

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

GOOGLE LLC,  
Petitioner

v.

CYWEE GROUP LTD.  
Patent Owner

---

Case IPR2018-01257  
Patent No. 8,552,978

---

**EXPERT DECLARATION OF DR. JOSEPH LAVIOLA, PH.D., IN  
SUPPORT OF PATENT OWNER RESPONSE**

**Table of Contents**

<b>I. INTRODUCTION .....</b>	<b>1</b>
<b>II. QUALIFICATIONS, PUBLICATIONS, AND PRIOR TESTIMONY .....</b>	<b>2</b>
<b>III. RELEVANT LEGAL PRINCIPLES .....</b>	<b>5</b>
<b>IV. PERSON OF ORDINARY SKILL IN THE ART.....</b>	<b>8</b>
<b>V. U.S. PATENT 8,552,978 (THE “978 PATENT”) .....</b>	<b>10</b>
<b>A. Specification.....</b>	<b>10</b>
<b>VI. Background of the Technology .....</b>	<b>17</b>
<b>VII. CLAIM CONSTRUCTION .....</b>	<b>22</b>
<b>A. “3D pointing device” .....</b>	<b>24</b>
<b>B. “spatial reference frame”/ “spatial reference frame associated with the     3D pointing device” .....</b>	<b>26</b>
<b>C. “rotation output” .....</b>	<b>27</b>
<b>VIII. REFERENCES RELIED ON BY THE PETITIONER .....</b>	<b>27</b>
<b>A. U.S. Patent 7,089,148 to Bachmann (<i>Bachmann</i>, Exhibit 1004) .....</b>	<b>27</b>
<b>B. U.S. Patent Application Pub. No. 2004/0095317 to Zhang (Zhang,     Exhibit 1005).....</b>	<b>31</b>
<b>i. <i>Zhang</i> has been interpreted by the USPTO in various ex parte         examinations against relevant parties.....</b>	<b>33</b>
<b>C. U.S. Patent 7,158,118 to Liberty (<i>Liberty</i>, Exhibit 1006) .....</b>	<b>34</b>
<b>i. <i>Liberty</i> has been interpreted by the USPTO in various ex parte         examinations against relevant parties.....</b>	<b>35</b>
<b>IX. <i>BACHMANN</i> DOES NOT QUALIFY AS ANALGOUS ART.....</b>	<b>37</b>
<b>X. THE REFERENCES DO NOT DISCLOSE ALL LIMITATION OF THE CHALLENGED INVENTIONS.....</b>	<b>41</b>
<b>A. Ground 1 –<i>Zhang</i> in view of <i>Bachmann</i>.....</b>	<b>41</b>
<b>i. Claim 1 .....</b>	<b>43</b>
<b>ii. Claim 12 .....</b>	<b>48</b>
<b>B. Ground 2 –<i>Liberty</i> in view of <i>Bachmann</i>.....</b>	<b>49</b>
<b>i. Claim 10 .....</b>	<b>50</b>
<b>ii. Claim 12 .....</b>	<b>52</b>
<b>XI. CONCLUSION .....</b>	<b>52</b>

## I. INTRODUCTION

1. I have been retained by Patent Owner CyWee Group Ltd. (“CyWee” or “Patent Owner”) as an expert in the area of motion sensors and sensor fusion technology. I make this Declaration at the request of CyWee regarding my opinions as an independent expert regarding issues of validity of U.S. Patent No. 8,552,978 (the “978 Patent”) raised in the matter of *Inter Partes* Review, Petition IPR2018-01257 (“Petition”).

2. I am being compensated for this work at the rate of \$375/hr, and my compensation is not dependent on the outcome of this matter.

3. In preparation for this Declaration, I studied Exhibits 1001-1006 provided by Petitioner as well as the Petition. I have also studied several documents from various district court actions concerning the ‘978 Patent. These include the claim construction orders in *CyWee Group Ltd. v. Samsung Electronics Co., Ltd., et al*, No. 2:17-cv-00140-WCB-RSP (E.D. Tex.) (the “Samsung Suit”) and *CyWee Group Ltd. V. Motorola Mobility LLC*, No. 1:17-cv-00780-GMS (D. Del.) (the “Motorola Suit”).<sup>1</sup> The claim construction orders from these cases are provided as Exhibits 2003 and 2006-2007.

---

<sup>1</sup> I have also reviewed the claim construction order in *CyWee Group, Ltd. v. Huawei Device Co. Ltd.*, No. 2:17-cv-00495-WCB-RSP (E.D. Tex) (the “Huawei Suit”) in which the court adopted the same constructions it adopted in the Samsung Suit.

4. In addition to the above Papers and other documents, my opinions herein are also based upon my personal knowledge, professional judgment, education and experience gained through my years as a computer scientist, professor, and consultant.

## II. QUALIFICATIONS, PUBLICATIONS, AND PRIOR TESTIMONY

5. My Curriculum Vitae is provided as Exhibit 2005. The following is a summary of my education and relevant experience.

6. I have almost 20 years of experience working in the virtual reality (“VR”) and augmented reality (“AR”) fields, as well as advancing three-dimensional (“3D”) interaction techniques for use in both VR and AR environments. More specifically, I have worked extensively on and with user and object motion tracking sensors, algorithms and systems.

7. I am the Charles N. Millican Professor of Computer Science in the Department of Computer Science at the University of Central Florida, located in Orlando, Florida. I also serve as the Director of the Interactive Computing Experiences Research Cluster at the University of Central Florida. Through these functions, I supervise over fifteen graduate and undergraduate students working on various research projects in the area of human-computer interaction. In addition, since 2013, I have served as an Adjunct Associate Professor of Computer Science at Brown University, located in Providence, Rhode Island.

8. I received my Bachelor of Science degree in Computer Science from Florida Atlantic University in 1996. I also hold two Masters degrees – an Sc.M. in Computer Science and an Sc.M. in Applied Mathematics from Brown University – which were awarded in 2000 and 2001 respectively. I received my Ph.D. in Computer Science from Brown University in 2005.

9. I serve as Associate Editor for various publications in the area of human-computer interaction, including the International Journal of Human-Computer Studies and the Association for Computing Machinery’s Transactions on Interactive Intelligent Systems. I have also served as Program Chair for the IEEE Virtual Reality conference.

10. I have contributed to more than 40 peer-reviewed journal publications and nearly 100 refereed conferences and workshops, the majority of which deal with virtual and augmented reality and user and object motion tracking. For instance, I am the lead author of the second edition of the most comprehensive textbook on 3D user interaction, entitled “3D User Interfaces: Theory and Practice.” As part of that work, I analyzed many different types of input and output hardware, 3D user interfaces and general topics related to virtual and augmented reality. I have also worked specifically with sensors and algorithms related to the ‘978 patent.

11. I have been working with recursive-style estimators, including Kalman filters and Extended Kalman Filters (“EKFs”), for over 15 years. I have

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.