Multi-touch Surface

New Mexico Supercomputing Challenge

Final Report

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Abstract

Multi-touch surfaces are becoming more and more popular for it allows individuals to interact with technology more. So, because of advancement in technology there have been greater demands for the new technology. However, the new advancement in technology is only available to large corporate companies or at government disposal. So, how do multi-touch surfaces work? Can they be easily be calibrated? What is needed and how do you calibrate a multi-touch surface in the first place? These questions will be answered. We first thought that building the touch surface would be a success but calibrating was the hardest part. Calibration might cause some problems with the PS3 Eye Cams. The heat that is emitted from the computer may cause interference on how the PS3 Eye Cam registers heat signatures. Once we received all the parts needed, we began assembling the surface. Further into assembling, the surface problems started popping up. Creating a frame for the surface proved to be very difficult because of the necessary angles needed for the mirror and projector. Once the surface was laid out, we realized that the projection had a large key tone. This meant that the sides of the visible projection had a curve to them. So lifting the surface to an angle was required to stretch the screen which eliminated the key tone and provided a better focus. Once we had all the angles set, the wooden box came together relatively fast. Once the surface was completed, calibration of the camera began. We realized that when we mounted the PS3 Eye Camera, we did not have it focused in the exact center of the surface. After we fixed this problem, calibration became easy. This proved our hypothesis both right and wrong. Calibration was easy once the PS3 Eye Cam was centered.

Problem

Multi-touch surfaces are becoming more popular in our everyday life, is the goal to revolutionize the way we use technology. One method is using it for educational purpose which in turn will allow student to interact more with their different learning styles. The multi-touch surface is only available to big companies and more prominently for military use.

The problem is to create a multi-touch surface relatively cheaper than retail price, as well as creating a piece of software that would utilize the multi-touch surface capabilities. This will give a better understanding of how a multi-touch surface works with the current interface. In addition build and calibrate a multi-touch surface and create a piece of software that utilizes the multi-touch surface and gives an easy to understand interface showing what the surface can do. The main purpose is to figure out exactly how a Multi-Touch Surface works.

Research

Multi-Touch Surfaces are becoming more and more popular as technology is becoming more interactive. They are easy to use and easy to understand and have two methods which it works. One method is the use of IR (infrared) cameras to find exactly where your hand is on the surface using heat signatures. The other method is applied pressure in which a sensor detects the actions that has been created by the user. This, in return, allows multiple users to use the surface at once. One user can be viewing a map while the other user could be doing something different for example, browsing the web or use the same map to place thumb nails on place of interest on the same map without the computer ever getting confused.

Multi-Touch Surfaces can be used in many environments. They are used in hospitals, laboratories, class rooms, even special education rooms and have a large tactical advantage in military use as well as corporate businesses; they provide an easy way to access programs and files on a computer. They can be used in all these environments because the surface gives an easy way for multiple people to work on the same project. For example, students in a classroom can use the surface to work on a virtual online lab where team work is needed. The surface will support each student's hands and hand gestures and will calculate each one within a blink of an eye.

A Multi-Touch Surface includes a system of parts that work together to do a single task, and that task is to calculate each hand gestures and perform a command. The basic parts to a Multi-Touch Surface are a projector, a dual core computer, IR LED strips, an IR filter, PS3 Eye Cams, IR band-pass filter, and three sheets of abrasion resistant acrylic. The PS3 Eye Cams are modified with the IR band-pass filter. This allows the cam to pick up IR signatures. The cams focus on the various layers of acrylic. While IR strips are mounted on the side of the acrylic sheets. The IR strips are detected by the PS3 Eye Cam, and software on the computer calculates what to do with the information.

Materials

PS3 Eye Camera

IR band-pass filter 8mm

5-meter long dimmable IR LED Strip

Dual Core Processor computer

2000 lumens projector

Front surface mirror

Abrasion resistant acrylic sheet

Rear projection acrylic sheet

EndLighten acrylic sheet

CCV Software

CL-Eye Platform Driver

Multi-Touch Vista

Procedure

In order for a PS3 Eye Cam to register IR signatures, the camera needs to be modified. Since a cheap PS3 Eye Camera has a resolution of 640X480 at 60fps, the camera is perfect for the surface since they provide a detail needed to pick up a small signature. So to setup the camera to pick up IR signatures, take apart the camera, removing all screws and remembering how it came apart. Between the eye and the lenses there will be a film strip. That is an IR filter and it filters out all IR signatures. Replace the filter with the IR band pass filter and then reassemble the camera.

The most important piece of acrylic is the EndLighten layer. This layer is the layer that reflects all IR signatures to the cameras. It is very important to polish the sides of the sheet. It is recommended to use laser cutting to do this. There is no need to polish the other sheets of acrylic because the IR signatures will not be reflected off them.

Next, take the IR strip lighting and wrap it around the edges of the EndLighten acrylic layer. Cut the access IR strip off since the strip will get hot. Tape the strip to the edges to keep it in place.

Connect the computer to an operational matter and attach the projector. Place the rear end acrylic sheet over the EndLighten layer then the Abrasion resistant layer on top of that layer. Install the CCV software, CL-Eye Platform Driver and the Multi-Touch Vista. Once all the software is installed, reboot the computer if necessary and plug the camera into an available USB port on the computer. Execute the Multi-Touch Vista application. This program should provide an image. This image is what the PS3 Eye Cam is detecting. Adjust the camera so that it reads the entire projection. Test the program by trying basic functions. The program automatically reads your hand and turns the data into readable information for the computer.

Results

The result obtained by the project is that it is possible to build a multi-touch surface relatively cheap. While the calibration was not as hard as predicted, it turned out that adjusting everything else to fit the screen and get rid of the key tones that was projected by the projector was hard because we had to figure out the angles needed. As for our program that will incorporate the use of the surface is still in the process of integrating into the surface. We hope that the program will be completed and integrated by the time of presentation of the Supercomputing challenge. As for the rest of the results we learned a better understanding on how a computer works. As well as different methods that is used in multi-touch surface developments.

Conclusion

The conclusion of the project showed that it is possible to build a multi-touch surface cheaper than retail. As well as creating programs that can be used to utilize the multi-touch surface. Not only did the software that was used provide valuable data it showed us how the camera was detecting the signatures. This was fascinating for the software was detecting heat signature and converting them into blobs that was only recognized by the software. Not only did it detect the signature but it calculated the X and Y coordinates.

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