

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TOYOTA MOTOR CORPORATION

Petitioner

Patent No. 5,714,927

Issue Date: March 24, 1998

Title: METHOD OF IMPROVING ZONE OF COVERAGE RESPONSE OF
AUTOMOTIVE RADAR

DECLARATION OF NIKOLAOS PAPANIKOLOPOULOS, PH.D.

Case No. IPR2016-00293

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 was entitled “Controlled Active Vision” and focused on using computer vision in a controlled fashion to monitor and manipulate objects in the environment. 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 nineteen years, my research and teaching work has focused on intelligent transportation systems, sensing, and robotics. This research has included autonomous vehicles and object detection and recognition including work with artificial intelligence and pattern recognition systems.

4. My research in the early 1990's focused on solving sensor deployment problems including using sensory systems and algorithms to monitor the exterior and interior spaces of vehicles. Our efforts ranged from monitoring for pedestrians at crosswalks to performing real-time vehicle following. In particular, we developed a system (using a CCD camera) that could track humans as articulated bodies. We also created a system that detected the license plate of a vehicle ahead and then allowed the vehicle on which the camera was mounted to keep a constant distance from the leading vehicle.

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

6. My research has been funded by many agencies including the NSF and FHWA, and has produced more than 320 journal and conference publications. More than 70 publications are in refereed journals. Many of my publications and grants relate to intelligent vehicles and intelligent transportation systems. Some examples include:

- “CPS: TTP Option: Synergy: Collaborative Research: Dynamic Methods of Traffic Control that Impact Quality of Life in Smart Cities” (with Co-PIs J. Hourdos, M. Jovanovic, and S. Guy), NSF.
- Atev, S., Miller, G., and Papanikolopoulos, N.P., “Clustering of

Vehicle Trajectories”, *IEEE Trans. on Intelligent Transportation Systems*, Volume 11, No. 3, September 2010, pp. 647-657.

- “Deployment of Practical Methods for Counting Bicycling and Pedestrian Use of a Transportation Facility”, ITS Institute.
- Masoud, O., and Papanikolopoulos, N.P., “A Novel Method for Tracking and Counting Pedestrians in Real-time Using a Single Camera”, *IEEE Trans. on Vehicular Technology*, Volume 50, No. 5, September 2001, pp. 1267-1278.
- Du, Y., and Papanikolopoulos, N.P., "Real-time Vehicle Following Through a Novel Symmetry-Based Approach", *Proceedings of the 1997 IEEE Int. Conf. on Robotics and Automation*, pp. 3160-3165, Albuquerque, NM, April 20-25, 1997.

7. As a result of my work and research, I am familiar with the design, control, operation and functionality of exterior monitoring systems for vehicles.

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

II. ASSIGNMENT AND MATERIALS REVIEWED

9. I submit this declaration in support of the Petition for *Inter Partes* Review of U.S. Patent No. 5,714,927 (“the ’927 patent”) filed by Toyota Motor Corporation (“Toyota”).

10. I am not an employee of Toyota or any affiliate or subsidiary thereof.

11. I am being compensated for my time at a rate of \$400 per hour. My compensation is in no way dependent upon the substance of the opinions I offer below, or upon the outcome of Toyota's Petition for *Inter Partes* Review (or the outcome of such an *inter partes* review, if a review is granted).

12. I have been asked to provide certain opinions relating to the '927 patent. Specifically, I have been asked to provide my opinion regarding (i) the level of ordinary skill in the art to which the '927 patent pertains, and (ii) the patentability of claims 1, 2, and 6 of the '927 patent over the prior art.

13. The opinions expressed in this declaration are not exhaustive of my opinions on the patentability of any of the claims in the '927 patent. Therefore, the fact that I do not address a particular point should not be understood to indicate any agreement on my part that any claim otherwise complies with the patentability requirements.

14. In forming my opinions, I have reviewed the '927 patent and its prosecution history, as well as prior art to the '927 patent including:

- a) U.S. Patent No. 5,517,196 to Pakett et al. ("Pakett")
- b) Japanese Laid Open Patent App. Pub. No. H4-348293 by Kawai et al ("Kawai")
- c) U.S. Patent No. 5,767,793 to Agravante et al. ("Agravante")
- d) U.S. Patent No. 5,508,706 to Tsou et al. ("Tsou")

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