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Handling Computer for Physically Disabled Person without Using Fundamental Input Device

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Abstract: **Disability is the consequence of an impairment that may be physical, cognitive, mental, sensory, emotional, developmental, or some combination of these that result in restrictions on an individual's ability to participate in what is considered "normal" in their everyday society. Touch screens are known by everyone in the current world. Not only mobile phones, tabs and laptops are already the product of the touch screen technology. For smart-phone purpose, these touch screens are generally resistive or capacitive. There are lots of image processing touch screens available in the market, but there exists a lots of disadvantage. This paper presents a solution to existing problems by introducing a cost effective approach. The setup requires IR and IR detection camera. There are lots of algorithms available for this kind of image processing technique but a simple approach is used here to detect the finger blobs.**

Keywords: **image processing, blob, camera, touch, pixel, noise, algorithm.**

I. INTRODUCTION

A multi-touch interface is a human-computer interface allowing users to compute without input devices such as mouse or mechanical keyboard [1].In June 2007, Apple introduced a multi-touch interface on the iPhone and later that year on the iPod touch [2].Both touch tables and touch walls project an image through acrylic or glass, and then back-light the image with LEDs [3]. Touch surfaces can also be made pressure-sensitive by the addition of a pressure-sensitive coating that flexes differently depending on how firmly it is pressed, altering the reflection. Handheld technologies use a panel that carries an electrical charge. When a finger touches the screen, the touch disrupts the panel's electrical field. The disruption is registered as a computer event (gesture) and may be sent to the software, which may then initiate a response to the gesture event. As applications become more sophisticated and processing capabilities increase, the means of interacting with and manipulating data need also to be refined, if not reconceived, to allow users to take full advantage of new possibilities. Maps [4], for example, are now able to incorporate vast amounts of satellite imagery, GIS data, weather information, real-time traffic conditions, and other elements. Allowing users to advanced mapping tools to manipulate the applications with their hands results in a more immediate, richer experience and greater understanding. In addition, large-format interfaces allow multiple users to interact with the same device simultaneously. Multi touch interfaces have the potential to alter the way that work with data and applications, resulting in more dynamic interactions around content [5]. These devices and supporting applications offer diverse ways of visualizing information to improve understanding. The proposed work however helps the user specifically physically disabled persons to communicate with the digital world by using their fingers instead of grabbing a mouse or perfectly pressing a key with accuracy. The work also defines a new design of capturing multi touch directly by an IR camera using the principle of natural user interface (NUI).

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II. BODY OF ARTICLE

I. Problem Statement:

Physically disabled people are an important part of our society that has not yet received the same opportunities as general people. It is necessary to develop a new way which can be blindly helpful to that type of person. Basically those people who are not able to hold a mouse. They cannot hold it properly. So how can they be able to click it? Suppose if one touchpad (that has multi sensation) is used in this criterion. Then it will be quiet valuable to that perspective. The persons have to keep their hands on the top of touchpad. If they have no control upon their finger, there will not any problem because the system needs only their hands, not the fingers' activity. So, a platform has been made to make these things happen. For this cause, an IR light and camera are used with some sort of card boards and one acrylic sheet. It is based upon Snell's law. Total internal reflection of light can be demonstrated using a semi circular block of glass or plastic. If $\theta > \theta c$, the ray will split. Some of the ray will reflect off the boundary and some will refract as it passes through. This is not internal reflection. If $\theta < \theta c$, the entire ray reflects from the boundary, none passes through.

II. Methodology Used For Solving the Problem:

Consider a light ray passing from glass into air. The light emanating from the interface is bent towards the glass. When the incident angle is increased sufficiently, the transmitted angle reaches 90 degrees. It is at this point no light is transmitted (Fig. 1).

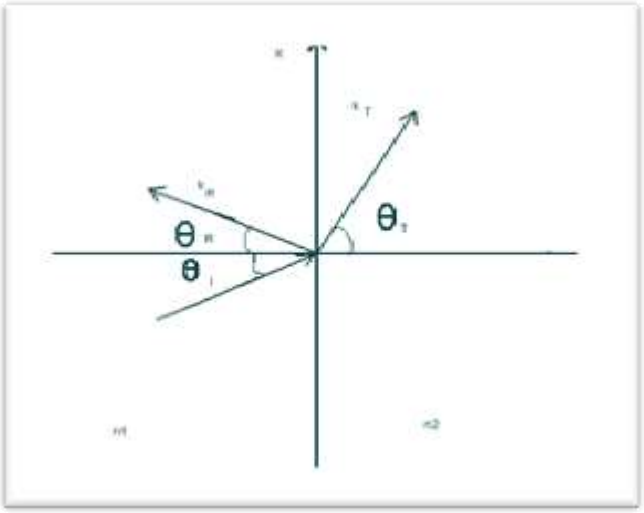

Fig. 1

So,

$n1 \sin \theta i = n2 \sin \theta t$

$\sin \theta i = n2/n1 \sin \theta t$

When,

$\theta t = 90\ degree$

thus $\sin \theta t = 1$

So, $\theta c = \theta i = \arcsin \frac{n2}{n1}$

An important side effect of total internal reflection is the appearance of an evanescent wave beyond the boundary surface. If a plane wave, confined to the xz plane, is incident on a dielectric with an angle θi and wave vector Ki and the transmitted wave vector Kt can be defined as

$Kt = kt \sin \theta t\ \hat{x} + kt \cos \theta t\ \hat{z}$

The transmission coefficient for FTIR is highly sensitive to the spacing between the third medium and the second medium, so this effect has often used to modulate optical this effect has often used to modulate optical transmission and reflection with a large dynamic range. Total internal reflection describes a condition present in certain materials when light enters one material from another material with a higher refractive index, at an angle of incidence greater than a specific angle. When this happens, no refraction occurs in the material; the light beam is totally reflected. Flooding in the inside of a piece of acrylic with infrared light by trapping the light rays within the acrylic using the principle of total internal reflection. When the user comes into contact with the surface, the light rays are said to be frustrated. They can pass through into the contact material; the reflection is no longer at that point.

- Capture

Basically the real world environment is captured by the webcam with the help of IR light. The picture is stored into the buffer and then it is executed for the future purpose.

- Color-conversion

The source image, obtained by the camera is color converted whenever required. It is possible to work with color images, but that would mean dealing with at least three values i.e. Red, green, blue incase of RGB or cyan, magenta and yellow and black in the case of CMYK.

- Monochrome conversion

Monochrome describes photographs in one color or values of one color. A monochromatic object or image reflects colors in shades of limited colors or hues. Images using only shades of grey (with or without black and/or white) are called grayscale or black-and-white.

- Background Remove

Background subtraction is a widely used approach for detecting moving objects in videos from static camera. The rationale in the approach is that of detecting the moving objects from the difference between the current frame and a reference frame.

- High pass

The amount of attenuation for each frequency depends on the filter design. A high-pass filter is usually modeled as a linear time-invariant system. It is sometimes called a bass cut filter.

- Scalar

The scaling of a object is based upon x-y plane with respect to world coordinate. The scaling for the x dimension does not have to be the same as the y dimension. If there are different, then the object is distorted.

- Rectify

Stereo vision uses triangulation based on popular geometry to determine distance to an object. More specifically, binocular disparity is the process of relating the depth of an object to its change in position when viewed from a different camera, given the relative position of each camera is known.

With multiple cameras it can be difficult to find a corresponding point viewed by one camera in the image of the other camera (known as the correspondence). In most camera configurations, finding correspondences requires a search in two-dimensions. However, if the two cameras are aligned correctly to be coplanar, the search is simplified to one dimension - a horizontal line parallel to the line between the cameras. Furthermore, if the location of a point in the left image is known, it can be searched for in the right image by searching left of this location along the line, and vice versa. Image rectification is an equivalent (and more often used) alternative to perfect camera alignment. Even with high-precision equipment, image rectification is usually performed because it may be impractical to maintain perfect alignment between cameras.

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- Segmentation

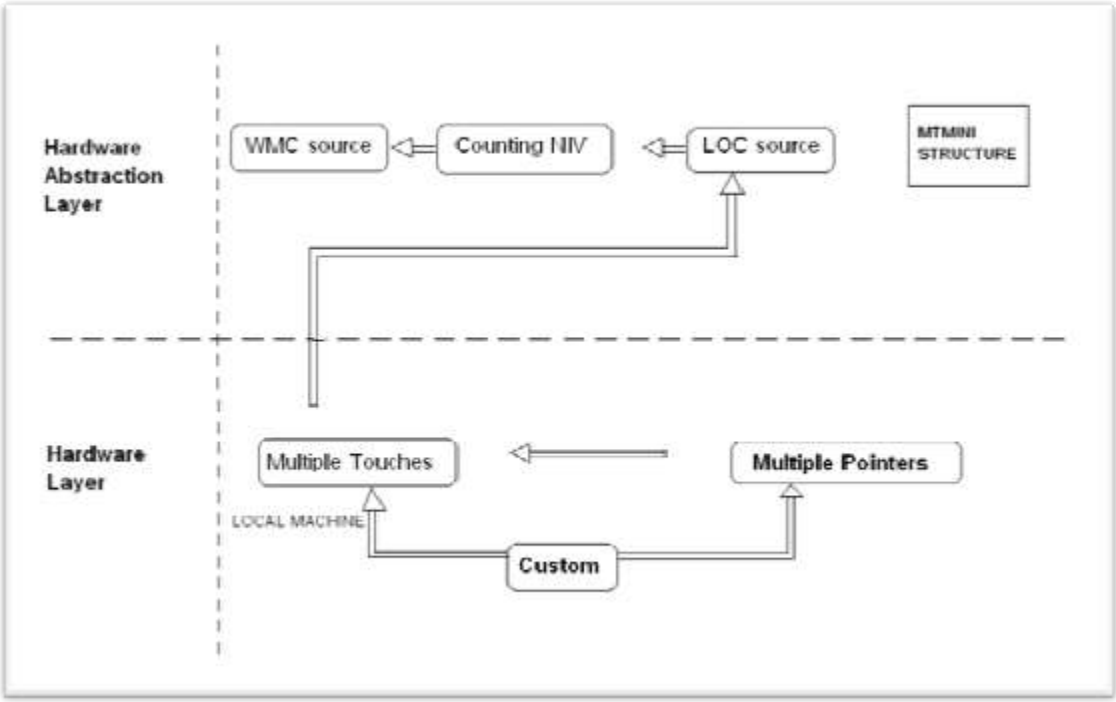
A key observation is that the zero-crossings of the second derivatives (minima and maxima of the first derivative or slope) of multi-scale-smoothed versions of a signal form a nesting tree, which defines hierarchical relations between segments at different scales. Specifically, slope extreme at coarse scales can be traced back to corresponding features at fine scales. When a slope maximum and slope minimum annihilate each other at a larger scale, the three segments that they separated merge into one segment, thus defining the hierarchy of segments. This is a mean of all pixels that fall under the blob region.

- Noise

For noise removal again a mean of all pixels is taken by the software. It is also needed to obtain the point of contact.

III. Solution:

For generating a system which will be used for input device, there are six layers of abstraction. The layers are hardware layer, hardware abstraction layer, input interpretation layer, transformation layer, window management layer and application layer. Local machine is used for taking multiple touches and these touches are taken by multiple pointers. Then that is transferred to Line of code class source. There are several ways to consume Loc class. After that, the counting of number of instance variables has started. Weighted method clustering source is used here to take that input values. A weight function w over X is a function w: $X \rightarrow R+$. Given a domain set X, denote the corresponding weighted domain by w[X], thereby associating each element $x \in X$ with weight w(x). A distance function is a symmetric function d: $X \times X \rightarrow R+ \cup \{0\}$, such that d(x, y) = 0 if and only if x = y. We consider weighted data sets of the form (w[X], d), where X is some finite domain set, d is a distance function over X, and w is a weight function over X. In order to construct predicted values for an output variable *y* from an input variable *x*, the modeling and calibration procedure arrives at a joint probability density function, $p(y,x)$.(Fig2.)



(Fig. 2)

The algorithm assumes that the original image is a 256 gray level * IMAGE->Rows * IMAGE->Cols pixel image stored in the structure IMAGE. The program then performs a sum of the reciprocal of all pixels contained within a square N * N region of the image centered at pixel X, Y. The size of the filtering operation is determined by the variable N and should be set to an odd number and be less than 12. Upon completion of the program, the filtered image is stored in the structure IMAGE1.

```
HarmonicMean (struct Image *IMAGE, struct Image *IMAGE1)
{
int x,y,i;
int j,z;
int n,AR[121], A;
float SUM;
N= 5;
for(y=N/2; y<IMAGE->Rows-N/2;y++)
for(x=N/2;x<IMAGE->Cols-N/2; x++)
{
z=0;
for(j=-N/2;j<=N/2;j++)
for(i=-N/2;i<=N/2;i++)
{
AR[z]=*(IMAGE->Data+x+i+(long) (y+j) * IMAGE->Cols);
z++;
}
z=0;
SUM=0.0;
for (j=0;j<=N*N-1;j++)
{
if(AR[j]==0)
{
z=1;
SUM=0;
}
else
SUM=SUM+1.0/ (float) AR[j];
}
if (z==1)
*(IMAGE1->Data+x+ (long) Y*IMAGE->Cols) =0;
else
{
A= (int) ((float) (N*N)/SUM+.5);
If (A>255)
A = 255;
*(IMAGE1->Data+x+ (long) y*IMAGE->Cols) =A;
}
}
}
```

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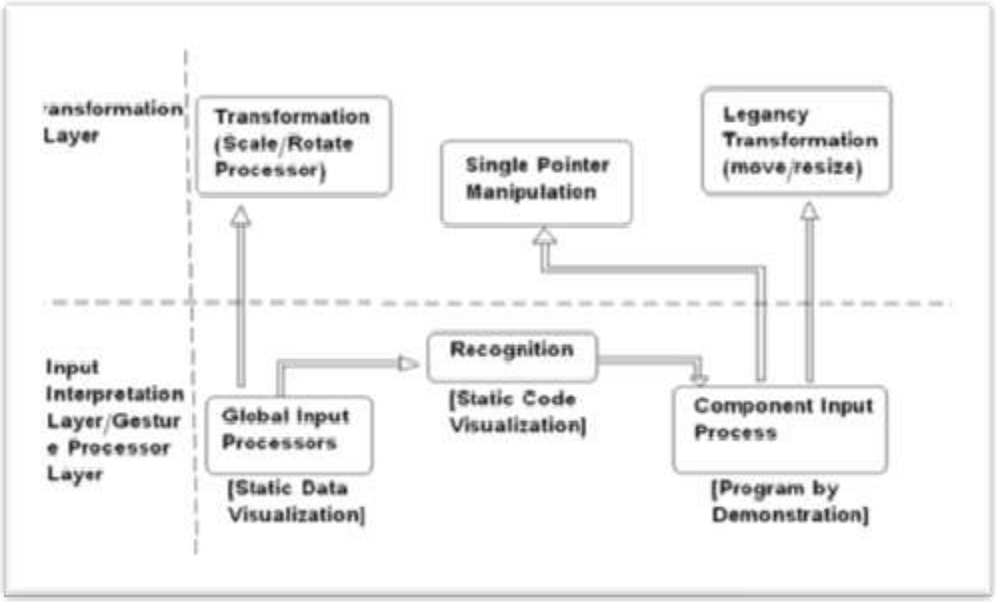
Static data visualization is the analysis of computer software that is performed without actually executing programs (analysis performed on executing programs is known as dynamic analysis. Static Code Analysis (also known as Source Code Analysis) is usually performed as part of a Code Review (also known as white-box testing) and is carried out at the Implementation phase of a Security Development Lifecycle (SDL). Static Code Analysis commonly refers to the running of Static Code Analysis tools that attempt to highlight possible vulnerabilities within 'static' (non-running) source code by using techniques such as Taint Analysis and Data Flow Analysis.

Ideally, such tools would automatically find security flaws with a high degree of confidence that what is found is indeed a flaw. However, this is beyond the state of the art for many types of application security flaws. Thus, such tools frequently serve as aids for an analyst to help them zero in on security relevant portions of code so they can find flaws more efficiently, rather than a tool that simply finds flaws automatically.(Fig. 3)



(Fig. 3)

To perform a sequence of transformation such as translation followed by rotation and scaling, we need to follow a sequential process −

- Translate the coordinates,
- Rotate the translated coordinates, and then
- Scale the rotated coordinates to complete the composite transformation.

If a transformation of the plane T1 is followed by a second plane transformation T2, then the result itself may be represented by a single transformation T which is the composition of T1 and T2 taken in that order. This is written as T = T1·T2.

Composite transformation can be achieved by concatenation of transformation matrices to obtain a combined transformation matrix.

A combined matrix −

[T][X] = [X] [T1] [T2] [T3] [T4] …. [Tn]

Where [Ti] is any combination of

- Translation
- Scaling

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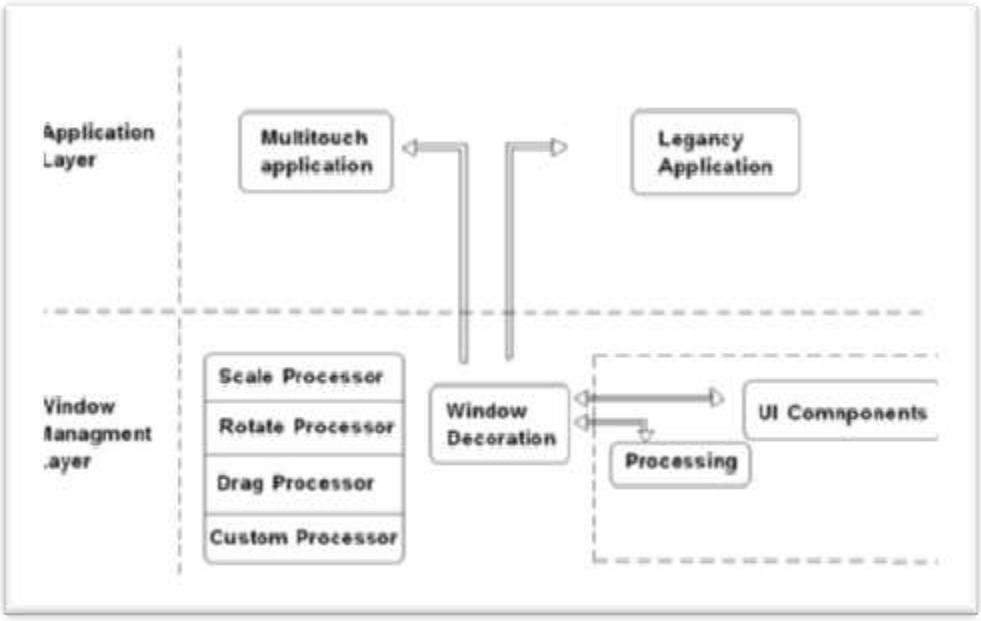
- Shearing
- Rotation
- Reflection

The change in the order of transformation would lead to different results, as in general matrix multiplication is not cumulative, that is [A]. [B] ≠ [B]. [A] and the order of multiplication. The basic purpose of composing transformations is to gain efficiency by applying a single composed transformation to a point, rather than applying a series of transformation, one after another. (Fig. 4)



(Fig. 4)

IV. Result:

The algorithm was implemented in Processing Language. It is possible to combine color conversion, mono transformation and finally rectification. Then segmentation, the user outlines the region of interest with the mouse clicks and algorithms are applied so that the path that best fits the edge of the image. Then finger tip is segmented from the rest of image. Resultant image is obtained by top to bottom scanning with specific intensity difference between every 2 pixels and threshold value for difference in pixel intensities.

III. CONCLUSION

The success rate of the architecture is moderate. It is tested by using several inputs from users. But it is not applied to the welfare of the society. It can be easily achieved by following the system architecture. The point of contact is detected accurately in several scenarios. The image processing touch screen has a wide scope in application. Due to its bulk, it perhaps will not replace the mouse or keyboard as the primary input device. Multi touch features can be added to the architecture with the help of augmented reality. Instead of wired webcam that is being used in our current experiment easily a wireless webcam or an IP cam can be used for this purpose. Image processing touch screens will make a huge difference for the cause of several progresses in this area. Using the architecture, one can implement several mind and head controlled algorithm for the welfare of physically disabled persons. Not only this type of application, but also many fields are available to apply this kind of technology. In developing advanced drivers assist for semi autonomous cars and also can be heavily used in autonomous cars. The camera apps in smart phones and digital cameras can be updated to enhance the image quality, video stabilization and noise removal etc. It can be applied in the field of robotics such as mobile robot's navigation in unknown environment (SLAM) and control of the robot by processing the video feed from the camera on robot to extract live scene around it. It can also be used in gaming console like Xbox kinect which uses

image processing from motion analysis of the human player. It can be taken as a solution to a variety of problems, starting from facial recognition access to defect identification in manufacturing industries. To identify defects in the processes and also to control the robots in performing certain tasks for ex: defects in manufacturing of a printed circuit board (PCB) can be observed using high resolution image processing.

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