

## IMAGE PROJECTOR WITH REFLECTED LIGHT TRACKING

### CROSS REFERENCE TO RELATED APPLICATIONS

**[0001]** This application claims the benefit of U.S. Provisional Application, titled "NOVEL PROJECTION SYSTEM USING A HIGH-SPEED PSEUDORANDOM SWEEPING LIGHT BEAM," Ser. No. 60/998,520, filed on Oct. 10, 2007, U.S. Provisional Application, titled "PHOTONJET SCANNER-PROJECTOR," Ser. No. 61/000,238, filed on Oct. 23, 2007, U.S. Provisional Application, titled "PHOTONJET TRACKING CAMERA," Ser. No. 61/002,402, filed on Nov. 7, 2007, and U.S. Provisional Application, titled "PHOTONJET SCANNER-PROJECTOR SYSTEM," Ser. No. 61/005,858, filed on Dec. 7, 2007, the benefit of the earlier filing dates of which is hereby claimed under 35 U.S.C. § 119(e) and the contents of which are further incorporated by reference in their entirety.

### TECHNICAL FIELD

**[0002]** The present disclosure is directed to an image projector in general, and more particularly, to an image projector that employs observed reflection of light beams to predict the subsequent position of light beams that display the image on a remote surface.

### BACKGROUND

**[0003]** With the ubiquity of images that are available for display by an electronic device, the capabilities of a particular electronic device's display has become a significant factor to users. These images can include, movies, videos, podcasts, television, pictures, cartoons, illustrations, graphics, tables, charts, presentations, and the like. Also, the quality, resolution, and type of display for images that can be displayed by an electronic device is often the primary factor in a user's decision to purchase that particular electronic device. For example, users' might prefer relatively low power projection displays for mobile devices, such as mobile telephones, notebook computers, hand held video game consoles, hand held movie players, personal digital assistants (PDA), and the like. These low power projection displays can include, and backlit or non-backlit Liquid Crystal Displays (LCD). Further, other relatively low power emissive displays such as Organic Light Emitting Diodes (OLED), are growing in popularity for mobile devices. Also, the size of a display for a mobile device is often limited to a relatively small area, i.e., displays that can easily fit in a hand or clothing pocket. The relatively small size of displays for many mobile devices can also limit their usability for some applications.

**[0004]** Stationary electronic devices, such as personal computers, televisions, monitors, and video game consoles, often employ high power projection display technologies, such as Gas Plasma, Cathode Ray Tubes (CRT), LCD, DLPs (Digital Light Processor), and the like. Also, displays for these relatively stationary electronic devices are often considerably larger than those displays employed with mobile devices, e.g., projection displays can be five feet across or more. However, the relatively large physical size of the cabinetry associated with most displays employed with stationary devices can be inconvenient and unattractive for many users, especially when the displays are not in use.

**[0005]** Front image projection devices can also be used to display images on a remote surface, e.g., a hanging screen of reflective fabric, or some other relatively vertical and reflective surface such as a wall. Also, a variety of different technologies are employed by front image projection devices, such as Digital Light Processors (DLP), Light Emitting Diodes (LED), Cathode Ray Tubes (CRT), Liquid Crystal Displays (LCD), Liquid Crystal on Silicon (LCoS), Micro-ElectroMechanicalSystems (MEMS) scanners, and the like. However, artifacts in the display of images projected on remote surfaces have been difficult to compensate for, and often adversely effect the quality, resolution, and usability of these remotely projected images.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0006]** Non-limiting and non-exhaustive embodiments of the present invention are described in reference to the following drawings. In the drawings, like reference numerals refer to like parts through all the various figures unless otherwise explicit.

**[0007]** For a better understanding of the present disclosure, a reference will be made to the following detailed description, which is to be read in association with the accompanying drawings, wherein:

**[0008]** FIG. 1 is a block diagram of one embodiment of a Image Projector Device (IPD);

**[0009]** FIG. 2 shows one embodiment of a client device that may be included in a system implementing aspects of the invention;

**[0010]** FIG. 3 shows one embodiment of a IPD control sub-system;

**[0011]** FIG. 4A shows one embodiment of light beam trajectories generated by a IPD;

**[0012]** FIG. 4B shows an embodiment of one light beam trajectory with scanned and predicted trajectory portions;

**[0013]** FIG. 5 shows an embodiment of a IPD depicting one image beam and tracer beam point;

**[0014]** FIG. 6A shows an embodiment of an application of an IPD with different user vantage points;

**[0015]** FIG. 6B shows an embodiment of an IPD response to different viewing perspectives;

**[0016]** FIG. 6C shows an embodiment of a IPD projection onto a tilted screen;

**[0017]** FIG. 7A shows an embodiment of a mobile device with an embedded IPD;

**[0018]** FIG. 7B shows another embodiment of a mobile device with an embedded IPD and a head-mounted position sensor; and

**[0019]** FIG. 8A shows a flow diagram of one embodiment of a high level process of generating an image using a IPD; and

**[0020]** FIG. 8B shows a flow diagram of one embodiment of a detailed process of generating an image with a IPD.

### DESCRIPTION OF THE EMBODIMENTS

**[0021]** The present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, which form a part hereof, and which show, by way of illustration, specific exemplary embodiments by which the invention may be practiced. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be