

Filed on behalf of ABB, Inc.

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ABB, INC.
Petitioner

v.

ROY-G-BIV CORPORATION
Patent Owner

Trial No. IPR2013-00062
Patent 6,516,236 B1

DECLARATION OF NIKOLAOS PAPANIKOLOPOULOS, PH.D.

ABB v ROY-G-BIV
TRIAL IPR2013-00062
TRIAL IPR2013-00282
ABB - EXHIBIT 1132

I, Nikolaos Papanikolopoulos, Ph.D., hereby declare and state as follows:

I. BACKGROUND

1. I am currently employed by the University of Minnesota as a Distinguished McKnight University Professor of Computer Science and Engineering. I have been a professor at the University of Minnesota (originally as an assistant professor, and then as an associate professor) since the Fall of 1992. Between Fall 2001 and Spring 2004, and between Fall 2010 and Spring 2013, I was the Director of Undergraduate Studies of the College of Science and Engineering.

2. In 1992, I received my Ph.D. in Electrical and Computer Engineering from Carnegie Mellon University. My thesis, supervised by Prof. Pradeep Khosla, was entitled “Controlled Active Vision” and focused on using computer vision in a controlled fashion to monitor and manipulate objects in the environment. The computer vision was implemented on a camera and a computer system that processed the images and issued motion control commands to a robot manipulator. My group was the Advanced Manipulators Laboratory (AML). In 1988, I also received my M.S. in Electrical and Computer Engineering from Carnegie Mellon University. My B.S. in Electrical Engineering was received in 1987 from the National Technical University in Athens, Greece.

3. Over the last twenty three years, my research and teaching work has focused on robotics, computer vision, real-time systems, and intelligent transportation systems.

This research has included control and sensing software for robots like manipulators

and mobile robots.

4. I have founded a company named ReconRobotics Inc. which is one of the largest manufacturers in the world of miniature robots like the UMN Scout. More than 4,000 Scout robots have been deployed around the globe.

5. My research in the early 1990's focused on solving sensor-based control problems for robots including using sensory systems and algorithms to move a manipulator to detect an object, track it, estimate its position and orientation, and finally grasp it. Some of our efforts were described under the term "visual servoing." Our robots where the algorithms were implemented ranged from a Direct Drive Arm (DDArmII) to a Puma 560 robot and the Chimera II system was used to coordinate the various software tasks. A screenshot of the pertinent system is shown in Figure 1.

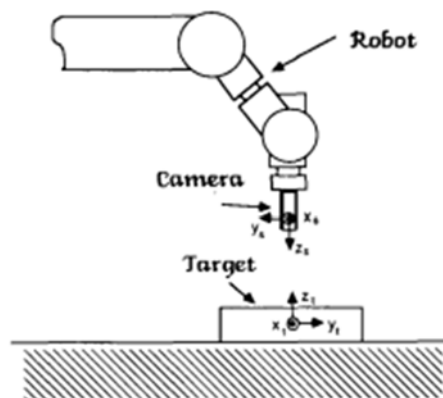


Figure 1: Experimental setup for the visual servoing task that used Chimera II.

6. When I moved to the University of Minnesota, I continued the work and in fact I received funding from the Sandia Labs (the initial source was the Department of Energy). The same unit partially funded the Chimera and Onika development efforts.

In particular, we developed a system (using a CCD camera) that could detect the depth of an object from a camera by moving the robot in a controlled way. We also created a robot-based system that could track non-rigid objects by using active deformable models.

7. I currently teach three courses relating to intelligent systems: (i) CSci 5551 Introduction to Intelligent Robotic Systems, (ii) CSci 5511 Artificial Intelligence, and (iii) CSci 5561 Computer Vision.

8. My research has produced more than 320 journal and conference publications. More than 70 publications are in refereed journals. Many of my publications relate to control software for motion control devices (including robots). Some examples include:

- 1) Janssen, M., and Papanikolopoulos, N.P., "Utilizing Queued Actions to Increase Interaction Efficiency in Robot Control Interfaces", *Proceedings of the 21st Mediterranean Conference on Control and Automation (MED' 2013)*, Patanias, Greece, 2013, pp 34-39.
- 2) McMillen, C., Stubbs, K., Rybski, P., Stoeter, S., Gini, M., and Papanikolopoulos, N.P., "Resource Scheduling and Load Balancing in Distributed Robotic Control Systems", *Robotics and Autonomous Systems*, Volume 44, No. 3-4, September 2003, pp 251-259.
- 3) Rybski, P., Stoeter, S., Gini, M., Hougen, D., and Papanikolopoulos, N.P., "Performance of a Distributed Robotic System Using Shared Communications Channels: A Framework for the Operation and Coordination of Multiple Miniature Robots", *IEEE Trans. on Robotics and Automation*, Volume 18, No. 5, October 2002, pp 713-727.
- 4) Papanikolopoulos, N.P., and Khosla, P.K., "Adaptive Robotic Visual Tracking: Theory and Experiments", *IEEE Trans. on Automatic Control*, Volume 38, No. 3, March 1993, pp 429 - 445.

5) Papanikolopoulos, N.P., Khosla, P.K., and Kanade, T., “Visual Tracking of a Moving Target by a Camera Mounted on a Robot: A Combination of Control and Vision”, *IEEE Trans. on Robotics and Automation*, Volume 9, No. 1, February 1993, pp 14 - 35.

9. As a result of my work and research, I am familiar with the design, control, operation and functionality of software for motion control devices including the ones used in robots (manipulators and mobile ones).

10. A copy of my curriculum vitae is attached as included herewith.

II. ASSIGNMENT AND COMPENSATION

11. I submit this declaration to oppose the Patent Owner’s Responses filed by RGB in the *Inter Partes* Review of U.S. Patent No. 5,516,236 (“the ’236 patent”), which includes Trial Nos. IPR2013-0062 and IPR2013-00282.

12. I am not an employee of Petitioner ABB or any affiliate or subsidiary thereof.

13. I am being compensated for my time at my usual rate of \$700 per hour. My compensation is in no way dependent upon the substance of the opinions I offer below, or upon the outcome of this *inter partes* review.

14. I have been asked to provide certain opinions relating to the ’236 Patent and the prior art that has been cited against the patent. Specifically, I have been asked to provide my opinion regarding (i) the level of ordinary skill in the art to which the patent pertains, and (ii) the patentability of claims of the patent.

15. The opinions expressed in this declaration are not exhaustive of my opinions

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