Dr. B. Babu Madhavan

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Babu's entrepreneurial skills have been instrumental in the development of several research projects. He has nearly 20 years' experience in Remote Sensing and GIS fields. He has a rich experience in promoting several hazard mapping projects as well as software research projects relating to 3D modelling, image processing and GIS. For the last 7 years he has been functioning in a variety of senior management roles for the Tokyo based PASCO and more recently as the President and CEO of its Indian operations based at Chennai. Prior to this he had completed a 3 year post-doctoral fellowship at Keio University (SFC), Japan followed by a two year stint with Japanese Government on IT projects also based in Tokyo. In all these roles he has been actively involved in the development of diverse image processing, computer vision (3D) techniques and policy suitable for geomatics industries and disaster management.

In addition to the research activities, Babu has also been involved in several researches and technical as well as business proposals for TerraSAR satellite, Lidar mapping projects, 3D textured modelling, GIS for Highways inventory, taxation, mapping, and GPS technology for vehicle tracking. Most of these proposals have been composed for World Bank and JICA projects.

Babu's research interests include Digital Image Processing, Computer vision, 3D modelling, data fusion, and developing software systems for high-resolution digital remote sensing data processing. He has more than 75 research publications and remains in touch with research academia by chairing and attending conferences. Notably he has chaired Computer Graphics and Imaging (CGIM) conference held at USA and International Symposium on Digital Earth (ISDE-J) in Japan.

Babu is a peer reviewer for the International Journal of Remote Sensing (IJRS-UK), Canadian Journal of Remote Sensing and other national journals. He was awarded the Japanese Monbusho scholarship and Japan Society for the Promotion of Science (JSPS) fellowship to carry out two significant post-doctoral research projects in the field of geomatics. He also serves as the Regional Correspondent (Japan) with the Geomatics International Magazine- GIM (The Netherlands).

Babu received his Ph.D. (1996) from the Indian Institute of Technology-Bombay, Mumbai, India with specialisation in x band SAR data application. He received his Masters' Degree in Remote Sensing (1990) from the College of Engineering, Anna University, Chennai, India.

Babu is a member of Japan Society for Promotion of Science (JSPS), Japan Society for Photogrammetry and Remote Sensing (JSPRS) and, Association for Real-time Imaging and Dynamic Analysis (ARIDA).

CV available on Request to babu@squ.edu.om/ b.babumadhavan@gmail.com

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1. **Detail of experience:**

Current Position - **Senior Research Scientist**- Remote Sensing and GIS Center, Sultan Qaboos University, Sultanate of Oman

a) Japan:

1. 11/2005 to 8/2010-*PASCO Corporation-Japan & India*- **Director**
2. 11/2004-10/2005- **General Manager**- PASCO Corporation, **Japan**
3. 7/2002 to 10/2004-**Manager**- PASCO Corporation, **Japan**
4. 4/2000 to 6/2002-*Softopia Japan* **Senior Research Engineer**
5. 4/1997-3/2000-*Geoinformatics Lab. Keio University- Japan*- **JSPS Postdoc fellow**

b) ***India:***

5/1990-3/1997- *Indian Institute of Technology-Bombay* -**Senior Research Associate**

2. Research results and professional accomplishments:-

- Published several research papers ***(More than 70)*** in many refereed international journals (11) and conferences.
- Refereed International Journal Publications= 13 nos.
- International Conference Publications=30 nos.
- National Conference Publications – India=5 nos.
- Invited Seminars=12 nos.
- Books/Special Volume Articles=8 nos.
- Four Japanese patents (2 awarded 2 pending) in the GIS and image processing fields.
- Software copy rights -5 nos

3. Nature of Work:-

1. Airborne Lidar, Digital sensor surveying proposals,
2. GIS application project promotion, Business proposal.
3. Research guidance for 3D Building modelling, image processing, Data Fusion and GIS
4. Software Development projects-Automated 3D Building modelling software, digital Air-photo Image processing software, GIS applications development.

4. Project Promotions:-

1) GIS mapping projects for Hazard Mapping (WorldBank/JICA)
2) Lidar mapping for Road Inventory Systems
3) Snow Avalanche Mapping
4) Tsunami Hazard Mapping
5) 3D urban modeling
6) Mineral Exploration

5. Professional Achievements:-

a). Fellowships/Awards/Membership:

(i) JSPS Post-doctoral Fellowship (Japan)-4/99 to 3/00
(ii) Monbusho Scholarship-Government of Japan- 4/97 to 3/99
(iii) GATE Scholarship- Government of India-6/88 to 3/90
(iv) Member-Japan Society of Photogrammetry and Remote Sensing (JSPRS) 2003

b). Referee:

1. International Journal of Remote Sensing (UK)
2. Journal for Pattern Analysis and Applications Journal, UK.
3. SCI (Systemics, Cybernetics and Informatics) –USA.
4. Regional Correspondent (Japan)- GIM International The Netherlands
5. Canadian Journal of Remote Sensing-Canada

c). Total number of Membership in Professional Societies: 06

- Indian Society of Geomatics (since 2005)
- Indo-Japan ICT forum (Since 2002)
- Japanese Society for Photogrammetry & Remote Sensing (Since 2002)
- Association for Real-time Imaging and Dynamic Analysis (ARIDA) (Since 2000)
- Softopia Japan Foundation (since 2000)
- Japan Society for Promotion of Science (since 1998)

6. Research Publications:-

a) Refereed International Journal Publications:

1) Pilar Casals-Carrasco, Marc Ventura, Valery Gond, **Babu Madhavan, B**, Joan Pretus and Jordi Catalan (2009). A Spectral approach to land cover classification in remote mountain lake areas (Advances in Limnology, Volume 62) **ISBN 978-3-510-47064-8.** http://www.schweizerbart.de/publications/detail/isbn/9783510470648/Patterns-and-factors-of-biota-distribution-in-remote-European-lakes
2) **Babu Madhavan**, **B**., Sasagawa, T., Tachibana, K, and Mishra, K. K. (2005) A High-level Data Fusion and Spatial Modelling System for High-resolution Airborne Digital Sensor Data, International Journal of Remote Sensing, Volume 27, Issue 16 August 2006 , pages 3571 – 3591.
3) **Babu Madhavan, B**., Hideki Tanahashi, Caihua Wang, Kazuhiko Yamamoto, Yoshinori Niwa, T. Sasagawa and K. Tachibana (2005). Computer Vision based approach for 3D building modelling of airborne Laser Scanner data, **Computers, Environment and Urban Systems** Volume Vol. 30, No.1, PP 54-77.
4) **Babu Madhavan, B.**, Sachio Kubo, Naoko Kurisaki, and TVLN Siva Kumar (2000). Appraising the anatomy and spatial growth of the Bangkok Metropolitan area using a Vegetation-Impervious-Soil model through remote sensing, International Journal of Remote Sensing, Vol. 22, No. 5, pp 789 - 806.
5) Pilar Casals-Carrasco, Sachio Kubo, and **Babu Madhavan, B**. (2000). Application of Spectral Mixture Analysis for Terrain Evaluation Studies, International Journal of Remote Sensing, Vol. 21, No. 16, pp 3039 – 3055.
6) Venkataraman, G., **Babu Madhavan**, **B.**, Ratha, D. S., Joju P. Antony, Goyal, R. S., Banglani, S and Sinha Roy, S, (2000). Spatial Modelling for Base metal mineral exploration through integration of Geological data sets, Natural Resources Research, V.9, No.1, pp 27-42. http://www.kluweronline.com/issn/1520-7439
7) Krishna Mohan, B., **Babu Madhavan, B.**, and Udyan Das Gupta. (2000) Integration of IRS-1A L2 data by Fuzzy logic approaches for land use classification, International Journal of Remote Sensing, Vol. 21, No.8, pp. 1709-1738.
8) **Babu Madhavan, B**., Venkataraman, G., Krishna Mohan, B., and Shah, S. D., (1999). Airborne SAR and IRS-1A LISS II data interpretation of Coastal Geomorphology in Godavari Delta, India. Geocarto International. Vol.14, No.2, pp. 51-59.www.geocarto.com.hk/cgi-bin/pages/june99/airborne.pdf
9) **Babu Madhavan, B.**, Sachio Kubo, and Nobuya W (1998). Development of Large-scale Digital Orthophotographs from Balloon-Borne Aerial Photos of Archaeological ruins in Angkor, Cambodia, Indian J. Geography, India, 73 (1), pp 23-34.

10) **Babu Madhavan, B**., Venkataraman, G., Krishna Mohan, B., and Shah, S. D., (1997). Revealing the geology of the Great Nicobar Island, Indian Ocean, by the interpretation of Airborne Synthetic Aperture Radar images - International Journal of Remote Sensing, Vol. 18, No.13, and pp. 2723-2742.
11) Venkataraman, G., **Babu Madhavan, B**., Ratha, D. S., and Banglani, S., (1997). Integration of geological and geophysical data for the identification of sulphide mineralised zones in Rajpura-Dariba Belt, Rajasthan - International Journal of Remote Sensing, Vol.18, No.6, and pp. 1221-1232.
12) **Babu Madhavan, B**., and Khire, M. V., (1992). Land use/land cover appraisal using air-borne SAR images vis-à-vis IRS 1A,LISS II image-a case study from Godavari delta, India. Asian-Pacific Remote Sensing Journal, Bangkok, Thailand. Vol. 5, No.1, pp.17-24.

b). International Conference Publications:

1. B. Babu Madhavan, K. K. Mishra. T. Sasagawa, H.Shimamua, K. Tachibana, 2008. GIS Utilization for e-Government, International conference on Intelligent system for Rural development - Insyder 2008 Aug 28-30, 2008, Arunai Engineering College, Velu Nagar, Tiruvannamalai, India.
2. B.P Sah, S.Senthil, **B. Babu Madhavan** and Jaeyoung CHOI. (2008)Geographic Information System based Decision Support System for the Transportation Planning in Maseru, Lesotho, Africa. The 21st EAROPH World Congress and Mayors' Caucus、October 21to 24, 2008 Himeji Hyogo 670-8501 Japan Website :http://www.earoph2008.jp
3. A.Alagammai, J.Deepa, T. Anitha, **B. Babu Madhavan**, T. Sasagawa, K. Tachibana H.Shimamura (2008) PASCO INDO – Road Inventory System ESRI Ninth User Conference – 22nd-23rd Jan,2008 New Delhi India.
4. **B. Babu Madhavan**, R. Sathya K. Tachibana, T. Sasagawa, K.K. Mishra (2007)-A High-resolution Airborne Digital Sensor Data Fusion and Spatial Modelling, MapMiddleEast, Dubai, April 9-11.
5. **B. Babu Madhavan,** K. Tachibana, T. Sasagawa - (2007)-CADASTRAL ADMINISTRATION SYSTEM MapMiddleEast, Dubai, April 9-11.
6. **B. Babu Madhavan**, T. Sasagawa, K. Tachibana H.Shimamura S. Senthil, V. Sai Sudha(2007)-Automated construction of 3D building Models of urban area from Digital surface models, MapMiddleEast, Dubai, April 9-11, 2007-03-23
7. **B. Babu Madhavan**, S. Senthil, V. Sai Sudha K. Tachibana, T. Sasagawa (2007)-AUTOMATED DEM GENERATION FROM MULTISPECTRAL IMAGES AND DSM DATA. MapMiddleEast, Dubai, April 9-11, 2007-03-23
8. **B. Babu Madhavan**, S. Senthil, V. Sai Sudha K. Tachibana, T. Sasagawa (2007)-Automated construction of 3D building Models of urban area from LiDAR Digital surface models -Mapworld Forum, January 22-25, 2007 Hyderabad
9. **B. Babu Madhavan**, S. Senthil, V. Sai Sudha K. Tachibana, T. Sasagawa (2007)-Very High-resolution Airborne Digital Sensor Data Fusion and Spatial Modelling-Mapworld Forum, January 22-25, 2007 Hyderabad.
10. ***B. Babu Madhavan, H. Miura***, ***T. Yanuma***, ***Y. Sumikawa***, ***M. Kondo***, ***T. Hatori***, ***B. P. Sah***, -(2006) TSUNAMI ANALYSIS AID GIS SYSTEM-ISPRS TC-IV/International symposium on"Geospatial Databases for Sustainable Development" Gao, India 2006/9
11. **B. Babu Madhavan**-Sensors for Hazard Mapping-Invited Seminar-Digital Earth- ISPRS TC-IV/International symposium on"Geospatial Databases for Sustainable Development" Gao, India 2006/9
12. *Yan Li , Peng Gong ,* ***MB. Babu*** (2005) AUTOMATED 3D BUILDING GEOMETRICAL MODELING FROM DSM International Symposium on Spatio-temporal Modeling, Spatial Reasoning, Analysis, Data Mining and Data Fusion, 27-29, Aug. 2005, Peking University, China.
13. J. Herrmann. Tadashi Sasakawa, **B. Babu Madhavan** (2005) **Commercial Exploitation of TERRASAR-X**
    56th International Astronautical Congress of the International Astronautical Federation, the

International Academy of Astronautics, and the International Institute of Space Law, Fukuoka, Japan, Oct. 17-21, 2005

14. **Babu Madhavan, B**., and Tadashi Sasagawa (2004). Automatic surface modelling of DSM data for 3D building models- Inter University Seminar on Association for Real-time Imaging and Dynamic Analysis (ARIDA), Tokyo University, November 09, 2004, Japan.
15. **Babu Madhavan, B**., Tadashi Sasagawa, and Kikuo Tachibana (2004). A high-level fusion method to fuse disparate high-resolution airborne sensor data for change-detection application. 4th International Symposium on Digital Earth, 28-31 March 2005, Keio University, Japan *)*.
16. **Babu Madhavan, B**., Tadashi Sasagawa, Kikuo Tachibana, and H. Koike (2004). AIRBORNE IMAGES PROCESSING AND MODELLING BY PASCO PROCESSOR & MODELLER (PPM): A New Computer Vision based ImageProcessing and Modelling Environment for High-resolution Airborne Digital Images, Map Asia 2004-Builiding Asia: Enabling g-Lateral Ties, GIS-Development (India) and Chinese Academy of Surveying and Mapping (CASM), Beijing, China.
17. **Babu Madhavan, B**., Tadashi Sasagawa, and Kikuo Tachibana (2004). Automatic 3D modelling of DSM through stable planar region extraction, *Japan Society of Photogrammetry and Remote Annual academic Conference-2004. June 17-18, 2004, Tokyo, Japan*,pp 145-148.
18. **Babu Madhavan, B**., Kikuo Tachibana, and Tadashi Sasagawa (2004). Automatic extraction of Shadow regions in High-resolution ADS40 images - By Robust Approach of Feature Spaces analysis*,* International Society for Photogrammetry and Remote Sensing- ISPRS 2004 Conference to be held in Istanbul, Turkey between July 12 and 21, 2004, pp 808-810. http://www.isprs.org/istanbul2004/comm3/papers/379.pdf
19. Atsumasa Ozawa, **Babu Madhavan**, **B.**, Kikuo Tachibana and Tadashi Sasagawa (2004). Airborne Hyperspectral and Thermal Information for Assessing the Heat Island in Hiroshima - International Society for Photogrammetry and Remote Sensing- ISPRS 2004 Conference to be held in Istanbul, Turkey between July 12 and 21, 2004, pp. 44-48. http://www.isprs.org/istanbul2004/comm7/papers/9.pdf.
20. Sasagawa, T., **Babu Madhavan**, **B**., Ozawa, A., and Tachibana, K (2004).Capability for Data Fusion by Airborne Sensing- International Society for Photogrammetry and Remote Sensing-ISPRS 2004 Conference to be held in Istanbul, Turkey between July 12 and 21, 2004, pp. 901-905. www.isprs.org/istanbul2004/comm3/papers/379.pdf
21. Pilar Casals-Carrasco, Jordi Catalan, Valery Gond,and **Babu Madhavan, B** (2003). Landsat-TM spectral signatures evaluation to model landscape attributes of mountain lake catchments. SPIE conference on Remote Sensing-2003, SPIE—The International Society for Optical Engineering, 8–12 September 2003, Barcelona, Spain.
22. Tadashi Sasagawa, Kikuo Tachibana, Yumiko Fukuzawa, Tohru Yotsumata, and **Babu Madhavan, B**., (2003). Image Capturing and Visualization by ADS40, 6th Conference on Optical 3-DMeasurement Techniques- Ed. A. Grun and H. Kahman, ISBN 3-906467-43-0, Zurich, Switzerland, pp322-324.
23. **Babu Madhavan, B**., Tadashi Sasagawa, Kikuo Tachibana, Yumiko Fukuzawa, and Tohru Yotsumata (2003). High Resolution off-nadir ADS 40 Images for 3D Building Texture Modelling, *Japan Society of Photogrammetry and Remote Annual academic Conference-2003. June 12-13, 2003, Tokyo, Japan*, pp145-148.
24. **Babu Madhavan, B**., Hideki Tanahashi, Caihua Wang, Kazuhiko Yamamoto, and Yoshinori Niwa (2002). Vision based 3D City Modelling by using Airborne Laser scanner data for Urban GIS, *Proceedings Map India 2002*, Centre for Spatial Database Management and Solutions (CSDMS), New Delhi, India, pp 267-270. www.gisdevelopment.net/application/urban/products/urbanp0007.htm
25. **Babu Madhavan, B**., Hideki Tanahashi, Caihua Wang, Kazuhiko Yamamoto, and Yoshinori Niwa (2002). Stereo Omni directional vision System for multimedia urban GIS, *Proceedings Map India 2002*, Centre for Spatial Database Management and Solutions (CSDMS), New Delhi, India, pp 279-280. http://www.gisdevelopment.net/technology/gis/techgi0046.htm
26. **Babu Madhavan, B**., (2001). Vision based 3D City Modelling by using ALS and SOS images 2nd Workshop on HOIP, Softopia Japan, Japan. Nov.8-9, 2001.
27. **Babu Madhavan, B**., Hideki Tanahashi, Caihua Wang, Kazuhiko Yamamoto, and Yoshinori Niwa (2001). Multimedia Urban GIS using Stereo Omni directional System-SOS- Presented at the

International seminar on new development in digital photogrammetry, Association for Real-time Imaging and Dynamic Analysis (ARIDA), Gifu, September 24-26, 2001, Japan.

28. **Babu Madhavan, B**., Hideki Tanahashi, Caihua Wang, Kazuhiko Yamamoto, and Yoshinori Niwa (2000). Induction of a real-time omni directional, stereoimages acquisition system for virtual environment application. Proc. Computer Graphics and Imaging (CGIM)-2000, International Association of Science and Technology for Development (IASTED), ISBN: 0-88986-310-5, Ed.: M. H. Hamza. Pp.83-86. http://www.hoip.jp/pdf/i001119b.pdf
29. **Babu Madhavan, B**., Hideki Tanahashi, Caihua Wang, Kazuhiko Yamamoto, and Yoshinori Niwa (2000). Development of Building Objects Information Systems by using 2D data from SOS. IP-IIS Joint Conference Dec.1, 2000, Keio K2 Town Campus, Kawasaki, Japan, IP-00-1~8, IIS-00-40~47, pp 43-46.
30. **Babu Madhavan, B**., Caihua Wang, Hideki Tanahashi, Kazuhiko Yamamoto, and Yoshinori Niwa (2000). SOS-Image processing and Application. 1st Workshop on HOIP, Softopia Japan, Japan. Nov.7-8, 2000.
31. Sachio Kubo, **Babu Madhavan, B**. and Kiyoshi Niitsu(1997). Comparison of Heat Island Phenomena in Asian Mega Cities, Biometeorology and Urban Climatology at the Turn of the Millennium", 8 - 12 November, 1999, Sydney, Australia.
32. Babu Madhavan, B. and Sachio Kubo, (1997). A multisensor approach to identify the effects of urban heat islands. Ed. T. Ichinose, Monitoring and Management of Urban Heat Island, Keio University (SFC), Japan. pp. 220-241.

c). <u>Conference Publications – India</u> *<u>(1990-1996)</u>*:

1. Bhattacharya, A., <u>Babu Madhavan, B</u>., and Krishna Murthy R (1990), SAR data analysis for geological application in south Andaman and Godavari Delta. *National Seminar on Microwave Remote Sensing Applications and New Sensors Available at National Remote Sensing Agency and Space Application Centre Dept. Space, October, 1990, Hyderabad,India.*
2. Murthy, M. V. R., <u>Babu Madhavan, B</u>., and Krishna Mohan, B. (1991), Evaluation of coral systems through Remote Sensing - A case study in Nicobar Islands, India. *Proc. 12th ACRS, Singapore, November 1991*, pp Q1-1 to Q1-6. www.gisdevelopment.net/aars/acrs/1991/psq/ps2001pf.htm
3. <u>Babu Madhavan, B</u>., Venkataraman, G. and Krishna Mohan, B., (1994), SAR data analysis for coastal morphology of Godavari Delta, Andhra Pradesh, India – *Proc. 15th Asian Conference on Remote Sensing (*ACRS*), Vol.II, 1994,* Bangalore, India*,* pp. J3-1 - J3-6.
4. Inamdar, A. B., and <u>Babu Madhavan, B</u>., (1995), Environmental status study in and around Keshlog, Himachal Pradesh - A land use/ land cover analysis through Remote Sensing. *Proceedings of Symposium on Remote Sensing for Environmental Monitoring and management with special emphasis on hill regions, A-Joint ISRS-NNRMS publication, Department of Space, Govt.of India, Dehra Dun, India*, pp. 391.
5. Venkataraman, G., <u>Babu Madhavan, B</u>., and Ratha, D. S., (1996), Spatial modelling of sulphide mineral exploration through integration of geological data sets. *Proceedings of National symposium on Remote Sensing for Natural Resources with special emphasis on water management, 4-6 December, University of Pune, India, Indian Society of Remote Sensing*, pp149-150.

d). <u>Invited Seminar</u>:

1. Airborne High Resolution Sensors for Hazard mapping-Training of Trainers Course on Disaster Risk Management: Chennai, India Worldbank program seminar Cross – Regional University Collaboration, September 25-29, 2007. (http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/CMUDLP/0,,contentMDK:21476076~pagePK:64156158~piPK:64152884~theSitePK:461754,00.html#ohter_materials)
2. Sensors for hazard mapping and vulnerability assessment -National Meet on 'Indian Ocean Tsunami – Its Impact Assessment and Lessons for Future' held on 5 June 2006 in the Anna University Campus.
3. Sensor for Hazard mapping and Vulnerability Assessment in Digital Asia Applications-ISPRS International symposium on Geospatial data bases for sustainable development, September 27-30 2006 Goa India

4. Automatic surface modelling of DSM data for 3D building models- Association for Real-time Imaging and Dynamic Analysis (ARIDA), Tokyo University, November 09, 2004, Japan.
5. Development of Automatic approaches for textured 3D building model construction (*International Institute for Earth System Science, Nanjing University, P.R. China-Feb 2004)*
6. Construction of 3D building models from Digital Surface Model (DSM) data (*International Institute for Earth System Science, Nanjing University, P.R. China-Feb 2004)*
7. Urban 3D GIS (15/November/2002), Japan International Cooperation Agency (JICA), GIS Plaza, Tokyo.
8. Vision based 3D City Modelling by using ALS and SOS images (12/2001). Geographic Information Analysis Research Division, Geography & Crustal Dynamics Research Center, Geographical Survey Institute (GSI), Tsukuba-shi, Ibaraki-ken, Japan.
9. Problems and probable solution in the extraction and integration of building edges from aerial images and laser scanned elevation data for 3-D urban GIS modelling (7/2000). Softopia Japan, Japan.
10. Towards digital Archaeology (3/2000). Centre of Excellence, Keio University, Japan.
11. Appraising the anatomy and spatial growth of Bangkok metro by using V.I.S Model through Remote Sensing (7/1998). Graduate school of Environmental Information, Keio University, Japan
12. A multisensor approach to identify the effects of urban heat islands in Bangkok, Thailand (11/1997, Graduate school of Environmental Information, Keio University, Japan).

e). Books/Special Volume Articles:

1. July 2005, Volume 19, Issue 7 > Digital Earth Facing Challenges B. Babu Madhavan, regional correspondent, GIM International, Japan http://www.gim-international.com/issues/articles/id503-Digital_Earth_Facing_Challenges.html.
2. July 2005, Volume 19, Issue 7 Digital Earth: Global Citizens of a Truly Global Society- GIM International Interviews Prof. Dr Hiromichi Fukui by B. Babu Madhavan.
3. Turning Research into Practical Solutions: GIM International Interviews Dr Tadashi Sasagawa, director,PASCO Corporation. B.B. Madhavan Geomatics Info Magazine, Vol.19, No.9, 2005
4. G. Venkataraman, G., B.Babu Madhavan, D.S. Ratha, S. Sinha Roy, S.Banglani and R.S. Goyal, (1997). Spatial Modelling for sulfide mineral exploration through integration of geological Data sets - *Remote Sensing for Natural Resources*, A joint Publication Indian Society of Remote Sensing & National Natural Resources Management System (NNRMS) Bulletin, pp. 375-388.
5. Venkataraman, G., Babu Madhavan, B., and Ratha, D. S., (1996), Integration of geological data sets and spatial modelling for basemetal exploration in Rajpura-Dariba region, Rajasthan. *Remote Sensing Applications,* Ed. M. G. Srinivas, Narosa Publishing House, New Delhi, ISBN 81-7319-404-1, pp439-448.
6. Venkataraman, G., Babu Madhavan, B. and Ratha, D. S., (1995). Integrated approach for the interpretation of sulphide mineralised zones in Rajpura-Dariba Belt, Rajasthan. *Remote Sensing for Natural Resources*-A joint Publication Indian Society of Remote Sensing & National Natural Resources Management System (NNRMS) Bulletin, No 15, pp. 38-43.
7. G. Venkataraman, B. Babu Madhavan, D. S. Ratha, A.K. Chattopadhyay and S. Banglani, (1994). Integrated approach for the interpretation of anomalies related to sulfide mineralised zones in Rajpura-Dariba belt, Rajasthan – *Remote Sensing and Geographical Information Systems for Environmental planning*. Ed. I. V. Muralikrishna, Tata McGraw-Hill Publishing Company Ltd., New Delhi, India, pp 690-694.
8. B. Babu Madhavan, G. Venkataraman and A.B. Inamdar, (1992). Airborne Synthetic Aperture Radar Data for structural, Geologic, Landform and Lithologic mapping. *Remote Sensing Applications and Geographic Information Systems-Recent Trends*, Ed. I.V. Muralikrishna, Tata McGraw-Hill Publishing Company Limited, New Delhi, India, pp 55-59.