Resume of
Prof. Anupam Basu ***FNAE***

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1. Name: Anupam Basu

2. Present Responsibility

Chairman
Center for Educational Technology,
&
Professor, Dept. of Computer Science & Engineering
Indian Institute of Technology, Kharagpur

3. Address with telephone/Fax/Email:

(i) Official: Professor
Dept. of Computer Science & Engineering
Indian Institute of Technology, Kharagpur
Kharagpur, 721302, India
Tel: (03222)-283462
Fax: (03222)-255303
Cell: +91-9434017654
Email:anupambas@gmail.com

(ii) Residential: A-82, I.I.T. Campus
Kharagpur, 721302, India
Tel: (03222)-283463

4. Date of Birth: July 01, 1957

5. Administrative Positions held:

- **Chairman, Educational Technology, IIT Kharagpur** (2014 till date):

The position entails the complete responsibility towards,
- Distance outreach educational programs of IIT Kharagpur
- Coordination of National level projects on Education and Pedagogy (NPTEL programs and Pedagogical training programs to Engineering college teachers, countrywide)
- Coordination of MOOC courses –preparation, dissemination and training
- Leading the TEQIP programs for Engineering teachers on Technology Enabled Education

- **Director,Society for Natural Language Technology Research** (SNLTR), Kolkata, a Multi-Institute Research Organization for Language Technology Research, Dept. of IT, GoWB, (2009 – present)

    - The responsibility at SNLTR is to lead and **co-ordinate research** both in-house as well as through collaboration with other institutes like **Jadavpur University, Indian Statistical Institute, BESU, Calcutta University** and others in the area of Language Technology development for localization with an aim to more meaningful e-governance.

    - **Responsible for**
        - **empowering the different departments of the GoWB, with local language based e-governance.**
        - **Enabling the schools and colleges with localization tools for using computers**

    - **Coordination with theGovt. of India for Technology Development Mission in Indian Languages**

    - The responsibility also includes making SNLTR self sustaining and to enthuse language and linguistics students into allied technology research and to the area of Natural Language Processing in general.

- **Research Director,** Media Lab Asia program, IIT Kharagpur Hub (2002-2009)

The Media Lab Asia Research hub at IIT Kharagpur was focused on development of technology and field deployment in the area of assistive technology (technology that empowers the physically challenged), intelligent interfaces for more natural use of computers and computer enabled rural education. Though the hub was at IIT Kharagpur, co-ordination with other institutes and NGOs was a major challenge besides research and development. Several successful deployments at the grass-root level resulted.

- **Head of the Department of Computer Science & Engineering**, IIT Kharagpur (2004 – 2007)

- **Head of the Computer & Informatics Center**, IIT Kharagpur (2002-2004)
  The task was to provide complete computational and internet infrastructural support to the institute 24 X 7.

- **Member, Research Program Evaluation Committee**, IIT Kharagpur (2005-2008)

6. Academic and Scientific Positions held:

Sl. No.	Period	Place of Employment	Designation
1.	May 1999 till date	I.I.T. Kharagpur	Professor
2.	May 1998-May 1999	University of California Irvine	Visiting Professor
3.	May 1997 to April 1998	University of Dortmund Germany	Humboldt Fellow
4.	Jan. 1996 to April 1999	I.I.T. Kharagpur	Associate Professor
5.	March 1989 to July 1992	University of Guelph, Ontario, Canada	Visiting Professor
6.	Feb. 1989 to Dec. 1995	I.I.T. Kharagpur	Assistant Professor
7.	July 1984 to Jan. 1989	I.I.T. Kharagpur	Lecturer
8.	July 1982 to June 1984	Webel Computers Ltd.	Systems Engineer (R&D)

7. Academic Qualifications (Bachelor's Degree Onwards):

Sl. No.	Degree	Subject	Class/ Marks	Year	University	Additional Particulars
1.	Ph.D.	Computer Science & Engineering Title of Thesis: CONEX: An Expert System Structure for Control System Design and Analysis		1988	I.I.T. Kharagpur	Thesis adjudged excellent
2.	M.E.	Computer Engineering	1st Class 85%	1982	Jadavpur University	Ranked 2ndin CS specializati on, 3rd overall
3.	B.E.	Electronics and Tele-communication Engineering	1st Class 84%	1980	Jadavpur University	Ranked4th

8. Recent Professional Contributions and Involvements:

- **Program Advisory Committee Member, SERB, of the Department of Science & Technology,** Govt. of India (2007 –till date)
- **Technical Advisory Board Memberof Microsoft Research**, India.(2006- 2012)
- **Technical Advisor**, Indian Institute of Cerebral Palsy (2006- till date)
- **Research Advisor, TCS Innovation Lab** (2011 to present)
- **Advisor, West Bengal Education Network (WB-EN)**
- **PRSG Member (Technology Development for Indian Languages), Ministry of Communication and Information Technology**, Govt. of India (2008-till date)
- **Member Technical Advisory Board (Technology Development for the Visually Impaired),** Ministry of Communication and Information Technology, Govt. of India (2007-till date)
- **Advisory Member** of the Social Development & Community Affair Sub-Committee for Eastern India of the **Confederation of Indian Industry** (2007-08)
- **Advisory Member (Science & Technology R&D Mission**) – Ministry of Social Justice and Empowerment, Govt. of India (2006-2009)
- **Member Technical Advisory Board,** National Institute of Mentally Handicapped (2006-2008)
- **Technical Advisory Board Member** of Media Lab Asia

9. Teaching Areas:

Basics: Programming and Data Structure
Systems: Computer Architecture, Operating Systems, Embedded Systems
Special Interest: Artificial Intelligence, Intelligent Systems, Cognitive Science

10. Research

a) Areas:

- Natural Interface Design &Human Computer Interaction
  - Cognitive Modeling
  - Natural Language Processing
  - Communication and Education Tools for the Physically Challenged
    - Sign Languages
    - Iconic Modes of Communication
    - Access Mechanisms and Adaptive interfaces

- Embedded Systems
  - Design Issues
  - Tools for Assistive Devices

- ICT for Development
  - Education Tools for the Underprivileged Children andfor Children with Learning Disability

b) A Summary of Research Contributions in Assistive Technology:

See Annexure II

c) Students:

See Annexure III

11. Awards and Honours:

i. State Award for Best Innovator for the Physically Challenged Community, Govt. of West Bengal, 2014

ii. NCPEDP-MPhasis Universal Design Award 2011, for contributions in design for the disabled, by National Council for Promotion of Employment of Disabled Persons, India

iii. National Award for Technology Development for Empowering Persons with Disability 2007, Ministry of Social Justice and Youth Empowerment

iv. Da Vinci Award, Engineering Society of Detroit and Multiple Sclerosis Society of Michigan, for the technology for communication by the speech impaired and people with cerebral palsy, 2004.

v. Fellow of Indian National Academy of Engineering, 2000

vi. International Research Affiliate, Center for Embedded Computing Systems, University of California, Irvine, USA, 1999 for contributions in Embedded Systems

vii. Humboldt Fellowship , Alexander von Humboldt Stiftung, Germany, 1997, for the nominee's works in Embedded Systems.

viii. Jaycee Award for Outstanding Persons, Calcutta Chamber of Commerce, 1996, for research on Assistive Devices for the Physically Handicapped.

ix. Young Scientist Award, Dept. of Science & Technology, Govt. of India, 1992, for R&D towards devices for visually handicapped.

12.List of Research Publications: Peer reviewed Journals and Conferences : 239

For details: Please see **Annexure I**

Books: 4
Int. Journals: 75
Int. Conferences: 160

Citations : 1914 as of date according to Google Scholar
h-index: 19

13.Significant Recent Projects Led: (Period 2002-2014)

- Aakash Application Development Laboratory, Ministry of Human Resource Development, 2013 – date, Rs 70 Lakhs
- Digital Contents for the Print Impaired Students, MHRD, 2010-12 (Pilot) 53 Lakhs
- An Open Source Web Browser for Blind People Ministry of Communication and Information Technology, Govt. of India, Rs. 29.94 Lakhs;
- Development of Bangla Linux and Standardized Bangla Keyboard, Society for Natural Language Technology Research, Rs. 15.0 Lakhs;
- Development of Multimedia Hardware-Software system for the Education of Students with Cerebral Palsy and Communication, Ministry of Social Justice and Empowerment GoI, Rs. 17.00 Lakhs
- Natural Language (Indian) and voice enabled communication system for the physically challenged, MHRD
- Shruti: Embedded Text to Speech Systems for Indian Languages (Client: Media Lab Asia, Value: 74.00 Lakhs;
- Sanyog: A Communication System for the Speech Impaired and Children with Cerebral Palsy Phase I and II, Media Lab Asia, Value: 160.00 Lakhs;
- A Low cost Off line Internet Access System for Rural Schools, Media Lab Asia, Value: 75.00 Lakhs;
- Multimodal Participatory Tutoring System for Rural Schools, Media Lab Asia, Value: 24.00 Lakhs;
- Named Entity Recognition, Microsoft Research Inc., Value: 10.00 Lakhs

14.Patents and Copyrights obtained:

- Title: Method and Apparatus for augmenting computational grids with data parallel execution on network edge; Patent ID:32/MUM/2014

- Title: Method and System for Identifying a sensor to be deployed in a Physical Environment Patent ID: 816/MUM/2014

- Title: A Multimodal System and Method facilitating Gesture Creation through Scalar and Vector , Application number PCT/IN2013/000139, Indian Application - 805/MUM/2012

- Title: A Method for Embedding and Multiplexing Audio Metadata in a Broadcasted Analog Video Stream Pub. No.: WO/2013/105116, International Application No.: PCT/IN2012/000859, Indian Application - 3702/MUM/2011

- System for an Intuitive, Customizable, Multilingual and Reconfigurable Augmentative Communication, Patent No.: 233682

- Title: Generating Spatial Proximity Model in Accordance with a User's Feedaback, Copyright

- Title: Bharati Braille Transcription System, Copyright

- Title: Sparsha Transliteration System, Copyright

- Title: SparshaChitra : Tool for integrating diagrams in Braille Coded Material, Copyright

References:

- Prof. K.L. Chopra(Padmashri)
  Honorary Professor,IITD,IITBN;BESU and ITM
  Chairman ,BoG ,BBIT and HDF -SoM
  (Former Director, Indian Institute of Technology, Kharagpur)
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Annexure I

Books:

T.Dasgupta and Anupam Basu, **Indian Sign Language Machine Translation and Lexical Data Acquisition,** LAMBERT Academic Publishing, Feb. 2013

Anupam Basu, T. Dasgupta and S. Banerjee, **ভাষা প্রযুক্তি পরিচয়** (Language Technology: an Introduction – in Bengali), SNLTR Pub, 2012

Srabona Mitra, Anirban Lahiri and Anupam Basu, **Battery-Aware Multiprocessor Task Scheduling,** LAMBERT Academic Publishing, April, 2012

Soumyajit Dey, Anupam Basu, **Embedded Architectures for Speech and Machine Learning: A Design Space Exploration Approach,** LAMBERT Academic Publishing, 2010

Journals

1. Tirthankar Dasgupta, Manjira Sinha, and Anupam Basu, "Development of Applications to Enhance Entertainment and Social Interaction Opportunities for People with Cerebral Palsy in India", Journal of Assistive Technology (Taylor & Francis), to appear.

2. Tirthankar Dasgupta, Manjira Sinha, and Anupam Basu, "Development of a web browsing interface for people with severe speech and motor impairment", Journal of Universal Access in the Information Society (UAIS), Springer, to appear.

3. Tirthankar Dasgupta and Anupam Basu, "Empirical Experiments to Study Compositionality in Bangla Compound Verbs", Journal of Language Resource and Evaluation (LREV), Springer, to appear.

4. Tirthankar Dasgupta, Manjira Sinha, and Anupam Basu, "Computational Modelling of Morphological Effects in Bangla Visual Word Recognition", Journal of Psycholinguistic Research (JOPR), DOI:10.1007/s10936-014-9302-x.

5. Tirthankar Dasgupta, Manjira Sinha and Anupam Basu, "Resource Creation and Development of an English-Bangla Back Transliteration System", International Journal of Knowledge- Based and Intelligent Engineering Systems (KES), IOS Press, 2015, (Accepted).

6. Tirthankar Dasgupta, and Anupam Basu, “Computational Models of the Lexical Representation of Bangla Compound Words in the Mental Lexicon”, Journal of Psycholinguistic Research (JOPR), Springer, 2015, (Accepted).

7. Manjira Sinha and Anupam Basu, “A Study of Readability of Texts in Bangla through Machine Learning Approaches”, International Journal of Education and Information Technologies (EAIT), Springer, 2014, (Accepted).

8. Sanjay Chatterji, Tanaya Mukherjee Sarkar, PragatiDhang, Samhita Deb, SudeshnaSarkar, JayshreeChakraborty, Anupam Basu, "A dependency annotation scheme for Bangla treebank" In Language Resources and Evaluation, Springer, pp. 1-35, 2014

9. Biswajit Das, SandipanMandal, PabitraMitra, Anupam Basu, “Aging Speech Recognition with Speaker Adaptation Techniques: Study on Medium Vocabulary Continuous Bengali Speech”, Pattern Recognition Letters,34(3) pp. 335-343 (2013)

10. Debatri Chatterjee, Aniruddha Sinha, Arpan Pal, Anupam Basu**, “**An Iterative Methodolgy to Improve TV Onscreen Keyboard Layout Design through Evaluation of User Studies”, Advances in Computing, Vol.2 No.5, 2012, pp. 81-91

11. B. Das, S. Mandal,P.Mitra and Anupam Basu, “ Effect of Aging on Speech Features and Phoneme Recognition: A Study on Bengali Voicing Vowels”, International Journal of Speech Technology, pp. 1-13, 2012.

12. Soumyajit Dey, Dipankar Sarkar and Anupam Basu "A Kleene Algebra of Tagged System Actors for Reasoning about Heterogeneous Embedded Systems” in IEEE Transaction on Computers (accepted, early access preprint available at http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6216352)

13. Soumyajit Dey, D.Sarkar and Anupam Basu, “A Kleene Algebra of Tagged System Actors”, IEEE Embedded Systems Letters, Vol.3, No.1, March 2011, pp. 28-31

14. Soumyajit Dey, Praveen Rokkam and Anupam Basu, “Modeling and Analysis of Embedded Multimedia Applications using Colored Petri Nets”, InternationalJournal of Modeling, Simulation, and Scientific Computing (IJMSSC), Vol.2, No. 2, 2011, World Scientific, pp. 169-193

15. Bhattacharya, S., Samanta, D. & Basu, Anupam, “Model-based Design of Scanning Input Communication Aids: State of the Art and Research Issues”. International Journal of Computers and Applications (IJCA). ACTA Press, 32(3), pp. 290-296.

16. Bhowmick P. K., Basu A. and Mitra P. Do we agree? Measuring agreement on the human judgements in emotion annotation of news sentences, Journal of Cybernetics and Systems, 41 (7),469-488

17. Soumyajit Dey, Dipankar Sarkar, Anupam Basu "A Tag Machine based Performance Evaluation Method for Job-Shop Schedules", *IEEE TCAD, vol 29(7), pp 1028-1041, 2010* . Digital Object Identifier : 10.1109/TCAD.2010.2049067.

18. TirthankarDasgupta, Anupam Basu and PabitraMitra, "A Framework for the Automatic Generation of Indian Sign Language", *Journal of Intelligent Systems* (JIS), 2010, Vol 19, no. 2, pp-125-144

19. Bhowmick P. K., Basu A., Mitra P. and Prasad A. (2010). Sentence level news emotion analysis in fuzzy multi-label classification framework, Special issue on Natural Language Processing and its Applications: Research in Computing Science, vol. 46, pp. 143–154.

20. Bhowmick P. K., Sarkar S. and Basu A. (2010). Ontology based user modeling for personalized information access, Special issue on Web Semantics & Ontology-I: International Journal of Computer Science & Applications, vol. 7, no. 1, pp. 1–22.

21. Bhowmick P. K., Roy D., Sarkar S. and Basu A. (2010). A framework for manual ontology engineering for management of learning material repository, Special issue on Web Semantics & Ontology-II: International Journal of Computer Science & Applications, vol. 7, no. 2, pp. 30–51.

22. Bhattacharya, S. and Basu, A. (2010). "Design of a Word to Sentence Generator for Augmentative Communication". International Journal of Computers and Applications (IJCA). ACTA Press, 32(1), pp. 73-83.

23. C.Misra, B.Bhattacharya and Anupam Basu, "A New Framework to Preserve Tagore Songs", Int. Journal of World Digital Libraries, WDL, TERI, pp. 63-72, 2010

24. S. Chakrabarty, D.Roy, Anupam Basu, "Development of Knowledge Based Intelligent Tutoring System", in Advanced Knowledge Based Systems, TMRF e-Book Series, P S. Sajja and R. Akerkar eds., pp.74-100, 2010

25. Mukherjee, A**.**, Choudhury, M., Basu, A., and Ganguly, N. (2009). Self-organization of the Sound Inventories: Analysis and Synthesis of the Occurrence and Co-occurrence Networks of Consonants, *Journal of Quantitative Linguistics,* 16(2), 157—184.

26. Tirthankar Dasgupta and Anupam Basu, "Automatic Transliteration of Indian Language Text to Braille for the Visually Challenged in India", *Information Technology in Developing Countries, International Federation for Information Processing* (IFIP), 2009, Volume 19, Number 3, pp-11-18.

27. Bhowmick P. K., Basu A. and Mitra P. (2009). Reader perspective emotion analysis in text through ensemble based multi-Label classification framework, Computer and

Information Science, vol. 2, no. 4, pp. 64–74.

28. Bhattacharya, S. and Basu, A. (2009). “Design of an Iconic Communication Aid for the Individuals with Speech and Motor Impairments in India”. Assistive Technology (AT), Taylor and Francis, 21(4), pp 173-187.

29. Mukherjee, A., Chakraborty, K., and Basu, A.(2008). SweepSticks - An Adaptive Virtual Mouse for People with Neuro-Motor Disorders, *Assistive Technology Journal of the Rehabilitation Engineering Society of North America*, **20**(2), 111—124.

30. Mukherjee, A., Choudhury, M., Roy Chowdhury, S., Basu, A., and Ganguly, N. (2008). Rediscovering the Co-occurrence Principles of the Vowel Inventories: A Complex Network Approach, *Advances in Complex Systems*, **11**(3), 371—392.

31. Bhattacharya, S., Basu, A. & Samanta, D. (2008). *Computational Modeling of User Errors for the Design of Virtual Scanning Keyboards*. IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol 16, issue 4, pp. 400-409.

32. Bhattacharya, S.,Samanta, D. & Basu, A. (2008). *User Errors on Scanning Keyboards: Empirical Study, Model and Design Principles*. Interacting with Computers (IWC), Elsevier press. vol. 20, issue 3, pp. 406-418.

33. Bhattacharya, S., Basu, A. & Samanta, D. (2008). *Performance Models for Automatic Evaluation of Virtual Scanning Keyboards*. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 16(5), pp. 510-519.

34. Bhattacharya S., Sarkar S., & Basu A. (2007), Sanyog: A Speech Enabled Communication System for the Speech Impaired and People with Multiple Disorders. Journal of Technology in Human Services (JTHS). PA: Haworth Press. Vol. 25, Issue-(1/2), pp. 177-180

35. Mukherjee A., Choudhury M., Basu A. and Ganguly N. (2007). Modeling the Co-occurrence Principles of Consonant Inventories: A Complex Network Approach. *International Journal of Modern Physics C*,18(2), 281--295.

36. Prodip Bhowal, Dipankar Sarkar, Siddhartha Mukhopadhyay, Anupam Basu, Fault diagnosis in discrete time hybrid systems - A case study. Inf. Sci. 177(5): 1290-1308 (2007)

37. Choudhury M.,Basu A. and Sarkar S. Multi-agent Simulation of Emergence of the Schwa Deletion Pattern in Hindi. *Journal of Artificial Societies and Social Simulation* 9(2). (2006) <http://jasss.soc.surrey.ac.uk/9/2/2.html>

38. Mukhopadhyay A., Chakraborty S., Choudhury M., Lahiri A., Dey S. and Basu A.

(2006). Shruti - An Embedded Text-to-Speech System for Indian Languages. *IEE Proceedings on Software Engineering*, 153 (2): 75-79, April 2006

39. Lahiri A., Basu A., Choudhury M. and Mitra S., Battery Aware Power Savings. *Electronics Systems and Software Magazine*, IET, April/May 2006.

40. U. Deshpande, A. Gupta, and A. Basu, “Performance Enhancement of a Contract Net Protocol Based System through Instance Based Learning", Communicated to *IEEE Transactions on Systems, Man, and Cybernetics, Part B – Cybernetics*, Vol. 35, No. 2, April 2005, pp. 345-358.

41. U. Deshpande, A. Gupta, and A. Basu, “Multi-agent Modeling and Fuzzy Task Assignment for Real-Time Operation in a Supply Chain”, Multi-agent Based Supply Chain Management (Edited Book, Editors – B. Chaibdraa, J.P. Muller) published by Springer, Berlin, in 2005.

42. U. Deshpande, A. Gupta, and A. Basu, “Task Assignment with Imprecise Information for Real-Time Operation in a Supply Chain", *The Journal ofApplied Soft Computing*, Elsevier Science, Vol. 5, Nov. 2004, pp.101-117.

43. U. Deshpande, A. Gupta, and A. Basu, "Coordinated problem solving through resource sharing in a distributed environment", *IEEE Transactions on Systems, Man, and Cybernetics, Part B - Cybernetics*, Vol. 34, No. 2, April 2004, pp. 1299-1304.

44. Dandapat S., Sarkar S., Basu A.,A Hybrid Model for Part-of-Speech Tagging and its Application to Bengali. International Journal of Information Technology(IJIT) Volume 1 Number 4 2004, pp 169-173.

45. Anupam Basu, “Computer Based Interfaces for People with Special Needs”, Computing and Information Science: Systems and Applications, Narosa Pub. 2003,pp.179-215.

46. U. Deshpande, A. Gupta, and A. Basu, "A distributed hospital resource scheduling system using a multi-agent framework", *IETE Technical Review*, Vol. 18, No. 4, 2001, pp. 263-275.

47. Raj S. Mitra, Anupam Basu: Hardware-Software Partitioning: A Case for Constraint Satisfaction. IEEE Intelligent Systems 15(1): 54-63 (2000)

48. P. Bhowal, R.Mall and A. Basu, “Estimation micro PLC execution time for time critical system design”, *Journal of System Architecture*,Elsevier, Volume 45 (1999), pp.1245-1248.

49. A. Basu, S. Roy, P. Dutta and S.Banerjee, " A PC Based Multi-user Braille Reading System for the Blind Libraries", IEEE Transactions on Rehabilitation Systems, March 1998, pp.60--68.

50. R.S. Mitra and A. Basu, "Knowledge Representation in MICKEY: An Expert System for Designing Microprocessor Based Applications", IEEE Transactions on Systems, Man and Cybernetics Pt. A, vol.27, no.4, July 1997, pp. 467-479.

51. A. Basu, S. Sarkar and A.K.Majumdar, " DOORS: An Object Oriented CAD System for High Level Synthesis", IEE Proceedings on Computers and Digital Techniques, vol.144, no.5, 1997, pp. 331-341.

52. A. Basu, S. Mukhopadhyay and P. Bhowal, " Issues in Hardware Software Co-Design of PLC Based Controllers", in Advances in Nuclear and Allied Instrumentation, Tata McGraw Hill Pub. 1997, pp. 193-199.

53. A.Basu, S. Mukhopadhyay and P. Bhowal, “Specification Acquisition and Validation for Designing Real Time Process Control Systems" in Advances in Nuclear and Allied Instrumentation, Tata McGraw Hill Pub. 1997, pp.200-2004.

54. R. S. Mitra, P.S.Roop, and A. Basu , "A New Algorithm for Implementation of Design Functions by Available Devices", IEEE Transactions on VLSI Systems, Vol.4, No.2, June 1996, pp. 170-180.

55. R.S.Mitra, P.S.Roop, and A. Basu , "An Overview of MICKEY: An Expert System for Automating the Design of Microprocessor Based Systems", SADHANA, Journal of the Indian Academy of Science , Vol.21, Pt.6, December 1996, pp. 719-739.

56. A. Basu ,S. Sarkar, K.A.Rao, A.K.Majumdar, "SRT:A Knowledge Engineering Tool for Scene Recognition", accepted for publication in Journal of Indian Institute of Science , special issue on Intelligent Systems ,Vol. 76, Nov-Dec 1996, pp. 793-812.

57. A. Basu et al, "A Modified Approach to Test Plan Generation for Combinational Logic Blocks", Journal of VLSI Design Vol.4, No.3, 1996, pp.243-256.

58. A.Banerjee, A.K.Majumdar, A. Basu , and J.Nath, "A Fuzzy Expert System Approach for Real Time Monitoring of Endemic Diseases", Information Sciences - Applications , North Holland, Vol. 3, No. 1, pp. 41 - 53, January 1995.

59. R.S. Mitra, and A. Basu, "Design of Microprocessor Based Systems: AKnowledge Based Approach", IEEE Transactions on Industrial Electronics, Vol.41, No.3, June 1994, pp. 532-540.

60. A.Banerjee, A.K.Majumdar, and A. Basu , "A Knowledge Based System using Multiple Expert Modules for Monitoring Leprosy - an endemic disease, IEEE Transactions on Systems, Man & Cybernetics , Vol.24, No.2, pp.173-186, 1994.

61. S. Sarkar, A.K. Majumdar and A. Basu, "Interface Design and Controller Synthesis ofDigital Circuits in Object Oriented Environment", Microprocessors andMicroprogramming , Vol. 40, pp.553-576, 1994, North Holland.

62. A.Banerjee, A.K.Majumdar, and A. Basu , "A Fuzzy Expert System Approach using Multiple Experts for Dynamic Followup of Endemic Diseases" SADHANA, Journal of The Indian Academy of Science (special issue on Expert Systems), Vol.19, Part I, pp. 51-73, 1994.

63. R.S.Mitra and A. Basu,"Design and Redesign of Microprocessor based Application Systems", in Cybernetics and Systems, Jan. 1993, pp.315-321.

64. R.S.Mitra and A. Basu " Synthesis of Microprocessor Based Application Systems" in Innovative Applications of Computing , E.Balaguruswamy eds., pp.253 -260, 1992.

65. T.Wilson, D.K.Banerji, A. Basu , J. Majithia and A.K.Majumdar, "Port Assignment in Multiport Memories for Interconnection Minimization in Datapath Synthesis", in Logic and Architecture Synthesis , North Holland, P. Michel and G. Saucier eds., pp. 59 - 67, 1991.

66. D. K. Banerji, S.Sutarwala, A. K. Majumdar, J.C.Majithia, T.Wilson and A. Basu "High Level Synthesis of DataPaths From a Behavioral Description", International Journal of Computer Aided VLSI Design , vol.3, pp. 367 - 391, 1991.

67. A. Basu , T.C. Wilson, D.K. Banerji, and J.C. Majithia, "Commutative Operand Alignment for Interconnect Optimization in Behavioral Synthesis", International Journal of Electronics , vol.73, no.2, pp.417-431, 1991.

68. T.Nayak, A. K. Majumdar and A. Basu , "VLODS: A VLSI Object Oriented Database System",Information Systems Journa, vol.16, no.1, pp.73-96, 1991.

69. A. Basu , "Expert Systems in Control Engineering : A Review of the Perspective", IETE Technical Review vol.8. no.3, pp.126-137, 1991.

70. A. Basu ,A. K. Majumdar and S.Sinha, "DEXT: An Integrated Knowledge Engineering Environment for Control Engineering Applications", Knowledge Based Systems , vol.4. no.3, pp. 131 -143, 1991.

71. A. Basu ,A. K. Majumdar and S.Sinha, "Design of Industrial Regulators using Expert System Approach", Int. Journal on Systems Science, , vol.22 ,no. 3, pp. 551 - 577, 1991.

72. A. Basu ,T.Nayak and S.Mukherjee, "Design and Simulation of a Parallel Inference Machine Architecture for Rule Based Systems", Data and Knowledge Engineering , North Holland, vol.4, pp. 267-285, 1989.

73. A. Basu ,T.Nayak and S.Mukherjee, "INFLOW: A Parallel Inference Machine Architecture for Rule Based Expert Systems", Computers and Artificial Intelligence, vol.9, no.4, pp. 357-377, 1990.

74. T.K.Nayak, A.K.Majumdar and A. Basu "A Formal Model of Objects for Object Oriented Database System" in Journal of Management of Data Management of Data, World Scientific, pp. 185-193, December, 1989.

75. A. Basu, A.K.Majumdar and S.Sinha, "An Expert System Approach to Control System Design and Analysis", IEEE Trans. on Systems, Man and Cybernetics , vol.18, no.6, 1988, pp.685-694.

Conferences

1. Manjira Sinha,Tirthankar Dasgupta, Anupam Basu, *Text Readability in Hindi: A Comparative Study ofFeature Performances Using Support Vectors*, International Conference on Natural LanguageProcessing (**ICON**), 2014, Goa, India, (Accepted).
2. Tirthankar Dasgupta, Manjira Sinha, Anupam Basu, *Web Browsing Interface for People with SeverSpeech and Motor Impairment in India*, 16*th* International ACM SIGACCESS Conference on Computers andAccessibility(**ASSETS**), 2014, pp:285-286, Rochester, New York.
3. Tirthankar Dasgupta, Manjira Sinha, Anupam Basu, *Development of Accessible Toolset to Enhance SociaInteraction Opportunities for People with Cerebral Palsy in India*, 16*th* International ACM SIGACCESSConference on Computers and Accessibility(**ASSETS**), 2014, pp:249-250, Rochester, New York.
4. Manjira Sinha, Tirthankar Dasgupta, and Anupam Basu, *Inuence of Target Reader Background and Text Features on Text Readability in Bangla: A Computational Approach*, 25th International Conference onComputational Linguistics (**COLING**), 2014,pp:345-354, Dublin, Ireland.
5. Manjira Sinha, Tirthankar Dasgupta, and Anupam Basu, *Design and Development of an On-line Computational Framework to Facilitate Language Comprehension Research on Indian Languages*, 9thInternational Conference on Language Resources and Evaluation (**LREC**), 2014,pp: 203-210, Iceland.

6. ManjiraSinha, TirthankarDasgupta, Surabhi Agrawal, Sneha Jain, Nidhi Bagaria,and AnupamBasu, *Development of Entertainment and Social Interaction Applications to improve Quality-of-Life(QOL) of people with cerebral palsy*, IEEE Technological symposium 2014 , TechSym'14, pp:19-24.
7. Tirthankar Dasgupta, Manjira Sinha, Anupam Basu, *A Joint Source Channel Model for the English toBengali Back Transliteration*, International Conference on Mining Intelligence and Knowledge Exploration (MIKE), 2013.pp. 751-760.
8. Manjira Sinha, Kaustav Rudra, Tirthankar Dasguptaand Anupam Basu, *How Word Order Affects Sentence Comprehension in Bangla: A Computational Approach to Bangla*, International Conference on Mining Intelligence and Knowledge Exploration (MIKE), 2013. pp. 769-779.
9. Mukhopadhyay, S., Dasgupta, T., Sinha, M., and Basu, A. (2012). Automatic extraction of compound verbs from Bangla corpora. 3rd International Workshop on South and South east Asian Natural Language Processing (WSSANLP, 2012) , collocated with COLING, 2012, pp. 153-162.
10. Dasgupta, T., Sinha, M., and Basu, A. (2012). Modelling the organisation and processing of Bangla polymorphemic words in the mental lexicon: A computational approach. 24th International Conference on Computational Linguistics (COLING), 2012, pp. 235-244.
11. Sinha, M., Sharma, S., Dasgupta, T., and Basu A.,. (2012). New readability measures for bangla and hindi texts. Accepted as short paper in the in the 24th International Conference on Computational Linguistics (COLING),2012,pp. 1141-1150.
12. Sinha, M., Jana, A., Dasgupta, T., and Basu, A. (2012). A new semantic lexicon and similarity measure in bangla. Accepted as short paper in the 3rd international workshop on Coginitive Aspects of Lexicon (CogALex, 2012), collocated with COLING, 2012, pp. 171-178.
13. Sinha, M., Dasgupta, T., and Basu A.,. (2012). A complex network analysis of syllables in Bangla through Syllablenet. In GirishNathJha, Kalika Bali, S. L., editor, Workshop on Indian Language and Data: Resources and Evaluation, LREC, pages 131–138.
14. Dasgupta, T., Sinha, M., and Basu, A. (2012). Forward Transliteration of Dzongkha Text to Braille. Accepted as short paper in International Workshop on Advances in Text Input Methods (WTIM, 2012), collocated with COLING, 2012, pp. 97-106.

15. Sibansu Mukhapadyay, Tirthankar Dasguptaand Anupam Basu, *Development of an Online Repository of Bangla Literary Texts and its Ontological Representation for Advance Search Options*, International Conference on Language Resources and Evaluation (**LREC**), Workshop on Indian Language and Data: Resources and Evaluation (WILDRE), 2012.

16. Tirthankar Dasgupta, Aakash Anuj, Manjira Sinha,Ritwika Ghose, Anupam Basu ,(2012), VoiceMail Architecture in Desktop and Mobile Devices for the Blind People. Accepted in the 4th International Conference on Intelligent Human Computer Interaction (IHCI), 2012.

17. DebmalyaSinha, Anupam Basu, (2012). Gardener: A file browser assistant to help users maintaining semantic folder hierarchy. Accepted in the 4th International Conference on Intelligent Human Computer Interaction (IHCI), 2012.

18. DebmalyaSinha, Anupam Basu: Design and Evaluation of a Cognition Aware File Browser for Users in Rural India.PerMIn 2012: 129-136.

19. S. Mandal, B. Das, P. Mitra and Anupam Basu, "A Robust Bengali Continuous Speech Recognition System Using Triphone clustering and Trigram Language Model", 4th International Conference on Contemporary Computing, Vol.168, pp. 556-558, 2011.

20. S.Mandal, B. Das, P.Mitra and Anupam Basu, "An Optimum Text Selection Method to Develop Bengali Speech Corpus for Bengali Phone Recognition System", International Conference on Asian Language Processing (IALP), pp. 268 -271, 2011.

21. Bhowmick P. K., Basu A., Mitra P. (2010). Determining reliability of subjective and multi-label emotion annotation through novel fuzzy agreement measure, in Proceedings of the seventh international conference on Language Resources and Evaluation (LREC '10), Valletta, Malta, May, pp. 1095–1100.

22. Bhowmick P. K., Basu A., Mitra P. and Prasad A. (2010). Sentence level news emotion analysis in fuzzy multi-label classification framework, in Proceedings of 11th International Conference on Intelligent Text Processing and Computational Linguistics (CICLing '10), Iasi, Romania, March.

23. Chakraborty S., Roy, D. and Bhowmick P. K. and Basu A. (2010). An authoring system for developing Intelligent Tutoring System, in Proceedings of IEEE TechSym'10, pp. 196–2005.

24. Soumya V.B., Monojit Choudhury, Kalika Bali, TirthankarDasgupta and Anupam Basu, "Resource Creation for Training and Testing of Transliteration Systems for Indian Languages",*International Conference on Language Resources and Evaluation* (LREC), 2010.

25. Tirthankar Dasgupta, Anupam Basu, Animesh Das and PromotheshMondol, “Design and Evaluation of Bangla Keyboard Layouts”, *IEEE Students’ Technology Symposium* (TechSym), 2010.

26. RitwikaGhosh, Tirthankar Dasgupta, and Anupam Basu, “Architecture of a Web Browser for Visually Handicapped People”, *IEEE Students’ Technology Symposium* (TechSym), 2010.

27. Sumit Das, Anupam Basu, and SudeshnaSarkar, "Discourse Marker Generation and Syntactic Aggregation in Bengali Text Generation", IEEE TechSym'10.

28. Ratnajit Mukherjee, SoumyajitDey, Sumit Das, and Anupam Basu, "An Iconic and keyboard based Communication Tool for People with Multiple Disabilities", IEEE TechSym'10.

29. Choudhury, M., Mukherjee, A., Garg, A., Jalan, V., Basu, A., and Ganguly, N. (2009). Language Diversity across the Consonant Inventories: A Study in the Framework of Complex Networks, *In the proceedings of EACL (09)* workshop on *Cognitive Aspects of Computational Language Acquisition*, Athens, Greece, 51—58.

30. Dasgupta, T., and Basu, A., “Indian Sign Language Machine Translation System for the Deaf People of India", Alternative and Augmentative Communication and Assistive Technologies (AACAT), 2009. pp:44-45.

31. Mukherjee, R., Dey, S. and Basu, A., Embedded Sanyog: a Portable Vernacular Communication Tool for People with Multiple Disabilities, Proceedings of the National Conference on Alternative & Augmentative Communication and Assistive Technologies March 14-15, 2009 Pages: 13-14.

32. Dasgupta, T., and Basu, A., “A Speech Enabled Text to Braille Transliteration System for the Visually Impaired People in India ", International Conference on Information and Communication Technology and Development (ICTD), 2009, pp-201-211.

33. Bhowmick P. K., Basu A., Mitra P. and Prasad A. (2009). Multi-label text classification approach for sentence level news emotion analysis, in Proceedings of the third International Conference on Pattern Recognition and Machine Intelligence (PReMI ’09), LNCS, pp. 261–266.

34. Dasgupta T., Basu A., Bhowmick P. K. and Mitra P.(2009). English to Indian Sign Language machine translation: A structure transfer framework, in Proceedings of Indian International Conference on Artificial Intelligence (IICAI ’09), Bangalore, pp. 2055–2070.

35. Sumit Das, Anupam Basu, and Sudeshna Sarkar, "Syntactic Aggregation in Bengali Text Generation", International Conference on Natural Language Processing (ICON'09), pp. 219-228, December 14-17, 2009.

36. Bhowmick, P.K., Mitra, P. and Basu, A., "An Agreement Measure for Determining Inter-Annotator Reliability of Human Judgements on Affective Text", Proceedings of Workshop on Human Judgements in Computational Linguistics, COLING 2008, Manchester, August 18-24**,** 2008**.** pp: 58-65.

37. Mukherjee, A., Choudhury, M., Basu, A., and Ganguly, N. (2008). Modeling the Structure and Dynamics of the Consonant Inventories: A Complex Network Approach, *In the proceedings of COLING-08*, Manchester, UK, 601—608.

38. Bhowmick, P. K., Mukherjee, A., Banik, A., Mitra, P., and Basu, A. (2008). A Comparative Study of the Properties of Emotional and Non-Emotional Words in the Wordnet: A Complex Network Approach, *In the proceedings of ICON-08*, Pune, India.

39. Bhattacharya, S., Samanta, D. & Basu, A. (2008). *Study and Modeling of User Errors for Virtual Scanning Keyboards Design*. ACM Computer Human Interaction (CHI-08) extended abstracts, Florence, Italy, pp. 3399-3404.

40. Dey, S., Kedia, M., Basu, A, An Approach to Software Performance Evaluation on Customized Embedded Processors. VLSI Design 2008: 111-117. ***Highlighted in EE Times***

41. Dasgupta, T., Basu, A.. 2008. “A Prototype Text-To-Indian sign language machine translation system”. International Conference on Intelligent User Interfaces (IUI), pp. 313-316, Gran Caneria, Spain.

42. Dasgupta, T., Shukla, S., Kumar, S., Jain, S., Basu, A., 2008. “A Multilingual Multimedia Indian Sign Language Dictionary Tool”. International Joint Conference on Natural language Processing (IJCNLP) Workshop on Asian Language Reources (ALR), pp. 57-64, Hyderabad, India.

43. Dasgupta, T., Basu, A. 2008. “A Prototype English-Indian sign language machine translation system”. International Joint Conference on Natural language Processing, Workshop on NLP for less privileged language, pp19-26, Hyderabad, India.

44. Banerjee, P., Garg, G., Mitra, P. and Basu, A., “Application of Triphone Clustering in Acoustic Modelling for Continuous Speech Recognition in Bengali”, In the Proceedings of International Conference of Pattern Recognition, Florida, Dec 2008.

45. Bhattacharyya, T., Chakraborty, S., Basu, A., (2008). Learning the Basics of Programming Language (C) by Adopting an Intelligent Tutoring System with Different Learning Styles. To be published in the proceedings of Technology Enhanced Learning Conference 2008 (TELearn, 2008). Hanoi, Vietnam.

46. Chakraborty, S., Roy, D., Basu, A., (2008). Shikshak: An Architecture for an Intelligent Tutoring System. In the proceedings of International Workshop of Cognitive Aspects in Intelligent and Adaptive Web-based Educational Systems (CIAWES, 2008) held in conjunction with International Conference on Computers in Education, ICCE, 2008. Taipei, Taiwan, pp 24-31.

47. Chakraborty, S., Roy, D., Basu, A., (2008). Semiautomatic Annotation of Test Materials in an ITS Authoring System. In the proceedings of International Workshop of Cognitive Aspects in Intelligent and Adaptive Web-based Educational Systems (CIAWES, 2008) held in conjunction with International Conference on Computers in Education, ICCE, 2008. Taipei, Taiwan, pp. 32-39.

48. U. Deshpande, A. Gupta, and A. Basu, "Adaptive Problem Solving among Business Organizations through Flexible Resource Allocation", 14th International Conference on Advanced Computing and Communications (ADCOM-2006), NITK, Surathkal, Karnataka, India, 2006, pp. 382-387.

49. Choudhury M., Jalan V., Sarkar S. andBasu A.(2007). Evolution optimization and language change: the case of Bengali verb inflections. In the *Proceedings of ACL SIGMORPHON9*. Prague, Czech Republic. pp 65-74.

50. Mukherjee A., Choudhury M., Basu A.and Ganguly N. (2007). Emergence of community structures in vowel inventories: an analysis based on .complex networks. In the *Proceedings of ACL SIGMORPHON9*. Prague, Czech Republic. pp 101-108.

51. Mukherjee A., Choudhury M., Basu A.and Ganguly N. (2007). Redundancy ratio: an invariant property of the consonant inventories of the world's languages. In the *Proceedings of the ACL'07*. Prague, Czech Republic. pp 104-111.

52. Dandapat S., Sarkar S. and Basu A(2007)**.** Automatic Part-of-Speech Tagging for Bengali: An approach for Morphologically Rich Languages in a Poor Resource Scenario. In *Proceedings of the Association of Computational Linguistics (ACL 2007),* Prague, Czech Republic.

53. Dey S., Kedia M., Agarwal N. andBasu A. (2007). Architectural Optimizations for Text to Speech Synthesis in Embedded Systems", 12th Asia and South Pacific Design Automation Conference (ASPDAC), 2007.

54. Dey S., Kedia M. andBasu A.(2007). Embedded Support Vector Machine: Architectural Enhancements and Evaluation", 20th International Conference on VLSI Design and 6th International Conference on Embedded Systems, 2007.

55. Choudhury M., Thomas M., Mukherjee A**.,** Basu A.and Ganguly N. (2007). How difficult is it to develop a perfect spell-checker a cross-linguistic analysis through complex network approach. In Proceedings of HLT-NAACL Workshop - Text Graphs2. Rochester, NY, USA, pp 81 - 88. <*http://*arxiv.org/abs/physics/*0703198*>

56. Choudhury M., Saraf R., Jain V., Sarkar S. andBasu A. (2007) Investigation and Modeling of the Structure of Texting Language. In *Proceedings of the IJCAI-07 Workshop on Analytics of Noisy Unstructured Text Data (AND07)* Hyderabad, India, pp 63 - 70 [Best Paper]

57. Gupta A., Mukherjee A., Chakraborty S. and Basu A**.** (2007). Mapping Graphical User Interfaces to Scanning Mechanisms: A Fuzzy Approach, *To appear in the proceedings of AACC(07),* Kathmandu, Nepal.

58. Bhattacharya, S., Basu, A. and Samanta, D. (2007). "Performance Models for VirtualScanning Keyboards: Reducing User Involvement in the Design," IEEE/ACM int. conf.on Information and Communication Technologies and Development (ICTD), Bangalore, India, pp. 193-200.

59. Chakraborty S., Bhattacharya T., Bhowmick P. K., Basu A. and Sarkar S. (2007). Shikshak: An Intelligent Tutoring System authoring tool for rural education, in Proceedings of the 2nd IEEE/ACM International Conference on Information and Communication Technologies and Development (ICTD '07), Bangalore, December 15-16, pp. 1-10.

60. Bhowmick P. K., Sarkar S., Chakraborty S., Sarkar S. and Basu A. (2007). Samvidha: A ICT system for personalized offline Internet access for rural schools, in Proceedings of the 2nd IEEE/ACM International Conference on Information and Communication Technologies and Development (ICTD '07), Bangalore, December 15-16, pp. 1-9.

61. Bhowmick P. K., Bhowmick S., Roy D., Sarkar S. and Basu A. (2007). Sahayika: A framework for participatory authoring of knowledge structures for education domain, in Proceedings of the 2nd IEEE/ACM International Conference on Information and Communication Technologies and Development, (ICTD '07), Bangalore, December 15-16,

62. Basu, A., Bhattacharya, S. and Mukherjee, A. (2006). A Flexible Multilingual Communication System with Special Access Mechanisms. Int. Conf. of the International Society for Augmentative and Alternative Communication (ISAAC).

63. Bhattacharya, S, Basu, A, Samanta, D, Bhattacherjee, S, &Srivastava, A. (2006). Some Issues in Modeling the Performance of Soft Keyboards with Scanning. Formal Methods in Interactive Systems (FMIS), Macau, China, pp. 124-140.

64. Choudhury M., Mukherjee A., Basu A. and Ganguly N. Analysis and Synthesis of the Distribution of Consonants over Languages: A Complex Network Approach. *In the Proceedings ofCOLING-ACL* (2006).

65. Lahiri A., Basu A, Choudhury M. and Mitra S. Battery-aware Code Partitioning for a Text to Speech System. *Proceedings of Design Automation and Test in Europe Conference*, pp 672 - 677, Munich, Germany (2006).

66. Choudhury M., Alam M., Sarkar S. and Basu A. . A Rewrite Rule based Model of Bangla Morpho-phonological Change. *Proceedings of the International Conference on Computer Processing of Bangla (ICCPB)*, Dhaka, Bangladesh (2006).

67. Dey S., Biswas S., Mukhopadhyay A., Basu A.: "*An Approach to Architectural Enhancement for Embedded Speech Applications*". Proceedings of the 19th International Conference on VLSI Design 2006, Hyderabad pp. 371-376.

68. Mukhopadhyay A., Dey S., Saraswat P., Biswas S., Nori V. S., Bhattacharya S. , Basu A.: "*Sanyog: An Iconic Communication Aid for Children Suffering from Cerebral Palsy and Motor Neuron Disorders*" Proceedings of the 19th International Conference on VLSI Design 2006, Hyderabad.

69. Mukherjee A. , and Basu A. (2006) A Bangla Predictive Keyboard for people with Neuro-Motor Disorders, *Proceedings of the International Conference on Computer Processing of Bangla (ICCPB06)*, Dhaka, Bangladesh.

70. Mukherjee, A., Bhattacharya, S**.**, Halder, P. and Basu, A. (2005). "A Virtual Predictive Keyboard as a Learning Aid for People with Neuro-motor Disorders," 5th IEEE International Conference on Advanced Learning Technology (ICALT-05), Kaohsiung, Taiwan, pp. 1032-1036.

71. Bhattacharya, S., Choudhury, M., Basu, A. and Sarkar, S. (2005). "Inflectional MorphologicalSynthesis of Bengali Noun, Pronoun and Verb Systems," National Conferenceon Computer Processing of Bangla (NCCPB-05), Dhaka, Bangladesh, pp. 34-43.

72. Anirban Lahiri, SatyaJyoti Chattopadhyay, Anupam Basu: Sparsha: A comprehensive Indian language toolset for the blind, ASSETS 2005 pp. 14-120.

73. Lahiri A., Choudhury M.,Choudhury S., Mukhopadhyay A., Dey S., Basu A.(2005) A Windows based File reader for Indian Languages (2005) IEEE VECIMS - International conference on virtual environments, human-computer

interfaces, and measurement systems,18-20 July 2005 Giardini Naxos - Taormina , Sicily , Italy.

74. Choudhury M., Sarkar S. and Basu A. Affects of Inflectional and Derivational Morphology in Bengali Phonology and its Implications in Speech Technology. To be presented in *Workshop on Morphology* , Mumbai, INDIA, Mar 2005.

75. Banerjee A., Choudhury M., SarkarS.and Basu A.**,** Learning Schwa Pronounceability Rules in Bengali Compound Words using Decision Trees. In *Proc. of the Second Symposium on Indian Morphology, Phonology and Language Engineering (SIMPLE'05).* Published by CIIL Mysore, pp. 49 - 55, Kharagpur, INDIA, Feb 2005.

76. Bhatt A., Choudhury M., SarkarS.and Basu A., Exploring the Limits of Spellcheckers: A comparative Study in Bengali and English. In *Proc. of the Second Symposium on Indian Morphology, Phonology and Language Engineering (SIMPLE'05).* Published by CIIL Mysore, pp. 60 - 65, Kharagpur, INDIA, Feb 2005.

77. Mukherjee A., Bhattacharya T., Chakraborty K.and Basu A**.** (2005)**.** An Intelligent Tutoring System in Promotion of BAnGLA Literacy in the Rural Scenario, National Conference on Computer Processing of Bangla,(NCCPB-05)Dhaka, Bangladesh.

78. Bhowmick P.K., Sarkar S., Sarkar S. and Basu A. (2004). Acquisition of user profile for domain specific personalized access, in Proceedings of the 7th International Conference on Information Technology (CIT '04), Hyderabad, December.

79. Sarkar S., Bhowmick P. K., Sarkar S. and Basu A. (2004). A system for offline Internet access for education in schools, in Proceedings of the 7th International Conference on Information Technology (CIT '04), Hyderabad, December.

80. Mukherjee, A., Bhattacharya, S., Chakraborty, K., and Basu, A. (2004). "Breaking the Accessibility Barrier: Development of Special Computer Access Mechanisms for the Neuro-Motor Disabled in India". Proc. Int. Conf. on Human Machine Interfaces-2004 (ICHMI-2004). Bangalore, India, pp 136-142.

81. Sarkar, S., Basu, A., Roy, P. R., Choudhury, M., and Bhattacharya, S. (2004). "A Machine Translation and Natural Language Generation Framework using a Semantic Frame Based Interlingua". Proc. first Symposium on Indian Morphology, Phonology and Language Engineering (SIMPLE'04), Kharagpur, India, pp 95-98.

82. Basu, A., Bhattacharya, S., Chakraborty, S., and Bhattacharya, T. (2004). "Computer Based Education and Communication Systems for People with

Multiple Disabilities". Conference on Multiple Disabilities. NIMH, Hyderabad, India.

83. Bhattacharya, S., Sarkar, S., and Basu, A. (2004). "Speech Enabled Communication Tool for the Speech Impaired and People with Multiple Disorders". Seventh Int. Conf. Human Services Information Technology Applications (HUSITA7). Hong Kong, China.

84. Abhishek& Basu A**.** (2004).A Framework for Disambiguation in Ambiguous Iconic Environments.In Proceedings of 17th Australian Joint Conference of Artificial Intelligence (AJCAI'04), Cairns, Australia; Springer-Verlag.

85. Abhishek& Basu A. (2004). Disambiguation in Ambiguous Iconic Environments by Constraint Satisfaction.Proceedings of the Knowledge Base Computer System (KBCS), Hydrabad, India.

86. Agarwal A. **,**Ray B**.,** Choudhury M**.,** Basu A.andSarkar S**.**. Automatic Extraction of Multiword Expressions in Bengali: An Approach for Miserly Resources Scenario. *Proc. of the International Conference on Natural Language Processing (ICON 2004)*. Allied Publishers, Hyderabad, INDIA pp. 165 - 172, Dec 2004.

87. Bansal B**.,** Choudhury M**.,** Ray P.R.**,**Sarkar S.and Basu A. **.** Isolated-word Error Correction for Partially Phonemic Languages using Phonetic Cues. *Proc. of the International Conference on Knowledge based Computer Systems (KBCS 2004)*. Allied Publishers, Hyderabad, INDIA Dec 2004.

88. Choudhury M**.,** Basu A.andSarkar S**.**.A Diachronic Approach for Schwa Deletion in Indo-Aryan Languages. *Proc. of the Seventh Meeting of the ACL Special Interest Group in Computational Phonology (SIGPHON 2004)*. ACL, Barcelona, SPAIN, pp. 20 - 26, July 2004.

89. Choudhury M**.,** Basu A.and SarkarS**.**.Schwa Deletion and Syllable Economy in Indo-Aryan Languages. *Lecture Compendium of Symposium on Indian Morphology, Phonology & Language Engineering (SIMPLE'04)*. IIT Kharagpur, INDIA, 35-38, March 2004

90. Sarkar S., Bhowmick P.K., Roy D., Sarkar S., Basu A. and Ghosh S.**.***A System for Personalized information Retrieval Based on Domain Knowledge*. Published in the proceedings of National Conference on Recent Trends in Computational Mathematics, March 18-19, 2004.

91. Brar G., Kundu S., Worah P., Biswas S., Mukhopadhyay A. and Basu A., OaSis: *An Application Specific Operating System for an Embedded Environment*. Proceedings of the 17th International Conference on VLSI Design, Mumbai 2004.(pp 776 - 779)

92. Mukhopadhyay A., Worah P., Biswas S., Biswas S., Das R. and Basu A.*Voice Output Communication Aid for the Children with Severe Speech and Multiple Disorders(SSMI).* Proceedings of the 17th International Conference on VLSI Design, Mumbai 2004.(pp 951 -956)

93. Sarkar S., Bhowmick P. K., Roy D., Sarkar S., Basu A. and Ghose S. (2003). A system for personalized information retrieval based on domain knowledge, National Conference on Trends in Computational Mathematics, March, pp. 18–19.

94. U. Deshpande, A. Gupta, and A. Basu, "*Performance improvement of the contract net protocol using instance based learning*", 5th International Workshop on Distributed Computing (IWDC 2003), Kolkata, India, 2003, Lecture Notes in Computer Science (LNCS) - 2918, Springer Verlag, Berlin, pp. 290-299.

95. Annam S.,Choudhury M. ,Basu A. and Sarkar S., ABHIDHA: An Extended LexicalNet for Indo-Aryan Languages. *Proceedings of the 13th International Workshop on Research Issues on Data Engineering: Multi-lingual Information Management*, IEEE, Hyderabad, INDIA, 2003.

96. Sen D., Sen S., Chakraborty S.J., Chakraborty A. and Basu A**.** An Indian Language Speech Interface for Empowering the Visually Handicapped. *Proceedings of International Workshop on Frontiers of Research in Speech and Music, Kanpur, 2003, (pp 113 - 120)*

97. Ray P. R., Harish V., Sarkar S. and Basu A.Part of Speech Tagging and Local Word Grouping Techniques for Natural Language Parsing in Hindi. Proceedings of International Conference on Natural Language Processing (ICON 2003), Mysore, 2003 pp 9 – 19.

98. Somnath Banerjee, Arobinda Gupta, Anupam Basu: Online Transcoding of Web Pages for Mobile Devices. Mobile HCI 2003: 271-285.

99. P. Bhowal, A. Basu, D. Sarkar and S. Mukhopadhyay, "Inferential problems form a class of discrete time hybrid systems Part I: Process Modeling", *15th Triennial World Congress of the International Federation of Automatic Control*, Barcelona, 21-26 July 2002.

100. P. Bhowal, A. Basu, D. Sarkar and S. Mukhopadhyay, "Inferential problems form a class of discrete time hybrid systems Part II: State Estimation", *15th Triennial World Congress of the International Federation of Automatic Control*, Barcelona**,** 21-26 July 2002.

101. D. Sarkar, P. Bhowal, A. Basu and S. Mukhopadhyay, "Inferential problems form a class of discrete time hybrid systems Part III: Fault Diagnosis", *15th Triennial World Congress of the International Federation of Automatic Control*, Barcelona**,** 21-26 July 2002.

102. U. Deshpande, A. Gupta, and A. Basu, "*Task assignment in a collaborative systemwith imprecise information*", 4th International Conference on Knowledge Based Computing Systems (KBCS- 2002), Mumbai, India, December 2002, pp. 127-136.

103. U. Deshpande, A. Gupta, and A. Basu, "*Adaptive fault tolerant hospital resourcescheduling*", 10th International Conference on Cooperative Information Systems (COOPIS- 2002), Irvine, USA, October 2002. (LNCS - 2519) pp. 503-520.

104. Basu, A., Sarkar, S., Chakraborty, K., Bhattacharya,S., Choudhury, M., and Patel, R. (2002). "Vernacular Education and Communication Tool for the People with Multiple Disabilities". 2nd Development by Design Conference (dyd02). Bangalore, India.

105. Choudhury M. and Basu A..A Rule-based schwa deletion algorithm for Hindi. *Proceedings of the International Conference On Knowledge-Based Computer Systems*, Vikas Publishing House, Navi Mumbai, INDIA, pp. 343 - 353, 2002.

106. U. Deshpande, A. Gupta, and A. Basu, "*A coordination mechanism for hospitalresource scheduling using a multi-agent framework*", 3rd International Workshop on Distributed Computing (IWDC 2001), Kolkata, India, 2001, 41-48.

107. Prodip Bhowal, Anupam Basu, D.Sarkar and S.Mukhopadhyay," A Framework for inferential Problems in Hybrid Systems. Part I: Modeling and Composition", *International Conference on Energy, Automation and Information Technology*, IIT, Kharagpur, *2001*, pp. 27-32

108. Prodip Bhowal, Anupam Basu, D.Sarkar and S.Mukhopadhyay," A Framework for inferential Problems in Hybrid Systems. Part II: State estimation and fault diagnosis", *International Conference on Energy, Automation and Information Technology*, IIT, Kharagpur, *2001*, pp. 607-611.

109. Prodip Bhowal, S. Mukhopadhay, A. Basu, " A framework for inferential problems in DEDS, Part II: State Observation", *2000 IEEE International Conference on System Man and Cybernetics*, Nashville, USA, 2000.

110. S. Mukhopadhyay, Prodip Bhowal, A. Basu, " A framework for inferential problems in DEDS, Part III: Fault Diagnosis", *2000 IEEE International Conference on System Man and Cybernetics*, Nashville, USA, 2000.

111. S. Mukhopadhyay, P. Bhowal and A. Basu, "A TTM based model for Real Time Systems: Part I: The Extended Framework", IEEE System, Man and Cybernetic Conference, Orlando, Florida, 2000.

112. S. Mukhopadhyaya, P. Bhowal and A. Basu, " A TTM based model for Real Time Systems: Part II: The Observer Model", IEEE System, Man and Cybernetic Conference, Orlando, Florida, 2000.

113. S. Mukhopadhyaya, P. Bhowal and A. Basu, " A TTM based model for Real Time Systems: Part III: Fault Diagnosis", IEEE System, Man and Cybernetic Conference, Orlando, Florida, 2000.

114. Dutta, S. Chaudhuri, A. Basu, H.Tomiyama and N.Dutt, " Task Layout Generation to Minimize Cache Miss Penalty for Preemptive Real Time Tasks: An ILP Approach", Proceedings of the Ninth Workshop on Synthesis and System Integration of Mixed Technologies (SASIMI 2000), pp. 202-208, April 2000.

115. Anupam Basu, Rainer Leupers, Peter Marwedel, "Array Index Allocation under Register Constraints in DSP Programs", Proc. of 12th International Conference on VLSI Design , Goa, January 1999.

116. Anupam Basu, Raj S. Mitra, "Two Layer Architecture for Hardware Software Codesign, Proc. Syntheis and System Integration of Mixed Technologies (SASIMI 98) , Tohuku, Japan, Oct. 1998.

117. Rainer Leupers, Anupam Basu, Peter Marwedel, " Array Index Computation in DSP Programs", ASP-DAC '98 , Yokohama/Japan, Feb 1998, pp. 87--92 .

118. Anupam Basu, Rainer Leupers, Peter Marwedel, "Optimized Array Index Allocation in DSP Programs", Design Automation & Test in Europe (DATE'98).

119. A.Basu, R.S.Mitra and P.Marwedel, "Interface Synthesis for Embedded Applications in a Codesign Environment", 11th International Conferenceon VLSI Design , Chennai, Jan. 1998, pp. 85--90.

120. P. Bhowal, R. Mall and A. Basu, "PLC Software Code Estimation for Predicting Micro PLC Execution Time", Proc. 5th International Conference on Advanced Computing (ADCOMP97), Chennai, Dec. 1997, pp. 533--542.

121. S. Sarkar, A. Basu and A. K. Majumdar, "Analyzing Controllability of a Hardware Circuit for its Reuse" 10th International Conference on VLSI Design , Hyderabad, 19 97, pp. 151-154.

122. D.Saha, R.S.Mitra, and A. Basu, " Hardware Software Partitioning using Genetic Algorithm", 10th International Conference on VLSI Design, Hyderabad, 1997, pp.155-160.

123. V.K.Rai, S.Banerjee and A. Basu, " Non Cooperative Agents in Multiagent Interaction" 7th Nat. Conf. On Science & Tech. in National Development – A Systems Dynamics Approach , Nov. 25-27 1996, Bangalore pp. 1-8.

124. P.S.Roop, C.V.Shastry and A. Basu, " An Algorithm for Mapping a Design Function to a Composition of Devices", Proc. Asia Pacific Conference on Hardware Description Languages , Bangalore, January, 1996, pp.75 -79.

125. S. Sarkar, A. K. Majumdar and A. Basu, " Synthesis of Interfaces for Designing Digital Circuits in an Object Oriented Environment", Proc. International Conference on VLSI System Design , Bangalore, January, 1996.

126. D.Saha, R.S. Mitra, and A. Basu, "Application of Genetic Algorithm for Hardware-Software Partitioning" in Proc. International Symposium on Intelligent Systems and Robotics, Bangalore, November, 1995.

127. P. Kangshabanik, A. K. Majumdar and A. Basu, " A Fuzzy Object Oriented Shell for Image Interpretation", Proc.International Symposium on Intelligent Systems and Robotics , Bangalore, November, 1995.

128. P.Ranjan, P. Kanghshabanik, A. Basu and A. K. Majumdar, "An Object Oriented Architecture for High Level Image Interpretation", Proc. Indian Conference on Pattern Recognition, Image Processing, and Computer Vision , Kharagpur, December, 1995.

129. R.S.Mitra, P.S.Roop and A. Basu , "Implementation of Design Functions by Available Devices", in Proc. 8th International Conference on VLSI Design, New Delhi, January, 1995.

130. R.S.Mitra, M.Qadir and A. Basu, " A Consistent Labeling Approach to Hardware Software Partitioning", in Proc. 8th International Conference on VLSI Design , New Delhi, January, 1995.

131. S. Sarkar, A.K.Majumderand A. Basu , "Synchronization and Communication of Modules and processes in High Level Synthesis", in Proc. 8th International Conference on VLSI Design, New Delhi, January, 1995.

132. S. Sarkar, A. Basu , and A. K. Majumdar, "A New Object Oriented Model and a Hardware Description Language for High Level Synthesis" International Conf. on Automation, 1995,

133. S. Sarkar and A. Basu , "An Object Oriented Environment for Modeling andSynthesis of Hardware Circuits", Proc. Seventh Int. Conf. on VLSI Design (VLSI 94) , January 1994.

134. R.S.Mitraand A. Basu, "A Knowledge Based Framework for Hardware SoftwareCoDesign", USEFI sponsored Workshop on Artificial Intelligence , IIM, Calcutta, March 1994.

135. A. Basu , R.S. Mitra and P.S. Roop, "Integrating Handbook Database with a Knowledge Based Expert System for Resilience", USEFI sponsored Workshop on Artificial Intelligence, IIM, Calcutta, March 1994.

136. R.S. Mitra, B. Guhaand A. Basu , "Rapid Prototyping of Microprocessor Based Systems", ICCAD 93, pp.600—603.

137. P.S.Roop, R.S.Mitra, and A. Basu , "A Multilayer Design Expert Systemwith Resilence", Symposium on Intelligent Systems , Bangalore, 1993.

138. A. Banerjee, A. Basu , and A. K. Majumdar, "A Fuzzy Expert System for Evaluation of Chronic Disease Over Time", First Asian Fuzzy Systems Symposium , Singapore, Nov. 1993.

139. A. Basu , A.Banerjee, and A. K. Majumdar, "A Multiple Expert Environment using Fuzzy Knowledge", Proc. Conference on Fuzzy Mathematics , ViswaBharati, Feb. 1993.

140. P.Dutta, S.Roy, A. Basu , and S.Banerjee, " A Low Cost Computerized Reading System for the Blind", Proc. Int. Conf. on Biomedical Engg. , Hyderabad, 1993.

141. A.Banerjee, A. Basu , and A. K. Majumdar, "On Building a Fuzzy Expert System Tools and its usage in Diagnosis of Endemic Diseases", Proc. Conf. on Fuzzy Mathematics , ViswaBharati, Feb. 1993.

142. A.Banerjee, A. K. Majumdarand A. Basu , "A Fuzzy Expert System Approach for Real Time Monitoring of Endemic Diseases", Proc. 1st. International Conf. on Fuzzy Theory and Technology , Oct. 1992, North Carolina, U.S.A. (revised and extended version published in Information Science Journal).

143. A. Basu , D. K. Banerji, T.C. Wilson and J.C. Majithia, "An Approach to Minimize Testability Overhead for BILBO base Built in Self Test", Fifth Int. IEEE VLSI Symposium (VLSI '92) , Bangalore, January, 1992.

144. M.K.Garg, A. Basu, andD. K. Banerji, "A New Algorithm for Test Scheduling in VLSI Circuits", Fourth. IEEE/CSI International Symposium on VLSI Systems , New Delhi, January, 1991.

145. A. Basu, T.C. Wilson, D. K. Banerji and Jay C. Majithia, "Integrated Approach to Area-Time Trade-Off for Built in Self Tests in VLSI Circuits",Great Lake Symposium for VLSI, Michigan, March 1991.

146. T.C.Wilson, A. Basu, D. K. Banerji and Jay C. Majithia, "Test Plan Generation and Concurrent Scheduling of Tests in the Presence of Conflicts", Great Lake Symposium for VLSI , Michigan, March 1991.

147. T.C. Wilson, A. Basu,D. K. Banerji and J.C. Majithia, “Interconnect Optimization through Commutative Input Pair Alignment", Proc. Of Canadian Conference on VLSI 1991, Kingston.

148. A. Basu, A.K. Majumdar and S.Sinha, "Towards EfficientInferencing in Sequential Inference Machines", A. K. Chaudhury Memorial Symposium, India, 1991.

149. A. Basu , et al, "An Approach for Combining I-Paths for Multiport Combinational Logic Blocks in VLSI Circuits", IFIP Conference on Design and Test for ASICs , Hiroshima, Japan, 1990.

150. A. Basu ,D. K. Banerji, T.C. Wilson and J.C. Majithia, "GENPLAN: An Algorithm for Test Plan Generation for VLSI Circuits", Proc. of CCVLSI (Canadian Conference on VLSI) , Ottawa, October 1990.

151. T.Nayak, A. K. Majumdarand A. Basu , " An Approach to Modelling of Objects for an Object Oriented Database System", Proc.of COMAD 89, 1989.

152. A.Banerjee, A. Basu and A. K. Majumdar , "MEDIC: A Prototype Expert System for Diagnosis of Chest Diseases", Proc. of National Sys. Conference , India, pp. 180- 184, 1989.

153. A.Banerjee, A. Basu , and A. K. Majumdar, "An Expert System for Diagnosis and Therapeutic Counselling of Chest Diseases", Proc. Knowledge Based Computer Systems , 1989, pp. 169 -174.

154. T.K.Nayak, S. Sarkar, A. K. Majumdarand A. Basu , "An Object Oriented Database System", Proc. National System Conference,Dec. 1989, India, pp. 184-187.

155. A. Basu ,T.Nayak and S.Mukherjee, "An Architecture for Parallel Inferencing in Rule Based Systems", in Proc. of Conf. on Parallel Processing, I.E.,1988.

156. A. Basu and T.Nayak, " The Concept of Inference Flow Graphs Applied to Inference Machines", Proc. International Conf. on Circuits and Systems, IIT Kharagpur, 1987.

157. A. Basu and A. K. Majumdar, "An Organisation of Rule Base in an Expert System for Control System Design and Analysis", Proc. 2nd International Conf.on Advances in Patt.Recog.and Digital Systems, 1986.

158. P.Sengupta, D.DuttaMajumdarand A. Basu , " An Implementation of PROLOG in Microcomputers", Proc. 2nd International Conf. on Advances in Pattern Recognition and Digital Techniques, 1986.

159. A. Basu and A.K. Majumdar, " An Expert System Structure for Design and Analysis of Control Systems", Proc. IEEE Conf. On Distributed Control and Monitoring Systems , N.D, 1985.

160. A. Basu "Artificial Intelligence in Medical Diagnosis", Proc. ACE ,IEEE, 1984.

Annexure II

Summary statement on Research in Assistive Technology

A. Sanyog – An Iconic Multimodal Communication Device for the Children with Neuro-Motor Disorders and Speech Impairment

Sanyog is an iconic communication device that accepts icons as input from the user (using special access switches for those who have neuro-motor impairments and cannot use the mouse), forms syntactically and semantically correct natural language sentences in Indian languages (using Natural Language sentence Generator, at present for Bengali, Hindi and English). The sentences can be modified and inflected with the desired tense and mood. The sentences can be spoken out using Shruti (text to speech system).

Iconic sentences are also formed – so that the preliterate children can also understand and communicate. There are various modes of operation such as Iconic (mentioned above), Stored Sentence or On-Screen Keyboard.

It interfaces with different types of indigenously made access switches (single or two-switch modes). These switches allow the user to navigate across the panel and select icons from an auto-scan display.

It is possible for a user to integrate a different text to speech system according to her choice and allows personalization, i.e., the icon set can be modified at ease and icons suitable for a specific user can be easily incorporated.

Thus Sanyog is a complete device that can be used by speech-impaired users or by people with severe speech and motor impairments (SSMI) allowing them means to form their own messages and speak it out. It won the prestigious “da Vinci” award in 2004. Special educators have also pointed out that Sanyog is an excellent device for the children with Autism. The system has been deployed at several schools for children with such special needs, namely, Indian Institute of Cerebral Palsy (IICP), Kolkata, Action for Ability Development and Inclusion (AADI), New Delhi, VidyaSagar, Chennai.

Currently, the sentence generation in Sanyog is verb-directed, and work is in progress towards making it also object-directed. Plan is also there to make it possible to generate compound and complex sentences.

Sanyog has received the Da Vinci Award awarded by the Engineering Society of Detroit and the Multiple Sclerosis Society of Michigan in 2004 and the National Award for Technology Development for Empowering Persons with Disability 2007, Ministry of Social Justice and Youth Empowerment.

B. Special Access Switches:

Special Access Switches are designed to enable persons with Cerebral Palsy, Motor Neuron disease or other disabilities to operate Communication Software (such as Sanyog), Toys, Electrical Devices and Appliances, with suitable adaptations. The adaptations are mostly simple but will be different according to the application or device to be operated.

Various types of Special Access Switches have been developed (hand operated, foot operated, lip operated etc.). One such switch was designed and is being manufactured by Electrosoft Consultants, Kharagpur. These have been deployed at several special schools (all over India, including IICP, Kolkata, AADI, New Delhi, VidyaSagar, Chennai) for such children.

C. Chitra Katha:

Chitra Katha is a portable communication aid for the Cerebral Palsy affected people. It can store up to 16 pre-recorded messages per layer (total 64 messages in 4 layers). The top of the device has a sheet of icons (as used by CP affected people for communication), these icons being scanned by LED lights, and selectable by an external access switch. When a particular icon is selected, the recorded message corresponding to that icon is played back. Four icon sheets can be prepared for the four layers as required, and the corresponding messages recorded by the parents or teachers. The layer, scanning speed etc. will have to be set by the parents/teachers after which the CP affected person can operate the device with the external switch only.

This has also been prototyped by Electrosoft Consultants, Kharagpur in collaboration with IIT Kharagpur and field-tested at IICP, Kolkata.

A new version of the system is being developed for National Trust.

D. Sparsha – Text to Braille Transliteration System for Indian Language Texts:

Sparsha was developed with the objective of providing on-demand Braille transliteration and printing of Indian language texts at an affordable cost. The languages supported at present are Hindi, Bengali, Marathi, Gujarati, Tamil, Telugu, Oriya and Kannada and the supported file formats are ileap (.lp2 files), ISCII (.aci files) and Unicode. Other Indian languages may be added on demand, within short notice.

It also offers transliteration of English text to its corresponding Braille representation, in Grade I or Grade II, the file formats supported are Text (.txt), MS Word (.doc), web-page (.html) and Adobe Acrobat (.pdf).

Sparsha provides support for printing the transliterated Braille text using any standard Braille printer (Index, Braillo etc.).

Sparsha is further equipped to translate mathematical and scientific notations (based on Nemeth code – 1972) to their corresponding Braille versions.

There are numerous other features of Sparsha as well as provision for upgradation as per the needs of the visually impaired people.

Sparsha has been successfully deployed in a number of institutes of national importance, such as,The National Association for the Blind, Delhi, Blind Peoples' Association, Ahmedabad, National Institute for the Visually Handicapped, Dehradun, Vivekananda Mission Ashram, Chaitanyapur, Haldia, and Blind Persons' Association, West Bengal. It is also been currently used by a large number of individual users form various parts of the country.

For further details please see http://www.cel.iitkgp.ernet.in/Sparsha.htm and http://www.facweb.iitkgp.ernet.in/~anupam/sparsha/index.htm

E. Shruti – Indian Language Speech Support for the Visually Impaired

The Shruti project includes development of a Text to Speech engine, that will convert Bengali and Hindi texts to speech and a Automatic Speech Recognition system for Bengali and Hindi. These can serve as: Computer interfaces for the visually challenged, the voice of the speech impaired, computer interfaces for neo-literates and pre-literates. Modules in software to help pre-literates learn languages using a computer, Interfacing modules in multilingual environments, where, depending on the need, the computer can talk in different languages.

At present a Hindi and a Bengali Text to Speech synthesizers have been developed. This has been deployed as a built-in engine with devices for the speech impaired. This is also being used to provide a text reader for the sightless people.

Text to speech has been one of the greatest challenges of modern computational science. While the utterance of flat speech by a computer has been achieved – the challenges of imposing natural intonation and prosody is being worked on.

The Speech recognition system is being developed and used for developing speech enabled interfaces for the blind people.

For details see http://www.cel.iitkgp.ernet.in/Shruti.htm

F. An Open Source Web Browser for the Blind people:

The objective of the project is to develop a framework, with the required toolset, to enable the sightless people browse the web. Moreover, the system will be open source, enabling future developments by different groups.

The proposed system will be having the following key features:

i) A web browser that can be accessible by any blind person,
ii) Facilities to provide proper voice feedback to any keyboard operation performed by a blind user,
iii) Facilities to recognize mouse input methods that allow a blind user to browse the web,
iv) Facilitate recognition of speech input methods allowing a blind user to browse the web using some pre-defined speech commands,
v) Extraction of texts from web pages, formatting the extracted text into a system friendly representation which the TTS or the Braille transliteration engine can easily access,
vi) Represent the selected text in the form of Braille,
vii) Represent the selected text in the form of speech.

G. Creating Accessible Study Material for the Print Impaired (Blind and Low Vision) Students

This project aims to solve the problem of non-availability of reading materials for print impaired students pursuing higher education courses in universities across the country. This will be achieved by converting and distributing course books and recommended

reference books for a few courses which are popular amongst visually impaired students into an accessible e-text DAISY format. The material shall include books in English and regional medium languages. The e-text content can also be used to generate the text books in Braille, large print and audio formats.

Once the text books have been converted into an e-text format, the content will be saved on DVDs and distributed to all registered Universities in India. It is hoped that once this project is completed, print impaired students pursuing higher education will get study material at no extra cost and at the same time as their sighted contemporaries, thus enabling them to enjoy a full and participatory academic life.

In the pilot phase the target is to convert a total of 200 books in six languages and distribute for the benefit of Print Impaired students through libraries of Indian Universities and Academic Institutes. Fifty books each in English and Hindi and twenty-five each in four regional languages (Bengali, Tamil, Marathi and Assamese) will be taken up in this phase.

Through this project a large number of agencies and people including students will be involved in the book conversion process. Thus a larger pool of resources will be developed for future requirements as well as more people will be sensitized about the problems of the print impaired.

For more details see http://www.cel.iitkgp.ernet.in/asm

Annexure III

List of Ph.D Students

Sl. No.	Names	Title of the Thesis	Year
1	Raj SekharMitra	Rapid prototyping of Microprocessor-based Systems	1995
2	SantanuSarkar	Object Oriented VLSI Design Framework	1996
3	Prodip Bhowal	On Fault Diagnosis of Timed Discrete Event Systems and Hybrid Systems	2003
4	Umesh Ashok Deshpande	Collaborative Problem Solving among Organizations using a Multiagent Framework	2005
5	Monojit Choudhury	Computational Models of Real World Phonological Change	2007
6	Animesh Mukherjee	Self Organization of Speech Sound Inventories in the Framework of Complex Networks	2009
7	Samit Bhattacharya	Models and Algorithms for Virtual Scanning Keyboard Design	2009
8	PlabanBhaumik	Emotion Recognition from Textual Data	2010
9	Soumyaji tDey	Formal Analysis of Heterogenous Embedded systems using Tagged signal Models	2011
10	Sanjay Chatterjee	A Framework to Improve Bangla to Hindi Translation of Texts	2014
11	Manjira Sinha	Readability of Text: A Deeper Look into Semantics and Sociological Factors	submitted
12	TirthankarDasgupta	Discovering Individual Mental Lexicon	submitted
13	PriyankaSinha	Faceted Text Mining	Ongoing