Touch detection and object recognition in multi-touch interactive video walls

Large-format, interactive video walls are fast becoming an indispensable promotional platform for organizations everywhere. As touch and multi-touch recognition technologies continue to improve, so do the benefits of being able to engage and captivate audiences. When deployed in environments such as retail, stadiums, museums, universities and corporate spaces, interactive displays increase audience dwell time, create stronger brand loyalty, greater satisfaction for the user and higher brand awareness.

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What do we mean by multi-touch?

While touch sensing is commonplace for single points of contact, multi-touch sensing devices enable a user to interact with a display system with more than one finger at a time. Such sensing devices are also able to accommodate multiple users simultaneously, which is especially useful for larger interaction scenarios, such as large-format video walls and tabletops.

Today's multi-touch interactive technologies

There are many different touch technologies available, each with its own distinct advantages and disadvantages. It is therefore important to select the right technology for a particular application.

Smaller formats – such as smartphones, tablets and small monitors – use resistive, capacitive or acoustic overlays to achieve multi-touch interactivity. For larger formats, optical technology using infrared light is the more cost effective solution. The two most popular types of optical systems are: imager-based systems with two or four cameras in the corners of the display, and sensor-based systems which use a series of sensors along one or two edges of the display. Imager-based systems may be more affordable, but support fewer touches and are less reliable than sensor-based systems.

▶ The Christie Interactivity Kit is a sensor-based, modular, multi-touch interactive solution. It supports up to 18 simultaneous touches on a large-format display.

Christie's multi-touch interactive solution

The Christie® Interactivity Kit is a sensor-based system that transforms any large-format video wall into a dynamic and responsive multi-touch surface. Due to its modular design, the Christie Interactivity Kit can accommodate almost any video wall up to 21.4 ft. (6.5m) wide by 6 ft. (1.8m) high, or a Christie MicroTiles® array measuring up to 16 units wide by 6 units high.

These field-installable kits attach around the perimeter of a display wall and plug into a computer USB port without any need for drivers. The Christie Interactivity Kit is automatically recognized as a multi-touch device by Windows 7 and no manual calibration of sensors or cameras is required.

Using Baanto™ ShadowSense™ technology, the Christie Interactivity Kit offers excellent performance with high-touch accuracy and fast response times while supporting up to 18 simultaneous touches.

What is Baanto ShadowSense?

Baanto ShadowSense touch technology is an innovative and patented optical position-sensing technology. Unlike other optical technologies that utilize cameras or imaging arrays, ShadowSense uses sensors operating in the analog domain to provide fast response, stable performance and accuracy. Featuring an efficient sensor architecture, coupled with elegant position detection algorithms, ShadowSense overcomes many of the challenges faced by traditional optical designs.

The best analogy for ShadowSense technology lies in the 6000-year-old sundial. The shadow cast by a sundial instantly and accurately responds to the position of a light source without the use of lenses, with an infinite depth of field and without the need for exposure control. ShadowSense technology exploits the same characteristics for touch applications, resulting in a high performance and robust optical sensing solution.

Object recognition

The challenges with object recognition

The proliferation of multi-touch technologies has created a new set of challenges for application developers who have been comfortable with traditional single touch user interfaces. Drags, pinches and other dynamic touches now cause the traditional "single extended finger" to move and be oriented in unexpected ways as the entire hand moves across the screen. Depending on the touch technology, unwanted touch events, such as from the side of the hand, the palm, jewelry and coat sleeves, may be recognized and reported as a legitimate touch, causing the content to respond in unintended ways.

Sensitivity

The level of sensitivity to an unwanted, random touch will vary based on the touch technology and implementation details. For example, projected capacitive touchscreens are more likely to report a touch from the side of the hand, palm, dragging knuckles or a little finger. Depending on the sensitivity of the touch controller, contact with the screen may not have even occurred as the body part simply entered into the hover distance of the touchscreen. Optical systems featuring "Any Object" touch detection will register a touch from any solid object entering the touch plane, including inanimate objects a user may be wearing or holding, which increases the number of unwanted touch events.

◀ Optical systems featuring "Any Object" touch detection will register a touch from any solid object, such as the side of a palm.

▶ Large-format, multi-touch interactive video walls provide an exciting and engaging platform that can inform, educate and inspire.
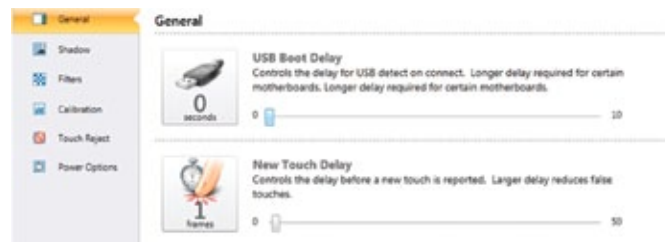
Touch Area Detection

Within Baanto™ ShadowSense™, the touch size information has been coupled with a dashboard application. This Touch Area Detection feature allows users to define the size limits associated with expected, desired or required touch objects to reduce or even eliminate the reporting of unwanted touch events.

New Touch Delay

An additional parameter to further enhance unwanted touch recognition is the "dwell time" before a new touch is acknowledged and reported to the host PC. Also controlled by the dashboard, the "New Touch Delay" feature allows an application developer to control the number of frames a touch object must exist before reporting a valid touch event. This setting further enhances the transient touches which are characteristic of jewelry or clothing accidently entering the touch plane when a user is in the act of touching or tracking a touch point on the screen.
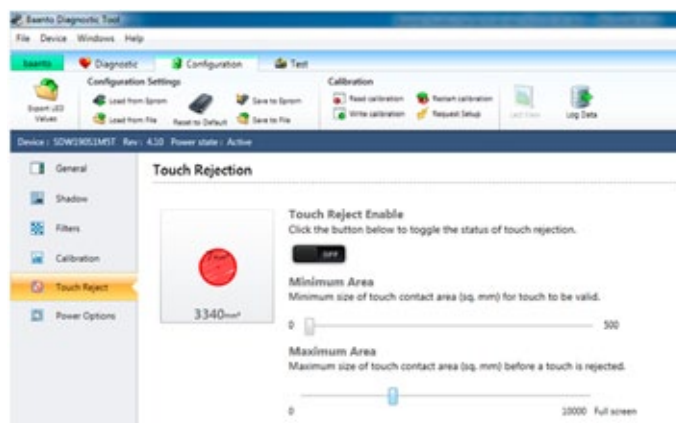
▲ Adjusting the touch gate to a minimum touch area of 7mm and a maximum touch area of 3340mm is designed to eliminate palm touches in a multi-touch system.

▲ The New Touch Delay feature controls the number of frames a touch object must exist before being reported as a valid touch event.

Unprecedented control

The combination of Touch Area Detection and New Touch Delay provides users with unprecedented control over the performance of a touchscreen display solution using Baanto ShadowSense technology. This creates an opportunity for application developers to exploit the advantages of optical touch systems with a much higher degree of reliability and control. The result, as seen below, is that the fist resting on the touch screen is ignored while the finger trace is within the size "gate" and is reported as a valid touch.

Touch detection

How does Baanto ShadowSense touch detection work?

Baanto™ ShadowSense™ is a frame-based technology. Sensors are placed along the top edge of the frame while LED light sources are placed along the two sides and the bottom. Because the Christie® Interactivity Kit frame design is modular, the number of sensors and LEDs varies depending upon the size of the configuration. The simplified diagram (below) illustrates the location of the sensors and LEDs.

ShadowSense touch is based on the precise and accurate detection of an object's shadow as it enters, hovers within or transitions out of a sensor's field of view. The object's position in the touch plane is then calculated based on the ratio of a fully illuminated condition to the shadowed state for multiple light sources and multiple sensors.

Basing touch detection on the shadow of an object results in the touch screen detecting the position of almost any object entering the touch plane. This eliminates the need to use a specific object such as a bare finger or specialty pen to activate the screen, improving the user experience.

Lastly, ShadowSense detects and calculates not just the position of a touch object, but also its size and opacity. This enables creative applications, such as a paint program that uses real paint brushes.
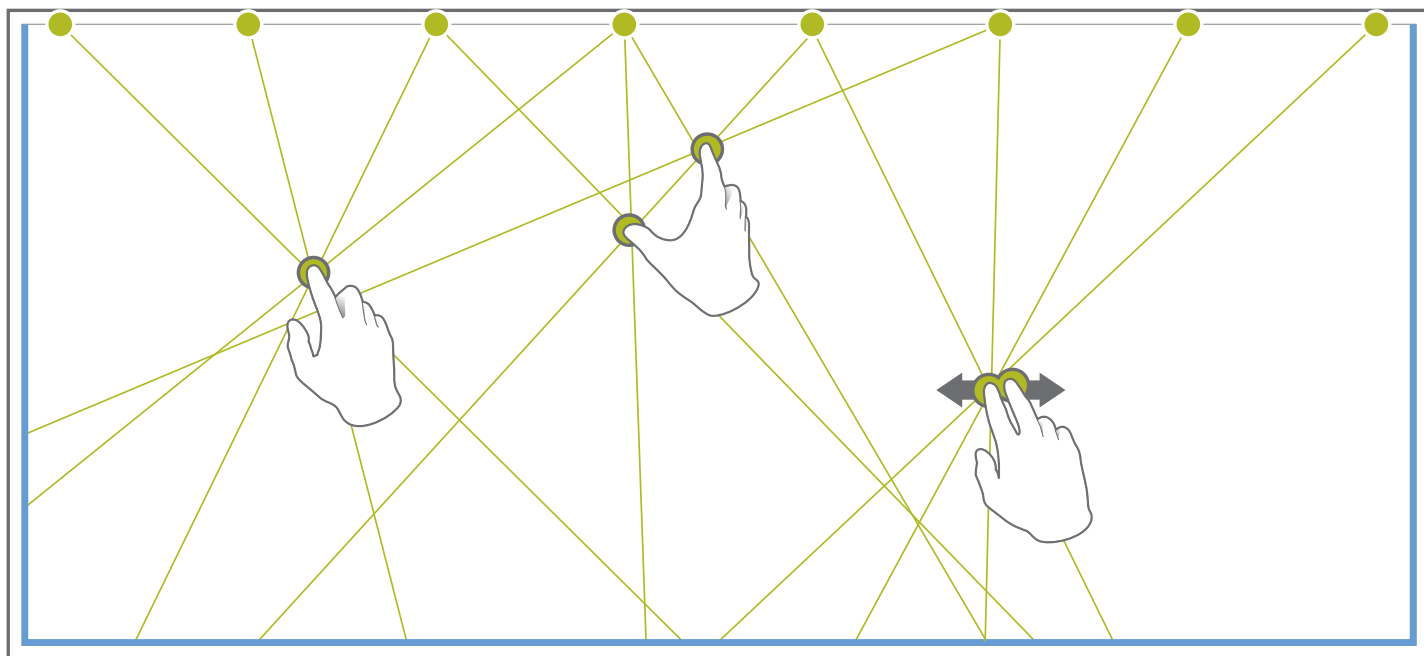
▲ Sensors along the top (green circles) and Infrared LEDs along sides and bottom (blue strips) allow for precise and accurate detection of an object's shadow as it enters, hovers within or transitions out of a sensor's field of view.

▲ The Christie Interactivity Kit is a high-performance, multi-touch system that allows several people to interact simultaneously with the touch surface, opening up creative learning, collaboration and entertainment applications such as painting and drawing.

What are the unique features of Baanto ShadowSense technology?

❶ High performance

The Baanto ShadowSense technology that powers the Christie Interactivity Kit provides a high-performance, multi-touch experience so that multiple people can use the touch surface at the same time. In addition, ShadowSense sensors have a field of view approaching 180°, allowing them to be placed along the entire width of the display rather than being restricted to the corners – this provides additional perspective of objects or touches and low susceptibility to occlusion[1] or ghosting.

ShadowSense supports:
Up to 18 concurrent touches on a large-format display
Common multi-touch gestures using two or more fingers
Object size recognition, opening up creative possibilities to applications such as painting textures

❷ High reliability

Baanto ShadowSense provides a high resolution, multi-touch solution that operates predictably and reliably without degradation over time.

Highly reliable
Sensors perform well in indoor, high ambient light environments
Operates in a wide range of temperatures, from 0°C to 35°C (32°F to 95°F) and under humid conditions from 5% to 90%, non-condensing
Does not rely on any special film to operate, meaning limitless touches, slides and gestures are possible without any compromise in performance due to scratches in the film

❸ Quick and easy set up and simple operation

Easy set up
No cameras required
No critical alignment or calibration required
No glass or special stylus required
No drivers required
No PC-based algorithms required

Learn more about Christie Interactivity Kit

Watch the video: Christie Interactivity Kit – How it works
Visit: christiedigital.com/interactivity

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[1] User touches in one place but it is ignored or registered in another.

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