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**Motta et al.**

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- (54) **THREE DIMENSIONAL USER INTERFACE EFFECTS ON A DISPLAY**
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- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 206 days.

This patent is subject to a terminal disclaimer.

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- (63) Continuation-in-part of application No. 12/849,945, filed on Aug. 4, 2010, now Pat. No. 8,913,056.
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- (51) **Int. Cl.**  
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CPC ..... **G06F 3/012** (2013.01); **G06F 3/005** (2013.01); **G06F 3/0346** (2013.01); **G06F 3/04815** (2013.01); **G06T 15/20** (2013.01); **G06F 2203/0381** (2013.01)

- (58) **Field of Classification Search**  
None  
See application file for complete search history.

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- (57) **ABSTRACT**
- The techniques disclosed herein may use various sensors to infer a frame of reference for a hand-held device. In fact, with various inertial clues from accelerometer, gyrometer, and other instruments that report their states in real time, it is possible to track a Frenet frame of the device in real time to provide an instantaneous (or continuous) 3D frame-of-reference. In addition to—or in place of—calculating this instantaneous (or continuous) frame of reference, the position of a user's head may either be inferred or calculated directly by using one or more of a device's optical sensors, e.g., an optical camera, infrared camera, laser, etc. With knowledge of the 3D frame-of-reference for the display and/or knowledge of the position of the user's head, more realistic virtual 3D depictions of the graphical objects on the device's display may be created—and interacted with—by the user.

**20 Claims, 15 Drawing Sheets**

