Users can read a scanned image of a page and annotate it with digital ink. Annotations are captured and used to organize information. Scrolling has been removed from the system: pages are turned using a pressure sensor on the tablet. Users can also examine a thumbnail overview to select pages. Pages can be navigated by locating similar annotations across multiple documents. Fishkin et al. (**2**) describe embodied user interfaces that allow users to use physical gestures like page turning, card flipping, and pen annotation for interacting with documents. The system uses physical sensors to recognize these gestures. Due to space limitations we limit our review: other systems exist that link the digital and physical world through paper. Examples include Freestyle (**10**), Designers' Outpost (**8**), Collaborage (**12**), and Xax (**6**). One feature common to prior work in this area is the restriction of the use of physical paper to a flat surface. Many project onto or sense interaction in a coordinate system based on a rigid **2**D surface only. In our system, by contrast, we use as many of the three dimensional affordances of flexible displays as possible.

[**0011**] In Illuminating Digital Clay (**15**), Piper et al. proposed the use of a laser scanner to determine the deformation of a clay mass. This deformation was in turn used to alter images projected upon the clay mass through a projection apparatus. The techniques presented in this patent are different in a number of ways. Firstly, our display unit is completely flexible, can be duplicated to work in unison with other displays of the same type and move freely in three-dimensional space. They can be folded 180 degrees around any axis or sub-axes, and as such completely implement the functionality of two-sided flexible displays. Secondly, rather than determining the overall shape of the object as a point cloud, our input techniques rely on determining the 3D location of specific marker points on the display. We subsequently determine the shape of the display by approximating a Bezier curve with control points that coincide with these marker locations, providing superior resolution. Thirdly, unlike Piper (**15**), we propose specific interaction techniques based on the 3D manipulation and folding of the display unit. The advantages of regular paper over the windowed display units used in standard desktop computing are manifold (**21**). In the Myth of the Paperless Office (**21**) Sellen analyzes the use of physical paper. She proposed a set of design principles for incorporating affordances of paper documents in the design of digital devices, such as 1) Support for Flexible Navigation, 2) Cross Document Use, 3) Annotation While Reading and 4) Interweaving of Reading and Writing.

[**0012**] Documents presented on paper can be moved in and out of work contexts with much greater ease than with current displays. Unlike GUI windows or rigid LCD displays, paper can be folded, rotated and stacked along many degrees of freedom (**7**). It can be annotated, navigated and shared using extremely simple gestural interaction techniques. Paper allows for greater flexibility in the way information is represented and stored, with a richer set of input techniques than currently possible with desktop displays. Conversely, display systems currently support properties unavailable in physical paper, such as easy distribution, archiving, querying and updating of documents. By merging the digital world of computing with the physical world of flexible displays we increase value of both technologies.

SUMMARY OF THE INVENTION

[**0013**] The present invention relates to a set of interaction techniques for obtaining input to a computer system based on methods and apparatus for detecting properties of the shape, location and orientation of flexible display surfaces, as determined through manual or gestural interactions of a user with said display surfaces. Such input may be used to alter graphical content and functionality displayed on said surfaces or some other display or computing system.

[**0014**] One aspect of the invention is a set of interaction techniques for manipulating graphical content and functionality displayed on flexible displays based on methods for detecting the shape, location and orientation of said displays in 3 dimensions and along 6 degrees of freedom, as determined through manual or gestural interaction by a user with said display.

[**0015**] Another aspect of the invention is a capture and projection system, used to simulate or otherwise implement a flexible display. Projecting computer graphics onto physical flexible materials allows for a seamless integration between images and multiple 3D surfaces of any shape or form, one that measures and corrects for 3D skew in real time.

[**0016**] Another aspect of the invention is the measurement of the deformation, orientation and/or location of flexible display surfaces, for the purpose of using said shape as input to the computer system associated with said display. In one embodiment of the invention, a Vicon Motion Capturing System (**23**) or equivalent computer vision system is used to measure the location in three dimensional space of retro-reflective markers affixed to or embedded within the surface of the flexible display unit. In another embodiment, movement is tracked through wireless accelerometers embedded into the flexible display surface in lieu of said retro-reflective markers, or deformations are tracked through some fiber optics embedded in the display surface.

[**0017**] One embodiment of the invention is the application of said interaction techniques to flexible displays that resemble paper. In another embodiment, the interaction techniques are applied to any form of polymer or organic light emitting diode-based electronic flexible display technology.

[**0018**] Another embodiment of the invention is the application of said interaction techniques to flexible displays that mimic or otherwise behave as materials other than paper, including but not limited to textiles whether or not worn on the human body, three-dimensional objects, liquids and the likes.

[**0019**] In another embodiment, interaction techniques apply to projection on the skin of live or dead human bodies, the shape of which is sensed via computer vision or embedded accelerometer devices.

[**0020**] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention pertains. Although methods and materials similar or equivalent to those described herein can be used in the practice of the present invention, suitable methods and materials are described below. All publications, patent applications, patents, and other references mentioned herein are