light source(s) **18** is occluded by the tip of the finger and does not reach the front side surface **12**B of the screen **12**. Therefore, the light on the rear side **12**A of the screen **12** at point B in situation B comes solely from the rear light source(s) **16**, and corresponds to the sum of the light reflected from the rear surface **12**A and the light reflected by the skin of the user's fingertip. Therefore, in situation B the image obtained by the camera **14** corresponding to the position of the user's finger (point B) is solely due to the reflection of the light coming from the rear light source(s) **16**. It can be noticed that points in the area around point B, not covered by the user's finger, have similar characteristics of point A (i.e., the light reaching the camera **14** is light originating from both the front light source(s) **18** and the rear light source(s) **16**).

[**0026**] The exact location of point A and/or point B on the screen **12** may be readily determined from a transformation from camera **14** coordinates to screen **12** coordinates.

[**0027**] As such, it can be appreciated than an aspect of this invention is a signal bearing medium that tangibly embodies a program of machine-readable instructions executable by a digital processing apparatus to perform operations to detect a user input. The operations include, in response to providing a system having a translucent screen having an image capture device located for imaging a first side of the screen opposite a second side where user interaction occurs: determining at least one of where and when a person touches an area on the second side of the screen by detecting a change in intensity of light emanating from the touched area relative to a surrounding area.

[**0028**] **FIG. 2** shows examples of imagery obtained by the camera **14** when the user touches the screen **12** according to the difference between front and rear projection light source(s) **18** and **16**, respectively. As shown in the top row of images (designated **2**A), corresponding to a case where the front light source(s) **18** are brighter than the rear light source(s) **16**, touching the screen **12** creates a dark area on the contact point. Since the front light source(s) **18** are brighter than the rear light source(s) **16**, the touching situation obscures the user's finger skin on the point of contact from the influence of the front light source(s) **18**. In this situation the user's finger reflects only the light coming from the rear light source(s) **16**, which are less bright than the front light source(s) **18**, thereby producing a silhouette effect for the fingertip. The second, lower row of images (designated **2**B) illustrates the opposite effect, where the rear light source(s) **16** are brighter than the front light source(s) **18**. In this situation, as the finger touches the screen **12**, it reflects mostly the light arising from the rear light source(s) **16** and, since these are brighter than the front light source(s) **18**, the image of the finger appears brighter from the camera **14**. The last (right-most) column of **FIG. 2** depicts the absolute difference between the two previous images in the same row. As can be readily seen, the largest absolute difference between the two previous images in each row occurs exactly at the point on the front side surface **12**B that is touched by the user.

[**0029**] **FIG. 3** shows a logical flow diagram that is descriptive of one cycle of the method to detect those situations where a user, or multiple users, touch the screen **12** either sequentially or simultaneously. It is assumed that the logical flow diagram is representative of program code executed by the data processor **20** of **FIG. 1**. The procedure starts **(010)** by grabbing one digitized frame **(110)** of the video stream produced by the camera **14**. If the video output of the camera is in analog form, then the analog video signal is preferably digitized at this point. In the next step, the grabbed frame is subtracted pixel-by-pixel **(120)** from a frame captured in a previous cycle **(100)**, producing a difference image. To simplify the following computation, a non-limiting embodiment of the invention uses the absolute value of the difference on each pixel. The difference image is scanned and pixels with high values are detected and clustered together **(130)** in data structures stored in the computer memory **22**. If no such cluster is found **(140)**, the procedure jumps to termination, saving the current frame **(160)** to be used in the next cycle as the previous frame **(100)**, and completes the cycle **(300)**. If at least one cluster of high difference value are found **(140)**, the procedure examines each detected cluster separately **(150)**. For each cluster, the procedure determines whether generating a touch event is appropriate **(200)** considering either or both the current cluster data and the previous clusters data **(210)**. This evaluation can include, but is certainly not limited to, one or more of a determination of the size of a cluster of high difference value pixels and a determination of the shape of a cluster of high difference value pixels. If the cluster is found to be appropriate to generate an event, the procedure generates and dispatches a detected touch event **(220)** to the client application or system. After generating the touch event **(220)**, or if a cluster is deemed not appropriate to generate a touch event (the No path from **(200)**), the procedure saves the cluster data **(230)** for use in future cycles **(210)**. After all clusters are examined **(150)**, the procedure saves the current frame **(160)** to be used in the next cycle and completes the current cycle **(300)**.

[**0030**] A non-limiting aspect of this invention assumes that the amount of light from the front light source(s) **18** that passes through the screen **12** is different than the amount of light reflected by the skin from the rear light source(s) **16**. Otherwise, the changes are not detectable by the computer vision system. However, situations where both light levels are similar occur rarely, and may be compensated for by increasing the amount of front or rear light. En particular, it has been found that it is preferable to have the front light source **18** brighter than the rear light source **16**.

[**0031**] As was noted in the discussion of **FIG. 2**, if the amount of front generated light passing through the rear side surface **12**A of the screen **12** is greater than the rear light being reflected from the rear side surface, the user's point of contact with the front side surface **12**B is silhouetted, creating a dark spot (row **2**A). By differencing consecutive frames of the image stream (e.g., frames generated at a rate of 30 per second), the data processor **20** is able to detect the time when the user touches the screen **12**, and also the duration of the contact. Notice that at the moment of contact, because of the light difference, there is a remarkably discontinuous change in the image. In the opposite situation, that is, when the rear light reflected by the skin of the user's finger is brighter than the light passing through the surface **12**A from the front light source(s) **18** (row **2**B), one can again observe a clear change in the image at the moment of contact.

[**0032**] In the procedure described in **FIG. 3 a** relatively basic computer vision method can be used, such as one