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ABSTRACT

SENSITIZE is a facility which enables a user to interactively organize the surface area of a graphic input device into sensitive areas. A sensitivity area is a physical portion of the graphics surface which has an associated unique value. Given a graphic input capability (such as a touch sensitive screen[1]) , one must also have a means of organizing areas of the screen into active and dead zones. The definition of these areas is accomplished by entering a "finger painting" mode in *SENSITIZE.* Once areas are defined the resulting **sensitivity map** is written on a file for use by the particular application program being used. Currently *SENSITIZE* is running on an 11/23 with UNIX. Graphical indications of the active sensitivity areas are provide by a special graphics processor.[2]

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Subject: **Sensitize: A Graphical Area Sensitization Facility**
Case- 011170-0101 -- File- 39394

date: **January 28, 1981**

from: **S.P. Ressler**

TM: **81-11356-2**

MEMORANDUM FOR FILE

1. Introduction

The *SENSITIZE* facility provides the user of a touch sensitive device (TSD) with the capability of defining functional areas. These areas are defined by "finger painting" the screen. When touched each defined area will cause the system to return a unique value. *SENSITIZE* has two primary modes of operation: **reading** and **writing.** A typical user of the TSD would be concerned only with reading mode, which returns the value of the sensitized area touched. Upon entering writing mode the user, in this case a systems person, would then have the option of defining a new sensitivity map or of modifying an existing one.

The sensitive areas of the screen can be thought of as the active portions of a visual menu. Each portion of the image (which is to be provided by some means on the tv set) which is significant can be a separate sensitive area. Thus each visually important element can be associated with a unique value. Each portion of the screen which is not defined becomes a dead zone which simply does not return any value and forces the user to wait until a sensitized area has been selected.

In the existing implementation the touch sensitive device is a standard television monitor which has been modified with a set of infrared emitter-detector boards, commercially available. The TSD is hosted by an PDP 11/23 which is running Unix version 7. All software is written in C. The sensitive areas defined by the user are visually represented on the monitor via the TMS9918 Video Display Processor which has been interfaced to the computer with a custom built hardware board. There is however no reason a computer crt terminal or some other graphics device could not be converted into a touch screen. Any device which can generate x,y coordinates can be used with *SENSITIZE.* The useful aspect of the system is however to visually define and identify those areas which are active.

2. System Organization

SENSITIZE is organized to allow the creation and deletion of many sensitivity maps. Each sensitivity map presumably corresponds to a different visual image being presented to the user. This can be thought of as a visually interactive question and answer session leafing through only those parts of the system requested for by the user.

Each sensitivity map must have a name and an entry in the sensitivity file. The structure of the file will be described later. When a sensitivity name is requested from the file the map corresponding to the name is read into the system and activated. It is up to the particular application to provide the visual information which corresponds to the sensitivity map. If no sensitivity map exists for a particular name then the default is to make the entire screen a single sensitive area returning a 1.

One useful way to organize the system is to define two functions called touch1 and touch2. Touch(1 or 2) is the main function which is passed the sensitivity name, plus some file information. Both touch functions are called in an identical manner, however only one can enter into write mode. In this way you can have two version of the application, where one is for the general user and the other is for the maintainer of the application. This technique avoids the danger of the user accidentally entering write mode and inadvertently changing the sensitivity file.

3. Usage

Read mode

During usage of the system the touch function returns a unique value for each sensitized area touched. This is accomplished in the following manner:

Function touch is called
Named entry in sensitivity file is read
User touches screen generating x, y selection
If no sensitized area is hit get more x, y input
Number of corresponding sensitivity area is returned

Once the particular area has been selected the application takes over and uses this information for further processing. From a users point of view he has simply touched some important looking image or word on the screen and an action of some sort has resulted from this selection.

Write Mode

Using the system in write mode allows the user, presumably the application maintainer, to create and modify sensitivity file. One enters write mode by hitting the **delete** key. The first time the key is hit the system will change from read to write mode. During the area definition process there will be many times that you will need to interact with the TSD. **Each time** keyboard input is required and you have just finished TSD input the **delete** key must be hit. This key transfers input control from the TSD to the keyboard. If you have just completed keyboard input and have further keyboard input you do not have to hit the delete key.

A typical sequence for defining a map would be as follows:

Hit delete key to enter write mode.
Type c to clear the existing map.
Type s to select an area number.
Type 1 to the prompt "Enter sensitivity area number:"
Type d to begin touch input sensitizing touched areas with area number 1.
Hit delete to end touch input and enable keyboard.
Type s to select area
Type in 2 for the area number.
Type in d to begin sensitizing.
Hit delete to get keyboard input.
Type e to erase some of area 2 (the current sensitivity area).
Type p to write map to file and end write mode.

During the above sequence the user would have defined area one correctly. Made a mistake defining area 2 and went back to erase a little of area 2. Written to the sensitivity file the completed map.

4. File Structure

The file used by *SENSITIZE* consists of sensitivity names followed by an encoded version of the sensitivity map. For this particular implementation we are using an effective map resolution of 24 rows by 32 columns. The hardware however can handle approximately 80 rows by 100 columns. The decoded version of the sensitivity map is used in the program. This map is 24 rows by 32 columns and is a character array. Sensitivity area 1 is identified in the map with an **A**, area 2 with a **B** etc..etc... The 24 x 32 area corresponds to the 24 x 32 limit of characters displayed by the Video Display Processor. Other devices can certainly have other area limits, up to the resolution of the input hardware.

The entry in the file is a coded version of this character array. The map is run length encoded. There are 24 rows always. Within the row however is the number of the first entry followed by the entry, the number of the second entry followed by the entry..etc..etc until the limit of columns. For example, the row:

```
AAAAABBBBBBB     CCC
```

would be encoded with:

```
5A7B5 3C
```

This means that there are 5 A's followed by 7 B's followed by 5 spaces and 3 C's. The total number of columns adds up, in this case to less then the actual number of columns in the map so the difference is assumed be a dead zone at the end. (Of 4 in this example) All row entries in the file are terminated with a newline \n. The complete map entry would have 24 such rows. This form of storage allows for a much more compact representation of the maps.

Each map entry is preceded by a sensitivity name which has the form of a percent sign, '%', in the first column followed by a character name. For example:

```
%bonzo
```

When the touch subroutine is passed the sensitivity name it searches for this name in the file and then decodes the next 24 rows into the 24 x 32 character array which is used in the program. When deleting a map entry a pound sign '#' replaces the percent sign. Run the routine compress to garbage collect the file.

5. Installation

In order to install *SENSITIZE* into an existing application there are four files to be aware of:

touch.h	Header file containing macro definitions.
sen_lib.c	Routines common to entire *SENSITIZE* system.
touch1.c	The read only version of the system.
touch2.c	The read and write version of the system.

Only one of the files touch1.c and touch2.c must be used. Touch1.c would be used in the version of the application system which is only for the end user. Touch2.c is for the version which the system maintainer interacts with. Touch2.c can be the only file used, however for safetys sake touch1.c exists. Splitting up read and write capabilities into two systems prevents the user from accidentally modifying the sensitivity maps.

Inside of your application program usage of *SENSITIZE* would be of the form of a call to the function touch, which is of the form.

```
int touch(fp, offs, nname)
File *fp
long offs
char *nname;
```

The function touch requires a file pointer fp, an offset into the sensitivity file, and the name of the map. If offs is **-1L** then the node is assumed to be nonexistent and the sensitivity map is defaulted to be a single sensitized area always returning **1**. If offs is **0** then the entire sensitivity file is searched for a name matching **nname**. If offs is some actual byte offset into the file then the searching starts at that point. Whenever a name is not found to match **nname** the area is defaulted to a single sensitivity area.

The value returned by touch is the sensitized area selected by the user of the application system. One routine must be provided by the installer of *SENSITIZE*. In the existing code the routine **tsd_read**, is the function which modifies the integers **x** and **y**. This is the routine which gets input from the touch device, or whatever device you wish to use. *SENSITIZE* expects these two integers to contain the value of the **x,y** location hit by the user. This function must be of the form **input(&x, &y)**.

Some other parameters which one should also be aware of are **XMAX** and **YMAX**, located in **touch.h**. These define the maximum number of **X** and **Y** positions available for the display device, **not** the touch input device. This will most probably need to be changed, dependent on the hardware being used to display graphic information. A scaling routine will probably also have to be provided, which essentially maps coordinates from the input *(touch)* device to the output graphic device. This could have the form **scale(&x, &y)** where **x** and **y** had just been input via **input(&x, &y)**.

6. Acknowledgements

The author would like to thank Ron Gordon, whose many ideas are are part of this system.

S.P. Ressler

MH-11356-SPR
Attached
References (1-2)
Tables (1)
Figures(1-2)

References

[1] *Carroll Manufacturing Touch Input Kits,* Users Manual, Rev. 2.0., Champaign, IL., Jan 1980.

[2] *TMS 9918 Video Display Processor Preliminary Data Manual,* March 1980.

Commands used in write mode

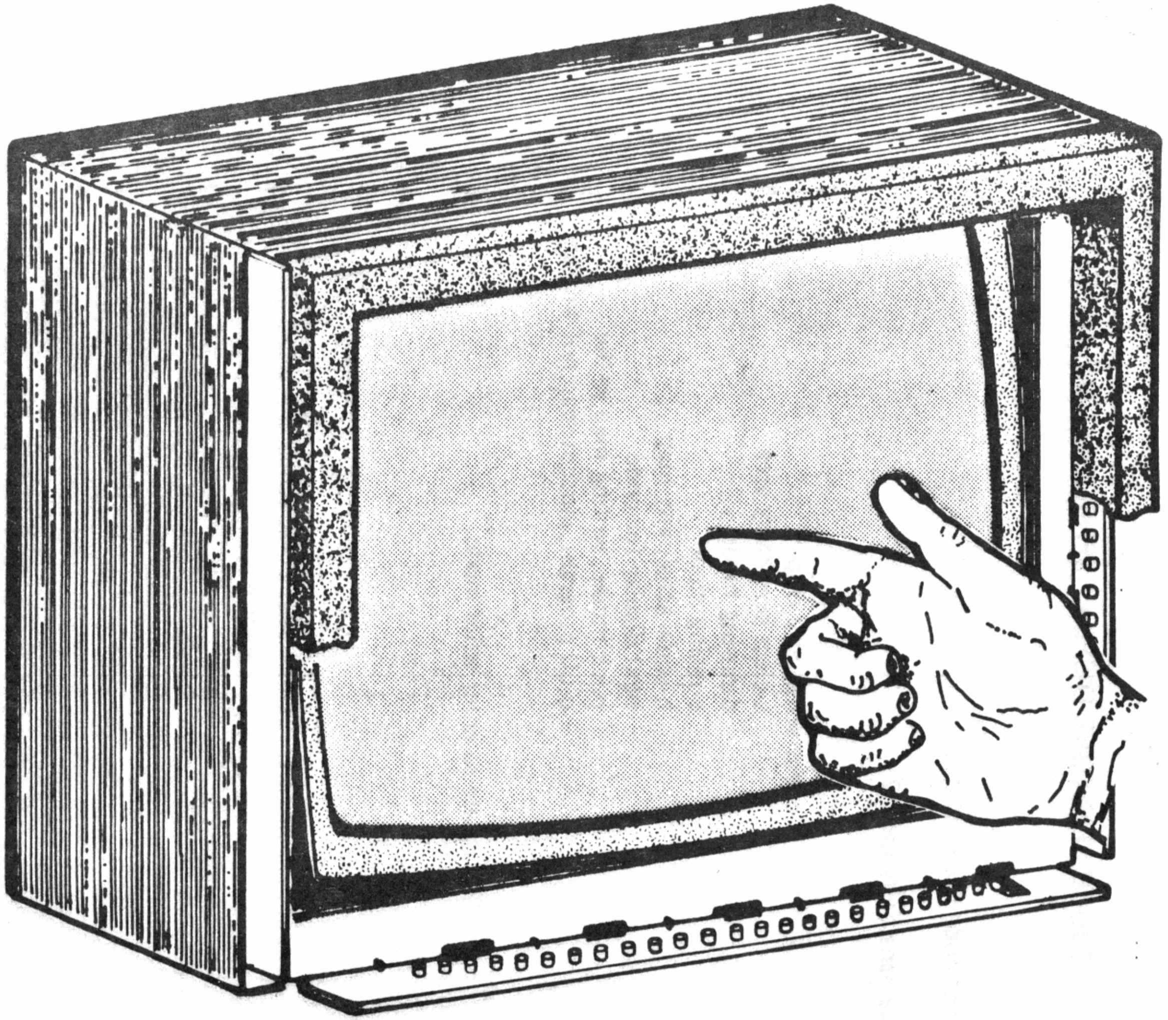
Delete	Enables write mode and transfers control to terminal keyboard from TSD. Must precede almost all other commands.
c	Clears the current sensitivity map to a single dead zone.
s	Select sensitivity area. Prompts for sensitivity area number.
d	Drawing mode. Causes those **dead zone** areas touched to become sensitized with the current sensitivity number.
e	Erasing mode. Causes only **current sensitivity number areas** to be erased when touched.
h	Show the current sensitivity map.
t	Text display what was on the screen from the text source (TMS9918).
p	Pick mode. Writes map to file and puts you back in reading mode.
q	Quit write mode without writing map and go back to read mode.

Table 1

Terminal display when in writing mode:

```
            TOUCH SENSITIVE DISPLAY SENSITIZATION FACILITY


   Current node name: bonzo

   Active sensitivity area: 2


                   c-lear sensitivity map
                          s-elect sensitivity area
                          d-rawing mode
                          e-rasing mode
                          h-show sensitivity map
                          t-ext display for node
                          p-ick mode...writing map to file
                          q-uit program, current map not written


             Hit delete to enter write mode
```

Figure 1



Touch Sensitive Screen

Figure 2