mr. Mahesh Reddy, Mr. Raghu Ganeshan, Dr. Riadh Tébourbi, Prof. Sami Faiz		
	Session 6 (2 to 4 pm)	Land management initiatives	Prof. Riadh Abdelfattah	On the potential of InSAR coherence for multitemporal change detection: Soil salinity and desertification mapping in Tunisia	
			Mrs. Thouraya Sahli Chahed on behalf of Mrs. Fatma Trabelsi	Application of Satellite Remote Sensing to support water resources management in the Medjerda watershed, North of Tunisia	
			Dr T V Ramachandra	Geo-visualisation of Local Hotspots of Biodiversity in Western Ghats"	
			Mr. H Hemanth Kumar	Geospatial Technologies for governance - Karnataka Experience	
	Discussion panel (4 to 5 pm)	Session 6	Dr T V Ramachandra , H Hemanth Kumar, Prof. Riadh Abdelfattah, Mrs. Thouraya Sahli Chahed		
Discussion panel (5 to 5.30 pm)		Mr. PS Acharya Mr. H. Hemanth Kumar Prof. Mohamed Rached Boussema	Summary and Recommendations for future collaborations		
Closing session (5.30 to 6 pm)		Mr. PS Acharya Mr. H. Hemanth Kumar Prof. Mohamed Rached Boussema			
22/01/2015	Visit to (i) Karnataka State Remote Sensing Applications Centre KARSAC and, (ii) Karnataka State Natural Disaster Monitoring Centre (KSNDMC), Bengaluru, India. (iii) Karnataka State Council for Science and Technology (KSCST) and (iv) Indo-French Cell at IISc				
23/01/2015	(i) Discussion on NSDI and Karnataka State SDI				

Annexure II: Indian Delegates

NAME	ORGANIZATION	PHOTO
Mr. P S Acharya	Head (TWF)/ CEO (NSDI)/ Associate Head (NRDMS-NSDI)/ and Coordinator (MMGA) Department of Science & Technology Government of India, Technology Bhawan New Mehrauli Road New Delhi - 110 016 Email : psa@nic.in	
Dr. M Prithviraj	Executive Secretary Karnataka State Council for Science and Technology Indian Institute of Science Campus, Bangalore - 560012 Karnataka State, INDIA Email: prithvi@kscst.iisc.ernet.in	
Dr. T V Ramachandra	Energy & Wetlands Research Group, Center for Ecological Sciences [CES] Centre for Sustainable Technologies (astra) Centre for infrastructure, Sustainable Transportation and Urban Planning [CiSTUP] Indian Institute of Science, Bangalore, Karnataka, 560 012, India Email: cestvr@ces.iisc.ernet.in; energy@ces.iisc.ernet.in	
Dr. Soumya K Ghosh	Professor School of Information Technology Indian Institute of Technology, Kharagpur 721302, India Phone : 91-3222-282332 / 281440 Email : skg@iitkgp.ac.in ; skgkgp@gmail.com	

<p>Mr. Mahesh Reddy</p>	<p>General Manager – Technical Services Intergraph SG&I India Pvt. Ltd. 1st Floor, V.V.S.Crest, Road#4, Banjara Hills Hyderabad, Telangana, 500072 India M: +91 9849045107 Email: mahesh.reddy@intergraph.com</p>	
<p>Prof. N L Sarda</p>	<p>Computer Science & Engg. Department IIT Bombay +91-9820120045 E Mail: nls@cse.iitb.ac.in</p>	
<p>Dr. Valli Manickam</p>	<p>Professor and Area Chairperson, Environment Area. Centre for Energy, Environment, Urban Governance and Infrastructure Development Administrative Staff College of India, Bella Vista, Raj Bhavan Road, Hyderabad 500 082. Email: vallim@asci.org.in</p>	
<p>Mr. Ramesh S Hooda</p>	<p>Chief Scientist Haryana Space Applications Centre (HARSAC) CCS Haryana Agricultural University Campus, Hisar 125 004 Email: hoodars@yahoo.com</p>	
<p>Mr. Raghu Ganeshan</p>	<p>President Avineon India Private Ltd Cyber Gateway, Block 'A' 1st floor, HITEC City, Madhapur, Hyderabad – 500 081. Telangana, Andhra Pradesh. INDIA Mob +91-98495 47778 Email: rganeshan@avineonindia.com</p>	

<p>Dr. K S Rajan</p>	<p>Head, Lab for Spatial Informatics, Associate Professor, International Institute of Information Technology Gachibowli, Hyderabad 500032, Andhra Pradesh, India Tel: (+91-40)6653 1276 E-mail: rajan@iiit.ac.in</p>	
<p>Mr. H Hemanth Kumar</p>	<p>Fellow & PI - NRDMS & KSSDI Karnataka State Council for Science & Technology (KSCST), Indian Institute of Science, Bangalore 560 012, India. 09845707380 Email:hemanth@kscst.iisc.ernet.in</p>	



Mr. P S Acharya

Head (TWF)/ CEO (NSDI)/
Associate Head (NRDMS-NSDI)/ and
Coordinator (MMGA)
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Shri PS Acharya has been working as a Scientist G and Associate Head in the Natural Resources Data Management System (NRDMS) Division of DST, Government of India. He is also the Chief Executive Officer of the National Spatial Data Infrastructure (NSDI). With the launching of NSDI in 2001, he has been actively involved with DST's Geospatial Interoperability initiative leading to the development of a Geography Markup Language (GML) prototype for a real-life topographic sheet from Survey of India using specifications from Open Geo-spatial Consortium (OGC). Shri Acharya has been the Co-chair of the NSDI Working Group on "Interoperability & Data Sharing" that oversees the testing and adoption of Open GIS standards in various SDI initiatives in the country. His areas of activities in DST include District level Enterprise GIS, Geospatial Interoperability & applications; Geo-web services; Workflow Management; Ontology/ Geo-semantic Web; Geo-visualisation; and capacity building in Geo-informatics.

Shri Acharya is also currently heading the newly set up Technology Watch & Foresight Division in DST that is overseeing a collaborative initiative on Electric Mobility with the Department of Heavy Industries. He is coordinating the MHRD-Most Grand Alliance Initiative. He is originally a Masters in Physics from Utkal University, Bhubaneswar and subsequently received M.Sc. in 'Geo-Information Science and Earth Observation' with specialization in Geo-Information Management from ITC, The Netherlands.



Dr. M Prithviraj

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Dr. M. Prithviraj, Scientist F / Director in the Department of Science and Technology, Government of India, New Delhi is currently on deputation to the Karnataka State Council for Science and Technology (KSCST) since May 2010 as its Executive Secretary.

Dr. M. Prithviraj, a Margine Geologist by training, taught in the Department of Marine Geology at Mangalore University from 1981 – 1984. He then joined the Centre for Earth Science Studies, Trivandrum in 1984 and worked on Near Inner-shelf sediments, beach and near shore sediment dynamics of South-Central Kerala and the Lakshadweep Islands. In 1991 he joined the Department of Space as a Scientist at Regional Remote Sensing Service Centre at Kharagpur where he developed several in-house research projects related to satellite applications for geomorphologic and coastal zone mapping and monitoring, as well as participated in the National Missions of ISRO viz. the Integrated Mission for Sustainable Development (IMSD) and Natural Resource Information System (NRIS) programmes. In 1998 he joined the Department of Science and Technology, and was associated with the Natural Resources Database Management System (NRDMS) Program, where he evolved sub-programs on Coastal Zone Management and Conservation, Ground water modeling and Promotion of SAR Interferometry. Later he got involved in the coordination of the Earth System Sciences Program. Dr. M. Prithviraj has to his credit several national and international publications and has participated in several symposia both in India and abroad and presented papers. He is on several committees at the national level.



Dr. T V Ramachandra

Energy & Wetlands Research Group, Center for Ecological Sciences [CES]
Centre for Sustainable Technologies (astra)
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Dr. T.V. Ramachandra, FIE, FIEE(UK) obtained Ph.D. in Ecology and Energy from Indian Institute of Science. At present, Coordinator of Energy and Wetlands Research Group (EWRG), Convener of Environmental Information System (ENVIS) at Centre for Ecological Sciences (CES). During the past twenty years he has established an active school of research in the area of energy and environment (<http://ces.iisc.ernet.in/energy>). He is a member of Karnataka State Audit Advisory Committee (2014-16) and member of Karnataka State Pollution Control Board Technical committee (Biodiversity). He was a Member of Karnataka State level Environment Expert Appraisal Committee (2007-2010), appointed by the Ministry of Environment and Forests, Government of India and a member of Western Ghats task force appointed by the Government of Karnataka. He is a recipient of Energy Legend (2011, 2014), Energy Engineer (international, 2009) of Association of Energy Engineers (USA), Johny Biosphere Award for Ecology and Environment (2004) and Satish Dhawan Young Scientist Award, 2007 of Karnataka State Government.

He is an Elected Fellow of the Institution of Electrical Engineers (IEE, UK; 2005), Indian Association of Hydrologists (India; 2006), Institution of Engineers (IE, India; 2003), and a Senior Member, IEEE (USA; 2000) and Association of Energy Engineers (USA; 2000), National Institute of Ecology (2011).

He has published over 220 research papers in reputed peer reviewed international and national journals, 40 book chapters, 202 papers in the international and national symposiums as well as 15 books.



Dr. Soumya K Ghosh

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Soumya K Ghosh is a Professor in the School of Information Technology, Indian Institute of Technology, Kharagpur, India. He received the MTech and PhD degrees in Computer Science and Engineering from the Indian Institute of Technology (IIT) Kharagpur, India. Prior to joining IIT Kharagpur, he worked for Indian Space Research Organization in the area of Satellite Remote Sensing and GIS. His research interests include cloud computing, spatial web services, spatial information retrieval and knowledge discovery. He has published over 100 research articles in referred international journals and conference proceedings. He is a member of ACM and IEEE



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Mahesh Reddy has extensive experience of working in the field of Remote Sensing, Desktop GIS & Enterprise GIS solutions. His 20 years of experience ranges from Remote Sensing, GIS, Photogrammetry, Enterprise GIS, LIDAR, training various clients in Intergraph/ERDAS/LPS/LIDAR technologies, Pre-Sales and Technical-Marketing of ERDAS/LPS/Apollo Products. He has attended 35-40 conferences and workshops; He has given guest lectures at more than 30 places.

Training Skills:

Mahesh Reddy is a qualified ERDAS Authorized Instructor in teaching Image Processing, GIS, and Photogrammetry in the country and abroad. He was one of the 34 instructors in the World Authorized by ERDAS Inc. USA to teach ERDAS (Geographic Imaging Software) according to ERDAS certified style.

Job Profile:

As General Manager for Technical services for India and Asia, managing a team of 18 support/pre-sales/technical Engineers in India. Responsible for all technical services like product training, pre-sales Demos, benchmarks, project consultancy & support services for Intergraph products.



Prof. N L Sarda
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Dr. Nandlal L. Sarda is an Emeritus Fellow (Professor) in the Department of Computer Science and Engineering at IIT Bombay. He received his Master's (M.Tech.) and PhD degrees from IIT Bombay, and joined as faculty at IIT Bombay, where he is teaching since 1972. He was a Visiting Associate Professor at University of New Brunswick, Canada from 1986 to 88. He was Head of the Computer Science & Engineering Department at IIT Bombay from 1994 to 1997. He was also Head of Shailesh J. Mehta School of Management from Aug. 2006 till Feb. 2007.

He was Dean of Academic Programs, IIT Bombay, from October 2001 to September 2004.. In this capacity, he coordinated with IIT's Senate and its various Academic departments for creating, revising, operationalizing and supervising IIT's academic programmes.

He served as Professor-in-Charge of Innovation and Entrepreneurship, from October 2004 to Feb. 2006, in which role he coordinated with the Society for Innovation and Entrepreneurship (SINE) hosted by IIT Bombay to encourage and actively facilitate IITB's faculty and students to convert intellectual property developed by them into business ventures. He has set up an Advanced Geospatial Information Science and Engineering (GISE) Research Lab (www.gise.cse.iitb.ac.in) at IIT Bombay to focus on computer science related aspects of geospatial applications.



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Environment Area, CEEUGID
ASCI, Hyderabad, INDIA

Dr. Valli Manickam, is a Ph.D with Masters in both Computer Applications and Sciences, with over ten years of teaching experience in the field of environmental science (to post graduate students). Prior to joining ASCI, she has worked at Centre for Atmospheric Sciences and Weather Modification and at Centre for Environment, Jawaharlal Nehru Technological University, Hyderabad. She has executed a DST Women Scientist Project for Lake Remediation technologies.

Dr. Manickam has developed software for the automation of the water and wastewater treatment systems and has also designed and developed a database for storage of the data during cloud seeding operations. She has worked for a number of environmental projects and activities which include environmental impact assessment study for taking up industrial or tourism activity, study of lakes in and around Hyderabad, study of pollution in surface and ground waters, review of environmental statements, risk assessment, common effluent treatment plants, air pollution assessment studies, weather modification operations. Dr. Valli has conducted training programs in ASCI for IFS officers in the area of Natural Resource Management, Environmental Indicators and Environmental Economics besides organizing three international conferences and three workshops. She has coauthored four books in the field of environment on Environmental Impact assessment, Analytical Chemistry, C for Environmental Engineers, Climate Change and Weather Modification Technologies. She has published and presented several papers in various international conferences and journals. She is presently executing projects sponsored by MoEF, UNDP and NPC.



Dr. K S Rajan
Head, Lab for Spatial Informatics,
Associate Professor,
International Institute of Information Technology
Gachibowli, Hyderabad. INDIA

Dr. KS Rajan is an Associate Professor at IIT, Hyderabad and leads the institute's Lab for Spatial Informatics (LSI). Dr. Rajan is a multi-disciplinarian, with major interests in Geo-Spatial Technologies - GIS and Remote Sensing; Land use modelling and Environmental Policy.

He has taken a key interest in the areas that overlap computer science and geospatial technologies and through his research works has helped focus on bridging this gap be it in developing spatio-temporal data mining algorithms; Spatio-temporal big data analytics; Web-based Geospatial technologies; or New algorithms to help convert satellite imagery to useful satellite based thematic products. He is also an active proponent of OpenSource in India and for Geospatial technologies in particular. His Lab released two Open Source tools - LSIViewer and VRGeo.in and actively contribute to a few more.

While in environmental modelling, work includes the integration through analysis of the multi-disciplinary fields of science and engineering and agent based modeling of the Human-Land-Water-Energy linkages with Ecosystem wide understanding and their interactions for impact studies and national and global level policy initiatives. He is an awardee of the Indian National Geospatial Award 2013 from Indian Society of Remote Sensing. He has handled more than 20 projects (from both Government and Industry), has over 100 publications in Books, Journals and Conferences and given more than 60 invited talks in a range of topics/domains.



Mr. H Hemanth Kumar

Fellow & PI - NRDMS & KSSDI

Karnataka State Council for Science & Technology (KSCST),

Indian Institute of Science,

Bangalore, INDIA

Shri H Hemanth Kumar is serving in Karnataka State Council for Science & Technology since 1985 as Fellow and has post graduate degree in Civil Engineering.

His areas of interest include resource planning using Geospatial technologies, Spatial Data Infrastructure, Watersheds and Minor irrigation tanks, Alternate Building Technologies and e-governance. Presently heading the Karnataka Natural Data Management Systems (NRDMS) program and State Spatial Data Infrastructure project in the Council. As Principal Investigator investigated more than 20 projects.

He has published more than twenty Conference Papers and several popular lectures in National/State conferences and several reports. He is member of a number of Expert/Technical Committees including the committee of NBA, DBT, Kerala, Uttarakhand, J&K, & Haryana Govt. Spatial data Infrastructure, BBMP, MHRD, UAS – Bangalore and organized/coordinated several national workshops/events.

His expertise in Geospatial Technologies is being utilized by several States and Universities in the implementation geospatial technologies for governance.

Annexure III: Tunisian Delegates

NAME	ORGANIZATION	PHOTO
<p>Prof. Mohamed Rached Bousemma</p>	<p>University of Tunis El Manar, Ecole nationale d'ingenieursde Tunis/Remote Sensing and GIS lab BP 37, LE BELVEDERE 1002 TUNIS, TUNISIA E-mail: mrboussema@gnet.tn</p>	
<p>Dr. Riadh Tebourbi</p>	<p>University of Carthage Ecole Superieure des telecommunications de Tunis, Cite Technologique des Communications, Route De Raued Km 3,5 2083 El Ghazala Ariana, Tunisia E-mail: ter216@gmail.com</p>	
<p>Prof. Sami Faiz</p>	<p>University of Manouba, institute Superieur des Arts multimedia de la Manouba, Campus Universitaire 2010, La Manouba, Tunisia E-mail: sami.fiaz@insat.rnu.tn</p>	
<p>Prof. Riadh Abdelfattah</p>	<p>University of Carthage Ecole Superieure ds telecommunication de Tunis, Cite Technologique des Communications, Rote de Raoued Km 3,5 2083 El Ghazala Ariana Tunisia E-mail: riadh.abdelfattah@supcom.rnu.tn</p>	
<p>Mrs. Chahed Thouraya Sahli</p>	<p>National Mapping and Remote Sensing Centre BP.200, 1080 Tunis Cedex, Tunisia E-mail: t_sahil@yahoo.fr, cnct@defense.tn Telephone (office): +216 71 76 13 33 Mobile Telephone: +216 22 63 83 55</p>	
<p>Dr. Tounis Kais</p>	<p>National Mapping and Remote Sensing Centre. BP.200, 1080 Tunis Cedex, Tunisia. E-mail: cnct@defense.tn</p>	



Prof. Mohamed Rached Bousemma
University of Tunis EI Manar, Ecole nationale
d'ingenieurs de Tunis/Remote Sensing and GIS lab
BP 37, LE BELVEDERE 1002 TUNIS, TUNISIA

Prof. Mohamed Rached Bousemma is a professor at the University of Tunis EI Manar (The National faculty of Engineers of Tunis) since 1999, has got doctorate in Geosciences in the year 1994. Also specialized in Engineering geodetic Sciences at ENSG Paris, DEA Mathematical Statistics at University of Paris.

After obtaining a degree in Mathematics in 1974 and the Bachelor degree in Mathematics in 1978, he passed the examination for ENSG study in Paris (France), where he got an engineering degree in 1979 and doctor engineer degree in 1981, both in Geodetic sciences. Meanwhile, he obtained a Master degree in Mathematical Statistics from the Pierre and Marie Curie University in 1980. After his return to Tunisia in 1981, he obtained a research professor position at ENIT (University of Tunis El Manar). In 1994, he obtained his Ph.D. at the Faculty of Sciences of Tunis.

In 1990, he created the Laboratory for Remote Sensing and GIS at ENIT. His main research activities are in the field of geomatics. He is more specialized in remote sensing and GIS. He has supervised more than thirty PhD and master dissertations. He has published over 160 publications.



Dr. Riadh Tebourbi
University of Carthage Ecole Superieure
des telecommunications de Tunis,
Cite Technologique Communications

Tébourbi Riadh was born in Tunis, Tunisia in 1969. He received the Electrical Engineering Degree from ENSAIS (National School of Engineering of Strasbourg, France) in June 1993. In September 1994, he obtained the Master of photonics and image from the ENSPS (National School of Engineering Physics in Strasbourg France).

He gained his PhD thesis from ENIT (National School of Engineering Sciences of Tunis) in 2003 under the supervising of Prof. Mohamed Rached Boussema. He participated too many research projects like the Flaubert project (Flood in Arid Units by Earth Remote Sensing Techniques), financed by the European commission on the valuation of the surface modes of flow of water in semi-arid areas by radar remote sensing. He also participated to GIS project on the cartography of the health hazards in the area of Gafsa, financed by WHO (the World Health Organization).

Actually he is an assistant professor in GIS/ IT development at High School of Telecommunication of Tunis. His work research focuses on 3-D reconstruction from stereoscopic images, Content-based image retrieval (CBIR) and image segmentation.



Prof. Sami Faiz

University of Manouba, institute Superieur
des Arts multimedia de la Manouba,
Campus Universitaire 2010, La Manouba, Tunisia

Sami FAIZ is a PhD in Computer Science from the «Laboratoire de Recherche en Informatique» of Orsay University (Paris 11). He is actually Professor in Computer Science at the Higher Institute of Multimedia Arts of Manouba and member of the Laboratory of Remote Sensing and Spatial Information Systems. He published more than 100 papers in specialized conferences and journals. He’s also the author of three books in the framework of GIS. Professor Sami FAIZ is a scientific and organizing member of various international conferences. He’s also the founder of many national and international projects in Geomatics.

The GIS has proven its efficiency by solving a countless number of spatial decision problems, rising from various application domains. Thanks to these solving capabilities, the GIS is becoming increasingly popular and widespread. However, the future of the GIS is full of challenges.

These examples, among many others, clearly show how much GIS is useful and flexible in dealing with other domains. However, some limitations are to be underlined when handling some complex and hard analysis of tasks to provide the best decision.

Some sophisticated analysis necessitates advanced functionalities as:

- Generation of efficient solutions for loading and routing problems.
- Finding ways and channels of lower costs in complex networks.
- Capacity optimization of antennas in telecommunication networks.
- Fragmentation and packaging of data in networks.

Under such circumstances, using solely GIS does not provide satisfactory solutions. In fact, it becomes unable to meet the high expectations of the fast growing of GIS community. In order to face this challenge, efforts have been devoted to obtain satisfactory solutions. Since, August 2014, she is Vice President of the University of Carthage, in charge of research coordination and international cooperation.



Prof. Riadh Abdelfattah

University of Carthage Ecole Superieure ds
telecommunication de Tunis,
Cite Technologique des Communications,
Rote de Raoued Km 3,5 2083 El Ghazala Ariana Tunisia

Riadh Abdelfattah received the engineer degree from the “École Supérieure des Postes et des Télécommunications” (Actually, SUP’COM), Tunis, Tunisia in 1995, then the M.S. Degree (DEA) and the the Ph.D degree in Electrical Engineering from the “École Nationale Ingénieurs de Tunis”, in 1995 and 2000 respectively.

Between 2000 and 2002 he was a postdoctoral researcher at the “Ecole Nationale des Télécommunications”, Paris, France, consecutively at the department TSI and then at the department COMELEC. Dr Abdelfattah is presently Professor at the Higher School of Communications for engineers at the University of Carthage in Tunisia and Associate Researcher at the Department ITI at Telecom-Bretagne, the “Institut de Telecom”, Brest, France. He is a senior member of the IEEE and was a member of the Executive Committee of the IEEE Tunisia Section (2013-2014). He has authored and co-authored more than 60 journal papers, conference papers and book chapter. He was a principal investigator (PI) and co-PI for more than 15 international research projects. His main research interests include interferometric radar imaging, multitemporal and multiscale image analysis, desertification, flooding and soil salinity mapping using remote sensed data.



Mrs. Chahed Thouraya Sahli
 National Mapping and Remote Sensing Centre
 BP.200, 1080 Tunis Cedex, Tunisia
 E-mail: t_sahil@yahoo.fr, cnct@defense.tn

Mrs. Chahed is an Agricultural Engineer, Specialised in water conservation and soil-Forest Mastery in Imaging, Remote sensing & computer mapping.

PROFESSIONAL EXPERIENCE

- 1991–2000** **Master in Laboratory Remote Sensing** National remote Sensing Centre (CNCT) specialised in Remote Sensing, GIS and mapping in Agriculture and environment.
- 2000 –2003** Responsible of the communication and training in the CNCT
- 2003 –2009** **Assistant Technologist ISET Nabeul** - Higher Institute of Technological Studies Nabeul- Geomatics and Topography
- 2009 –actual** Responsible of Research and Space in CNCT - Space Affairs Section.



Dr. Tounis Kais
 National Mapping and Remote Sensing Centre.
 BP.200, 1080 Tunis Cedex, Tunisia.

Mr Kais Tounsi received his Master’s degree (M.Sc) in Geo-Ecology (Speciality: Pedology, Hydrology, Hydrogeology, GIS and Remote Sensing) at the technical university of Freiberg (Germany). He is working since 2007 as Geographical Standards Department Head in the National Centre for Mapping and Remote Sensing (Tunisia).

He has experience of teaching in the field of Remote Sensing and GIS at the Geology department-Faculty of Sciences of Tunis and at the Regional Commission of Agricultural Development of Tunisia.

Mr. Tounsi has developed script for the automation of the spatial data quality control and has developed a geographical database for the navigation.