

## K Madhava Krishna

---

Assistant Professor  
IIIT Hyderabad

040-2300 1967 (Extn 269, 317)  
[mkrishna@iiit.ac.in](mailto:mkrishna@iiit.ac.in)  
<http://mail.iiit.ac.in/~mkrishna>

---

### Primary research interests:

- Mobile robotics, multi robotic systems, all terrain navigation and robotic system development

### Other areas of interest:

- network centered robotics, network mediated robotics
- 

### Education:

2001 November: Ph.D. from Electrical Engineering Dept, *Indian Institute of Technology at Kanpur*. The dissertation was on Soft Computing Applications to Real-time Navigation of Mobile Robots in Stationary and Dynamic Environments

1998 July: Masters in Electronics Engineering from *Birla Institute of Technology and Science at Pilani*

1996 July: Bachelors in Electrical Engineering from *Birla Institute of Technology and Science at Pilani*

---

### Fellowships:

Post Doctoral Fellowship of the French Government at the Robotics and AI Lab, LAAS-CNRS, Toulouse starting January 15<sup>th</sup> 2002 for a period of one year.

---

### Grants:

1 CVRDE-DRDO, "Digital Terrain Modeling using Single Laser Systems", Feb 2008– Aug 2009, INR 1 million (completed)

2 BRNS, "SLAM Algorithms: Development and Testing for Autonomous Navigation", 2008-2011, INR 3 million (ongoing)

3 DRDO-Extra Mural, "Snake Robots for Search and Rescue", 2009-2011, INR 1.5 million (ongoing)

4. MCIT, "Perceptual Engineering Project", 2009-2011 (ongoing)

5. CAIR, "Development of Algorithms for Mobile Robot Navigation", 2006–2007, INR 1 million

6. DST, "Predictable Performance Algorithm for a Multi-robotic Surveillance System", 2005–2008, INR 0.8 million

7. The French Ministry of Research's grant for young foreign researchers: "Safe Proactive Plans and their Execution for a Personal Mobile Robot", US\$ 75000, 2002 – 2003, Co-PI

8. "Research in Evaluation Methods for Data Fusion Capable Tactical Platforms for Electronic Warfare and Information Warfare Related Missions", Air Force Office of Scientific Research (AFOSR), US\$ 25000, Aug. to Nov. 2004, Co-PI

### Awards:

- Motorola Award for the Best Undergraduate Project for the fall of 95:  
The project involved simulation and real time implementation of a fuzzy logic based real time navigation algorithm on the ROVER robot equipped with an array of ultrasonic sensors
- Motorola Award for the Best Graduate Project for the fall of 97:  
The project involved simulation and real-time implementation of a navigation algorithm based on Kohonen's topology conserving networks and reinforcement learning on the ROVER.

---

### Work Experience:

April 2005 onwards:

Assistant Professor at IIIT Hyderabad ([www.iiit.net](http://www.iiit.net))

March 2003 - Feb 2005:

Visiting Research Faculty at the Dept. of Computer Science and Computer Engineering, University of Arkansas at Fayetteville. ([www.csce.uark.edu](http://www.csce.uark.edu)).

Jan 2002-Jan 2003:

Post Doctoral Fellow at Robotics and AI Lab, LAAS-CNRS, Toulouse (France)  
(<http://www.laas.fr/RIA/RIA.html.en>)

August 1998 – Nov. 2001:

Research and/or Teaching Assistant, Department of Electrical Engineering, IIT Kanpur  
([www.iitk.ac.in](http://www.iitk.ac.in))

July 1996 - June 1998:

Teaching Assistant, Department of Electrical Engineering, Birla Institute of Technology and Science, Pilani ([www.bits-pilani.ac.in](http://www.bits-pilani.ac.in))

---

### Courses taught:

- *Mobile Robotics* : :Monsoon 2005, 06, 07 IIIT Hyderabad
- *Multi Robotic Systems*: :Spring 2006, 07, IIIT Hyderabad
- *Embedded Robotics* : : Spring 2008, IIIT Hyderabad
- *Digital Logic Design*: :Monsoon 2005, 07, IIIT Hyderabad
- *Intelligent Robotic Control – Part 1*: :Graduate level (University of Arkansas, Spring 2004)
- *Intelligent Robotic Control – Part 2* : :Graduate level (University of Arkansas, Fall 2004)
- *Cognitive Science*: :University of Arkansas, Fall 2003
- *Circuit Theory*: :Second year undergrad, 1997 (BITS Pilani, India)
- *Systems Engineering*: :Second year undergrad, 1996 (BITS Pilani, India)

### Labs handled:

- *Digital Electronics and Microprocessor Lab*: Second year undergrad (IIT Kanpur)
- *Analog Electronics Lab*: Second year undergrad (BITS Pilani)
- *DSP (TMS 320C5X) Lab*: Graduate level (IIT Kanpur)

## Guidance of Students

### Present:

- Vijay Prakash (PhD) : Control Strategies for All-Terrain Vehicles
- Sartaj Singh (PhD) : All Terrain Navigation
- Subhash S (MS) : Micro robot system development
- Mahesh Mohan : Comparison of Mapping Algorithms
- Jyotika B (MS) : Learning in Sensor Systems
- Yasovardhan E (MS-DD) : Mapping in Outdoor Environments
- Rahul Sawhney (MS) : Performance Metrics in Coverage and Exploration, Mono SLAM
- Aravindhnan Krishnan (MS) : Vision Based Exploration
- Gururaj Kosuru : Indoor SLAM
- Abhijit Kundu : Geometry Based Tracking from Single Camera, SLAM amidst moving objects

### Past :

- A K Pandey (MS) : Probabilistic mapping and localization
- Karthikeya Viswanath (MS) : Network mediated robotics
- Shivudu Bhuvanagiri (MS) : Multi robot localization
- Hemanth K (MS-DD) : Fast Localization
- Aditya Teja (MS-DD) : Constrained Navigation in Multi Robotic Systems
- Satish Pedduri (MS) : Multi robot planning and collision avoidance
- *Rakesh Goyal* (MTech) : Probabilistic Localization
- *P K Ganesh* (MTech) : Kalman localization and Multi-sensor surveillance
- *Mayur Hemani* (MTech) : Planning in High Dimensional Spaces
- *Srijan Tripathi* (MTech) : Feature based localization
- *Shakti Sinha* (MTech) : Segment based localization
- Ankur Handa (BTech) : Multi Target Tracking with a Mobile Robot

### Some Exceptional Interns

- Siddharth Sanan : Force control and non holonomic motion planning

---

## PUBLICATIONS

### Journals:

1. Karthikeya Viswanath and K Madhava Krishna, "Towards Load Balanced Decongested Multi Robotic Traffic Control at Intersections", *Springer Journal of Intelligent Service Robotics*, March 2009
2. Shivudu Bhuvanagiri and K Madhava Krishna, "Motion in Ambiguity: Coordinated Active Global Localization for Multiple Robots", to appear in *Robotics and Autonomous Systems*
3. K. Madhava Krishna, R. Alami and T. Simeon, "Safe Proactive Plans and their Execution", *Robotics and Autonomous Systems*, **54** (2006) 244-255 (available online at [www.sciencedirect.com](http://www.sciencedirect.com))

4. A K Pandey and K Madhava Krishna, "Link Graph and Feature Chain based Robust Online SLAM for Fully Autonomous Mobile Robot Navigation System using Sonar Sensors", to appear in *Springer Verlag's LNCIS*, **2007**.
5. K Madhava Krishna and Henry Hexmoor, "A framework for guaranteeing detection performance of a sensor network", *Integrated Computer-Aided Engineering Journal*, **Volume 12, Number 3 / 2005**, Pages: 305 – 317, IOS Press
6. K Madhava Krishna, Srinivas Chellappa, and H. Hexmoor, 2005. "Reactive Navigation of Multiple Moving Agents by Collaborative Resolution of Conflicts", *Journal of Robotic Systems*, **22(5)**, 249-269, Wiley Periodicals, Inc
7. K Madhava Krishna and Prem K Kalra, "Detection Tracking and Avoidance for Multiple Dynamic Objects", *Journal of Intelligent and Robotic Systems*, **vol 33: 371-408** Apr 2002 Kluwer Academic
8. K Madhava Krishna and Prem K Kalra, "When does the Robot Perceive a Dynamic Object", *Journal of Robotic Systems*, **19( 2)**, Feb. 2002, John Wiley
9. K Madhava Krishna and Prem K Kalra, "Perception and Remembrance of the Environment during Real-time Navigation for a Mobile Robot", *Robotics and Autonomous Systems*, **37(1): 25-51**, Oct. 2001, Elsevier
10. K Madhava Krishna and Prem K Kalra, "Solving the Local Minima Problem for a Mobile Robot by Classification of Spatio-temporal Sensory Sequences", *Journal of Robotic Systems*, 17(10) : 549-564, Oct. 2000, John Wiley and Sons
11. K Madhava Krishna and Prem K Kalra, "Spatial Understanding and Temporal Correlation for a Mobile Robot", *Spatial Cognition and Computation*, **2( 3)**, Dec. 2000, Kluwer Academic

**Premier Conferences:**

1. Aravindhan Krishnan and K Madhava Krishna, "Autonomous Image Based Exploration for Indoor Environments using Local Features", to appear in *AAMAS 2010 (short paper)*
2. Piyooosh Mukhija, Rahul Sawhney and K Madhava Krishna, "Multi Robotic Exploration with Communication Requirement to a Fixed Base Station", to appear in *AAMAS 2010 (short paper)*
3. "Moving Object Detection by Multi-View Geometric Techniques from a Single Camera Mounted Robot ", Abhijit Kundu and K Madhava Krishna. To appear in *IROS 2009*
4. 2. "On Fast Exploration in 2D and 3D Terrains with Multiple robots", Rahul Sawhney and K Madhava Krishna *AAMAS 2009*
5. Rahul Sawhney, Mahesh Mohan, K Srinathan and K M Krishna, "Reduced time fault tolerant paths for Multi-UAV coverage of 3D Terrains", *AAMAS, 2008*
6. Shivudu B and K M Krishna, "Coordination in Ambiguity: Actively Localizing Multiple Robots", *AAMAS, 2008*
7. Mahesh Mohan, Rahul Sawhney, K Madhava Krishna, K Srinathan and M B Srikanth, "Covering Hostile Terrains with Partial and Complete Visibilities: On Minimum Distance Paths", *IROS, 2008*
8. A. H. Abdul Hafez, S Bhuvanagiri, K Madhava Krishna and C V Jawahar, "On-line Convex Optimization based Solution for Mapping in VSLAM", *IROS 2008*

9. S Bhuvanagiri and K Madhava Krishna, "Coordinated Active Global Localization for Multiple Robots by Disambiguating Multiple Hypotheses", *IROS 2008*
10. A K Pandey and K Madhava Krishna, "Integrating features onto an occupancy grid for sonar based safe mapping", *IJCAI (International Joint Conference on AI) 2007* ; <http://www.ijcai.org/papers07/contents.php>
11. Ganesh P Kumar and K Madhava Krishna, "Optimal Multi Target Detection by Multiple Sensors by Moving to the Maximal Clique in a Covering Graph", *IJCAI 2007, accepted (oral presentation)*; <http://www.ijcai.org/papers07/contents.php>
12. Siddharth Sanan, Darshan Santani, K Madhava Krishna and Henry Hexmoor, "Extension of Reeds and Shepp Paths for a Robot with Front and Rear Wheel Steer", *Proc of ICRA, 2006*
13. K Madhava Krishna and Henry Hexmoor, "A T Step Ahead Optimal Tracking Algorithm for a Surveillance Based Sensor Network", *In Proceedings of IEEE/RSJ International Conference on Intelligent Robot and Systems, Pages 1840-1845, Edmonton, CA*
14. K. Madhava Krishna and Henry Hexmoor "Reactive Collision Avoidance of Multiple Moving Agents by Cooperation and Conflict Propagation", *Proc. of ICRA, (IEEE Intl. Conf. on Robotics and Automation), New Orleans, April 2004*
15. K Madhava Krishna, R Alami and T Simeon "Moving Safely but not Slowly: Reactively Adapting Paths to Better Time-lengths", *published in proceedings of ICAR (IEEE Intl Conf on Advanced Robotics ), Coimbra, Portugal, Jun 2003*
16. R Alami, T Simeon and K Madhava Krishna, "On the influence of sensor capacities and environment dynamics onto collision free motion plans", *proceedings of IROS (IEEE-RSJ Intl Conf on Intelligent Robotics and Systems), Sep. 2002*
17. I J Nagrath, L Behera, K Madhava Krishna and K D Rajasekhar, "Real-time Navigation of a Mobile Robot using Kohonen's Topology Conserving Neural Networks", *Proc. IEEE Eighth International Conference on Advanced Robotics, pp 459-464, Monterey, CA, July 1997*

**Other Refereed Conferences:**

1. MDP based Active Localization for multiple robots Jyotika Bahuguna, B Ravindran and K Madhava Krishna. To appear in CASE 2009
2. On Measurement Models for Line Segments and Point Based SLAM Satish Pedduri, Gururaj Kosuru, K Madhava Krishna and Amit K Pandey ICAR 2009
3. Estimating Ground and Other Planes from a Single Tilted Laser Range Finder for On-Road Driving Yasovardhan Reddy E, Hemanth Korrapati and K Madhava Krishna ICAR 2009
4. Rakesh Goyal, K Madhava Krishna and Shivudu Bhuvanagiri, "Sensor Based Localization for Mobile Robots by Exploration and Selection of Best Direction", *accepted at Robio, IEEE/RSJ Intl' Conference on Robotics and Biomimetics*
2. A K Pandey and K Madhava Krishna, "Link Graph and Feature Chain based Robust Online SLAM for Fully Autonomous Mobile Robot Navigation System using Sonar Sensors", *Proceedings of ICAR 2007*
3. Satish Pedduri and K Madhava Krishna, "Collision Avoidance for Multiple Robots through Collision Free Paths till Next Waypoints from Collision Free Polygons", *Proceedings of ICAR 2007*
4. Karthikeya Viswanath and K Madhava Krishna, "Sensor Network Mediated Multi Robotic Traffic Control in Indoor Environments", *Proceedings of ICAR 2007*

5. Shivudu Bhuvanagiri, K Madhava Krishna and Rakesh Goyal, "Active Localization of Multiple Robots by Moving to Best Frontiers", *Proceedings of ICAR 2007*
6. Siddharth Sanan, Nageshwara Rao, K Madhava Krishna and Sartaj Singh, "On Improving the Mobility of Vehicles in Uneven Terrain", *Proceedings of ICAR 2007*
7. Ganesh P Kumar, K Madhava Krishna and P Menezes, "Multi-target Detection by Multi-sensor Systems: A Comparison of Systems", *accepted at Robio, accepted at Robio, IEEE/RSJ Intl' Conference on Robotics and Biomimetics*
8. K Madhava Krishna and Henry Hexmoor, "An Unconstrained Optimal Target Detection Algorithm for a Multi-Sensor Surveillance Systems", *IICAI, 2005*.
9. K Madhava Krishna, Henry Hexmoor and Subbarao, "Parametric Control of Multiple Unmanned Air Vehicles over an Unknown Hostile Habitat", *Proc of IEEE KIMAS, Boston, MA 2005*
10. K Madhava Krishna and Henry Hexmoor, "Resource Allocation Strategies for a Multi-sensor Surveillance System", submitted to *Conference on Collaborative Agents, Beijing 2004*
11. K Madhava Krishna and Henry Hexmoor, "A Framework for Measuring the Tracking Performance of a Sensor Network", *Proc. of PerMis'04 (Performance Metrics in Intelligent Systems), Aug 2004, Gaithersburg, MD*
12. K. Madhava Krishna, Henry Hexmoor and P Subbarao, "Role of Autonomy in a Distributed Sensor Network for Surveillance", *Proc. of ICAI 2004, (Intl Conf. on Artificial Intelligence), Las Vegas, July 2004*.
13. K. Madhava Krishna, Henry Hexmoor, P Subba Rao and S Chellapa, "A Surveillance System based on Multiple Mobile Sensors", *Proc. of FLAIRS 2004, Special Track on AI Techniques in Multi-sensor Fusion, Miami, May 2004*
14. K. Madhava Krishna, Henry Hexmoor and P Subba Rao, "Avoiding Collision Logjams through Cooperation and Conflict Propagation", *IEEE KIMAS'03 (International Conference on Knowledge Integrated Multi Agent Systems), Boston, MA, Oct 1-3, 2003*
15. K. Madhava Krishna and Henry Hexmoor, "Towards Quantification of the need to Cooperate between Robots", *Proceedings of PerMIS'03 (Performance Metrics in Intelligent Systems), Sep. 16-18, 2003*
16. K. Madhava Krishna and Henry Hexmoor, "Social Control of a Group of Collaborating Multi-robot Multi-target Tracking Agents", *IEEE, AIAA 22<sup>nd</sup> Digital Avionics Systems Conference, Indianapolis, Indiana, Oct. 12-16, 2003*.
17. Henry Hexmoor and K Madhava Krishna, "Collaborative and Social Reasoning about Interaction among a Large Group of Robots", *International Symposium on Collaborative Technologies and Systems, San-Diego, CA, Jan. 18-23, 2004*
18. K Madhava Krishna, K D Rajasekhar and L Behera, "On Fast Computation of Optimal Paths from the Visibility Graph for the Minimal Workspace", *Proc. International Symposium on Intelligent Robotic Systems , pp 147-154, Bangalore, INDIA, Jan 1998*.

---

### **Software Skills:**

- Versatile in C with more than ten-year experience starting from August of 1993
- Experienced in Java 2, TCL/TK toolkit and C++.
- Versatile in MATLAB with experience on the neural network and fuzzy logic toolbox.
- 8751 Assembly Language Programming (ALP), 8086 ALP, TMS320C5X 16bit fixed point DSP's ALP

- Familiar with MS Windows, Solaris, Linux OS
- 

### **Hardware Experiences:**

- Real-time control of Mobile Robots like XR-4000 NOMADIC, Active Media's AMIGOBOTS, LABMATE and ROVER
  - Hardware interfaces with PC's (Pentium 130 MHz) and 8051 microcontrollers
  - Interfaces with TMS320C5X 16 bit fixed point DSP
- 

### **Industrial Projects:**

- **Microcontroller (8751) based Product Mixer for Process Industry:**

Here a 8751 embedded controller based key board interface was designed, developed and implemented for the Central Electronics Engineering Research Institute at Madras during the summer of 94.

- **Design and Development of a Frequency Modulated File Transfer Protocol between Remote**

**Terminals:** This project was done during the Spring of 1996 for Amsoft Systems Pvt. Limited at New Delhi for facilitating wireless transfer of data in semi duplex mode between two remote PCs acting as dumb terminals.

---

### **Service:**

- Reviewer for IEEE Intl Conference on Robotics and Automation 2005, 2007
- Member IEEE
- Organized IROCHA, a Robotic Competition involving robotic system development and computer vision
- Organized a workshop, "Societal Applications for Multi Robotic Systems" as part of IJCAI.