

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Singh et al.

U.S. Pat. No.: 6,400,376 B1

Attorney Docket No.: 30146-0017IP1

Issue Date: June 4, 2002

Appl. Serial No.: 09/217,400

Filing Date: Dec. 21, 1998

Title: DISPLAY CONTROL FOR HAND-HELD DATA PROCESSING DEVICE

DECLARATION OF DR. GREGORY F. WELCH

I, Dr. Gregory F. Welch, of Longwood, Florida, declare that:

1. I am currently a Professor and the Florida Hospital Endowed Chair in Healthcare Simulation at the University of Central Florida (UCF) with appointments in the College of Nursing, the Computer Science Division of the Department of Electrical Engineering and Computer Science, and the Institute for Simulation & Training. I am also an Adjunct Professor of Computer Science at the University of North Carolina at Chapel Hill (UNC). My qualifications for formulating my analysis on this matter are summarized here and are addressed more fully in my curriculum vitae, which is attached hereto as Appendix A.

2. In 1986, I received a B.S. degree in Electrical Engineering Technology from Purdue University (with *Highest Distinction*). In 1995, I received a M.S. in Computer Science from UNC. In 1997, I received a Ph.D. in Computer Science from UNC.

3. Previously I have been a Research Professor at the University of North Carolina at Chapel Hill, a Senior Engineer at Northrop-Grumman's Defense Systems Division where I worked on the AN/ALQ-135 electronic countermeasures system for the U.S. Air Force F-15 Eagle, and a member of the technical staff of NASA's Jet Propulsion Laboratory where I worked on the Voyager Spacecraft project. The vast majority of my professional and academic work has been directed toward the use of computers to measure (sense) various physical phenomena and then act on those measurements.

4. My current research interests include human-computer interaction, virtual and augmented reality, human motion tracking systems, three-dimensional (3D) telepresence, projector-based graphics, computer vision and view synthesis, and medical applications of computers for training, assessment, and practice. I have co-authored over 100 publications in these areas, and I am a co-inventor on multiple patents. I currently supervise over \$2M in research funding, and am jointly responsible for over \$23M in grants overall since 1996, from (for example) the Office of Naval Research (ONR), the National Science Foundation (NSF), The National Institutes of Health National Library of Medicine (NIH-NLM), the Defense Advanced Research Projects Agency (DARPA), the Department of Energy (DOE), and private companies—all involving multi-disciplinary and multi-institutional projects. I am the Co-Director of the Synthetic Reality Laboratory and

the Interactive Systems & User Experience Research Cluster of Excellence at UCF.

5. I have co-chaired major academic conferences and meetings (including IEEE ISMAR 2012 and Virtual Reality 2013), served on numerous program committees, co-chaired workshops, and serve as a peer reviewer for many conferences and journals. I am an Associate Editor for the journal *Presence: Teleoperators and Virtual Environments*, and an Associate Editor for the journal *Frontiers in Virtual Environments*.

6. I am a member of multiple professional societies including the Institute of Electrical and Electronics Engineers (IEEE, Senior Member) and the Association for Computing Machinery (ACM).

7. My work in human interface systems and the associated the computer-based sensing (e.g., hardware, software, sources/sensors, signal processing, and algorithms) goes back at least to the early 1980s when I was an undergraduate at Purdue University, e.g., with the co-development of an environmentally aware “smart wheelchair” for children with Cerebral Palsy. Fellow student and co-developer James Williams and I received an “Outstanding Senior Design Project award for “The Easy Chair” in 1986. One of my core contributions to the wheelchair project was the development of a novel customizable touch pad to be used by the children to control the wheelchair. The touch pad was customizable to

allow caregivers to design an interface that was tailored to each child and their unique (limited) affordances. My work on touch pad technology in the mid 1980's built on technology that had been developed decades earlier. I co-wrote and delivered various documents describing our pressure sensitive and infrared touch pad technology, and "The Easy Chair" system as a whole.

8. My work in computer-based sensing continued into the late 1980s and early 1990s when I worked at NASA's Jet Propulsion Laboratory (the Voyager Project) and Northrop-Grumman's Defense Systems Division (a radar jammer). In particular in 1992 I attended graduate school at the University of North Carolina at Chapel Hill (UNC) where I studied/worked under the direction of Prof. Gary Bishop and others as a graduate student. My Ph.D. work, which I completed in 1996, introduced a new Kalman filter-based Single Constraint at a Time (SCAAT) approach to sensing for applications such as human motion tracking in Virtual Environments. It was one of the critical aspects of the HiBall system for tracking heads, hands, and user interface devices. This system was commercialized by 3rdTech and sold until approximately 2012. As a part of this work, I created what is now a popular web site dedicated to the Kalman filter, and I co-authored a paper titled "An Introduction to the Kalman filter" that has been cited over 6,000 times according to an estimate from Google search results.

9. While a research faculty member at UNC from 1996-2011, I co-
led/led the Tracker Research Group, the 3D Computer Vision Group, and the
Office of the Future Group. This includes conception and acquisition of contracts
and grants; leading the subsequent research efforts; advising students; serving on
Ph.D. committees; etc. In the mid-to-late 1990s I co-developed methods for
tracking human motion by combining measurements from cameras that recognize
and track natural features in the environment, with inertial and other sensing
devices (accelerometers and gyros). Along the way I have developed human
interface devices for research (e.g., physician interfaces for medical visualization
and telepresence), and supervised the development of human interface devices by
students in a Virtual Worlds course at UNC.

10. Over the course of my academic and career experiences, I have
invested a considerable amount of time researching technologies and techniques
regarding the ways people input touch commands to devices, including through the
use of touch screen displays. My efforts here include researching various resistive,
capacitive, and optical touch devices, and their interaction with human motion of
pen and finger inputs.

11. Presently I am leading the development of several human interface
projects related to military and healthcare simulation and training at UCF. For
example, my team recently developed a system that comprises a plastic model of a

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.