

# Tach-Mouse

Hand Interface for Searching on Large Map Area

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**Abstract :** Recently , many detailed maps are provided in digitalized form. Manipulating digitalized maps needs an intuitive control , however conventional interface is not enough. We suggest a new interface for manipulating maps with hand gestures which enables you to control the motion of cursor and scaling of maps intuitively.

**Key Words:** *Map manipulation , Hand gesture ,*

## 1. Motivation

Many digitalized maps are available in shop or on Web Site such as Google Maps[1]. They are very instrumental , because they are very detailed and cover very large area. However it is very hard work to look up something on so detailed and large maps. As a matter of course , you don't have to flip a page. However the manipulation of digitalized maps are hard to say to be comfortable.

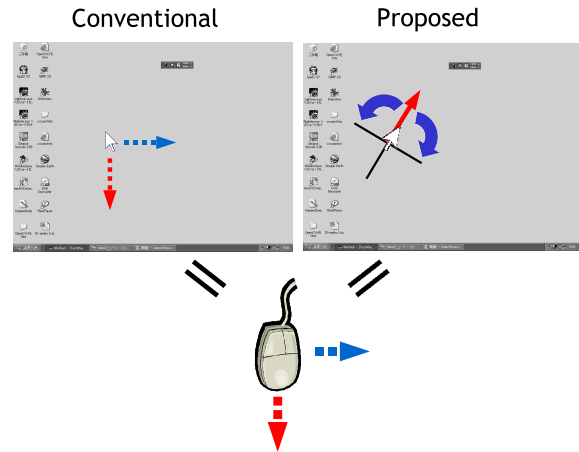
You should move a mouse to many directions to move a cursor which causes shift of map for dragging up area which are out of window. This needs a much motion of mouse , and it is very botheration. In addition , you have to control the scaling of a map by using a control bar which is located in the edge of window. This is an extra motion , and detracts a intuitive manipulation. Imagine the case you are looking up a good restaurant around UCL , and suddenly tempted to know where is NAIST. At first , you will zoom out the map , then move the map around Nara , Japan and finally zoom the map. Like this , control of scaling and shift of map are executed alternately and they are combined manipulation.

In fact the problems of conventional map interface is that there are much motion of mouse to shift a map , and control of scaling and shift of map are not intuitively combined. We proposed a new interface with hand gestures which provides a comfortable map manipulation by solving these problems.

## 2. Proposed Method

We considered two conditions to actualize a comfortable manipulation for maps.

1. Less motion for shifting a map(cursor)
2. Intuitive control of shift of map and scaling



**Fig1: Two types of Cursor Control**

To fulfill the first condition we propose a new cursor control and the second we propose a control of cursor and scaling with hand gesture.

### 2.1 Proposed Cursor Control

Generally the motion in the actual 2D coordinate systems are directly reflected to the shift of cursor in window coordinate system. In fact , shift of mouse to left causes shift of cursor to left(Fig1). This control system of cursor is easy to understand.

However when you apply this control system to map manipulation ,it requires much motion of mouse to search on large map which is larger than screen size. You have to do click-and-drag or other operations many times to shift a map. So we propose a new cursor control whose shift can be caused by giving a speed and an angle of speed. In Fig1 horizontal motion is reflected to angle , and vertical motion to acceleration. This control enables you to shift a cursor (map) with less motion.

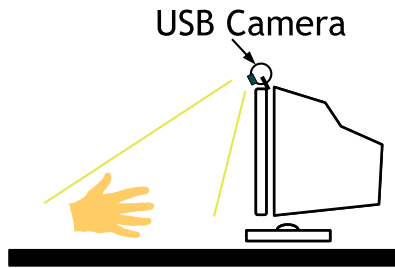


Fig2: System Overview

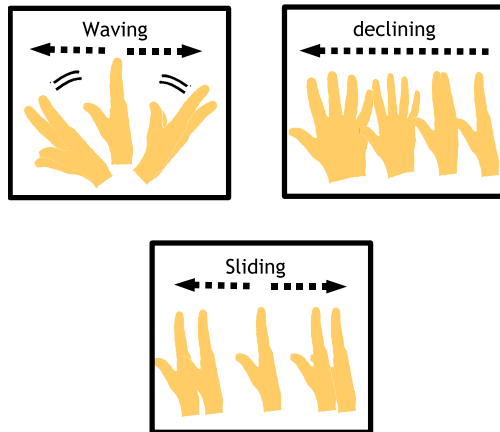


Fig3: Gestures

## 2.2 Control of Cursor and Scaling With hand Gesture

Next implemented a proposed cursor control with hand gesture. Hand is often used for pointing direction in real life and very feasible for intuitive control.

Hand gesture is captured by USB camera located on the display and recognized (Fig2). This system is assumed the situation a person is sitting in front of a PC facing monitor. This is very everyday situation.

There are two main hand gestures , one is waving , the other is declining. The angle of waving is reflected to the direction of speed , and the inclination is reflected to speed. In addition to these cursor control , We actualized controlling scaling with hand gesture. You can control the scale of map by sliding hand left or right(Fig3). With these gestures intuitive control of cursor and scaling can be actualized. Furthermore this control system can be also applied to the manipulation of class structure of folders.

## 3. Technical Summary

In this section we show how to recognize the hand gestures. Fig4 shows a flow of image processing. A image captured by USB camera is converted to HSV color

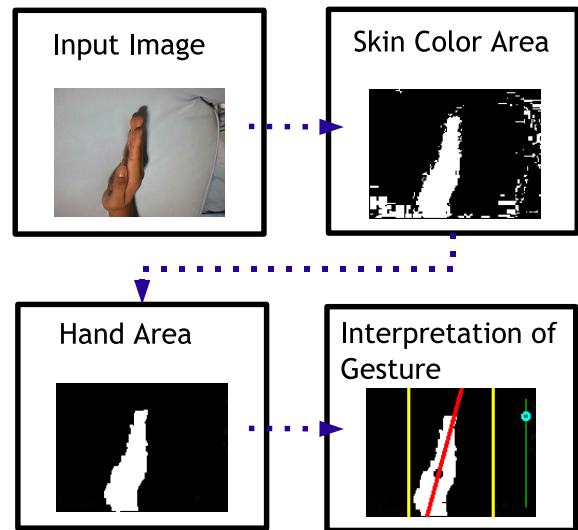


Fig4: Flow of image processing

space , the skin area is extracted using pixels threshold , and binalized. After eroded and dilated , the image is labeled. The biggest area in labeled areas is assumed to be a hand area , and PCA is applied to the area.

The eigen vector of the first principal component represents the angle of waving , and the contribution of first principal component represents quantity of inclination. As inclination from horizontal plane increase , the contribution of first principal decrease because the hand area in the image becomes long and thin. The contribution is mapped to speed , speed becomes 0 when the contribution of first principal come close to 0.5. The center of gravity of hand area is also calculated , and the horizontal placements of CG represent sliding gesture. Fig4 shows a flow of image processing.The center of gravity of hand is drawn as a circle , the angle of hand is drawn as a red line. The quantity of inclination is showed as a bar around right edge.

This system was implemented using OpenCV Library , which is provided freely from Intel(R) corp.[2]

The usage of the program is explained in README file which is included in the package. The instructional movie is available on <http://chihara.naist.jp/people/2004/jumpei-m/TachMouse.htm>

## 4. Conclusions

We proposed new interface for map serching. this enables to intuitive control of cursor motion and scaling of map.

## References

- [1] Google Maps <http://maps.google.com>
- [2] OpenCV <http://www.intel.com/technology/computing/opencv>