

# Sigma Xi – Grant In Aid of Research (GAIR)

## Sensing and Control for Self-Replicating Mobile Robots

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Here are the results of your GIAR application that you submitted on  
**10/15/2004:**

### Applicant Information

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Institution Type/Department:	Other Academic Institution
Current Status:	Graduate Student
Present Position:	2nd
Current Degree Program:	M.S.
Other:	
Enrollment Duration (in yrs):	2
Graduation Month:	May
Graduation Year:	2005
Degrees Earned:	Bachelor of Engineering (Electrical & Electronics Engg.) -

	Osmania University, India
Gender:	Male
Ethnicity:	Asian
Sigma Xi Member?:	No

### Faculty Advisor Information

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Advisor Middle Name:	
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College/University:	University of Bridgeport
Advisor Reference Letter Status:	NOT SENT

### 2nd Reference Information

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Second Reference Letter Status:	NOT SENT

### Grant Proposal

Title of Study:	Sensing and Control for Self-Replicating Mobile Robots
	<p>Telerobotics (controlling robotic devices from a distance) has enjoyed a rich history. It has led to many practical applications and to a broad vision of interacting with environments far removed from the user. With an ultimate goal of developing a community of self-manufacturing autonomous robots, we have built RISCBOT, a web-controlled autonomous navigational robot with recognition capabilities, as a first step in this direction. The next step within the self-replicating robots project will involve</p>

	<p>adding manipulation capabilities (robotic arm) to RISCBOT. Furthermore, we intend to develop RISCBOT II to collaborate with RISCBOT and be able to use raw materials, components, links and sensory elements for assembling / manufacturing "Baby RISCBOTs" (with similar sensing and manipulation capabilities) who would continue the tradition of self replication. RISCBOT can be commanded via the Internet to move to particular offices in the Engineering Technology Building of the University of Bridgeport. It localizes and fulfills online users' requests of navigating to desired rooms. Navigation is performed with the help of the cameras and ultrasonic sensors. The robot processes images from the cameras to differentiate between doors, walls and obstacles. Images captured from the camera are encoded and broadcast over the web. Online users can view real time video feedback from the robot and a global surveillance camera. Our web-controlled mobile robot can be utilized to perform video surveillance, and many other functions within the areas of remote material handling, service robotics, online tour guidance, remote inspection and security. RISCBOT can also be used in a multi-agent environment to monitor and supervise collective tasks. At a later stage in our research, we will look into ways of enhancing RISCBOT's cognitive capabilities using soft computing techniques for enhancing the robots adaptability to varying environments. We are interested in developing hardware/software tools that will enable later generations of RISCBOT to build and repair other robots. We are currently working on making RISCBOT recharge itself by plugging into wall outlets. In conclusion, it is our opinion that the research directions described above would make the experience of developing a self-reproducing community of robotic systems a worthwhile, exciting and expandable research project. RISCBOT has helped us in acquiring the initial necessary expertise and experience and we hope that the Sigma Xi award would enable us to jumpstart our research and development efforts within the self-manufacturing area. For more information, multimedia downloads, media interviews and publications about RISCBOT please visit <a href="http://www.bridgeport.edu/sed/risc/html/proj/riscbot/index.htm">http://www.bridgeport.edu/sed/risc/html/proj/riscbot/index.htm</a></p>
Location:	RISC (Interdisciplinary Robotics, Intelligent Sensing, and Control) Laboratory, School of Engineering, University of Bridgeport.
Budget:	4 DC servo motors @ \$60.00 each = \$240.00 6 Ultrasonic sensors @ \$15.00 each = \$90.00 2 Panasonic 9 volt lead batteries @ \$72.00 each = \$144.00 3 Lego mindstorm cameras @ \$30.00 each = \$90.00 1 NTSC Camera @ \$150.00 1 NM6403 based digital image processing board @ \$ 300.00
Total Amount Requested:	1014.00
Field of Research:	Engineering

Designated Funding:	
Literature Citations:	<p>[1] Sebastian Thrun, Maren Bennewitz, Wolfram Burgard, Armin B. Cremers, Frank Dellaert, Dieter Fox, Dirk Hahnel, Charles R. Rosenberg, Nicholas Roy, Jamieson Schulte, and Dirk Schulz. MINERVA: A second-generation museum tour-guide robot. In Proceedings: IEEE International Conference on Robotics and Automation (ICRA '99), Detroit, Michigan, USA, May 1999. [2] W. Burgard, A.B., Cremers, D. Fox, D. Hahnel, G. Lakemeyer, D. Schulz, W. Steiner and S. Thrun. "The interactive museum tour-guide robot", American Association for Artificial Intelligence (AAAI-98), Madison, Wisconsin, July 1998. [3] R. Goodwin, K. Haigh, S. Koenig, and J. Sullivan "A Layered Architecture for Office Delivery Robots" First International Conference on Autonomous Agents, Marina Del Ray, California, February 1997. [4] Kimura, F. and M. Shridhar, Handwritten numerical recognition based on multiple algorithms, Pattern Recognition, Vol. 24, 1991, No. 10, pp. 969-983. [5] NeuroMatrix Board Support Kit, "Multiprocessor module assembly NM42, Programmer's Manual", Rev. 01 95 02A, Module Research Centre, Russia, 2003. [6] Atmel ATM103 Datasheet, Rev. 0945SE - 01/00/xM, Atmel Corporation, USA, 2000. [7] Kazuyuki Kobayashi, "MATLAB Utilization Book", Shuwa System Co, Ltd., 2001, ISBN 4-7980-0141-4. [8] Henrik Hansen, Anders Wang Kristensen, Morten Porsborg Kohler, Allan Weber Mikkelsen, Jens Mejdahl Pedersen, Michael Trangeled "Automatic recognition of license plates" Institute of Electronic Systems, Aalborg University, Denmark, May 26, 2002. [9] J.R. Parker " Algorithms for image processing and machine vision", ISBN 0-471-14056-2, Wiley Computer Publishing, 1997.</p>
Previous Grants:	None
Submitted Report?:	Not Applicable
Funding Source:	University of Bridgeport Graduate Assistantship
Applications Pending:	None
Coworkers:	Rajeev Sanyal
IACUC Question 1:	
IACUC Question 2:	
IACUC Question 3:	
IACUC Question 4:	
Application	<a href="#">Complete</a>

Status:

