A Unified Physical Input Model of Pen-based Computers

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Abstract:

This article describes a unified physical input model of pen-based computers forwarding the forming of a unique ink data format. Based on the classification of states of pen-based computers, this article provides all the existing input models of the pen-based computers and submits several subsets of them to use. Also all the subsets are checked according to both the possibility and pragmatic use. As a prospective design, the unified model is the most important pre-requisite of a unified data structure of the pen-based computers.

Key Word:

Pen-based computer, unified model

1. The Parameter Elements in Pen-based Computer:

To the pen-based computers, the height, pressure and the Tip Switch's state of the pen is the decisive factor in deciding the current state of the pen. So the following tablet arranges all the parameters and the permutation will comprehend all the cases:

(Prox = Proximity, H = Height, P =Pressure)

No.	Tsw	Prox	H	P	Space Model	Symbol
1	1	1	1	1	N/A	
2	0	1	1	1	(I,H,HS,HP,S,P)	SMP1
3	1	0	1	1	N/A	
4	0	0	1	1	(H,HS,HP,S,P)	SMP2
5	1	1	0	1	N/A	
6	0	1	0	1	(I,Hnul,S,P)	SMP3
7	1	0	0	1	N/A	
8	0	0	0	1	(Hnul,S,P)	SMP4
9	1	1	1	0	(I,HTsw,STsw)	SMP5
10	0	1	1	0	(I,H,S)	SMP6
11	1	0	1	0	(HTsw,STsw)	SMP7
12	0	0	1	0	(H,S)	SMP8
13	1	1	0	0	(I,HnulTsw)	SMP9
14	0	1	0	0	(I,Hnul)	SMP10
15	1	0	0	0	(I,Tsw)	SMP11
16	0	0	0	0	N/A	SMP12

In the above tablet, in the Space Model Column, the current states are decided by the availability of the leading four columns' states. There are also some criteria regulation existing here:

1.TipSw and Pressure parameter is exclusive. For no manufacturer up to now provide such a device.

2.Proximity decide the availability of the state Invalid (I);

3.if there is no height parameter, state HS,HP is replaced by Hnul, for the Hnul is defined under the condition that height information is not available.

4.if no pressure parameter, states such as HP,P will be dismissed.

2.Detailed Explanation of the SMP1 type as an example:

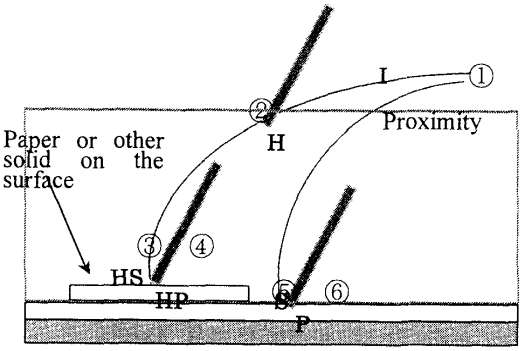

Fig. 1

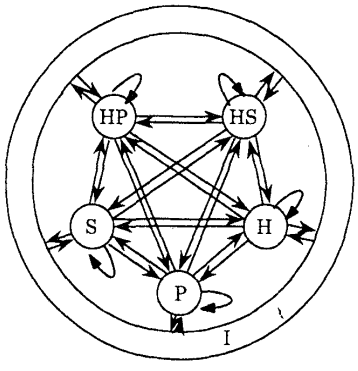

Fig. 2

In Fig. 2, a transferring diagram is given on which all the states is free to transfer to any others.

As to this case, all the parameter is available ,and the pen input states can range from I to P, spanning the H,HS,HP,S state. For example:

From Invalid state:

Please refer to Fig 1,in the above. When the pen is out of the proximity of the tablet, its state is undoubtedly I state, later as the movement and

position of the pen changes ,the second states will be

Case 1:(moving from Position ① to ②)

As the first case, the pen enters the proximity of the tablet and still in the air, because no pressure is exerted on the tablet and there is a distance between the two, the current state is H state., So I->H(abr. representing that Invalid state transfers to the Height state)and the reversible process is H->I

Case 2:(moving from Position ① to ③)

Suppose the pen lands on the paper gently, if the pressure passed by the paper is less than the pressure threshold and the paper's thickness is greater than the height threshold, the pen will be in the HS state.

Now the pressure passed to the tablet is between the P_{low} and P_{high}, and the current height is higher than Z_{upper}, so it is in the HS state. I->HS, A thing worth of observing is that because of the discrete data sampling of the tablet, the pen can jump from the Invalid state(of course, it passed the Height field) to the HS state. Vice verse HS->I.

Case 3:(moving from Position ① to ④)

Like case 2,the pen enters the proximity of the tablet but lands on the paper but with a force, as a solid object, the paper will pass the force to the tablet. In this circumstance, the pressure is greater than P_{high} and the pen's height is larger than Z_{upper}, this is the same as HP definition .So I->HP.

Case 4:(moving from Position ① to ⑤)

The pen from the Invalid state jumps to the tablet surface, at the same time, the pressure now is between the P_{low} and P_{high}. According to the above definition. The state is S state. So H->S.

Case 5:(moving from Position ① to ⑥)

Almost the same as case 4, the pen dropped from the Invalid area to the surface of the tablet with the pressure greater than the P_{high}, resulting in the I->P.

All the above process are revertible, the pen can transfer from the H, HP, HS, S, P to the Invalid state by just revert the movement of the pen.

3.Other SMP types' Case:

The other SMP types are similar to SMP1, and above figure covers all the circumstance that a concrete pen-based computer can show. For example, when the height information is not available in some pen-based computers, the Height space is replaced by the H_{nul} space, at that time, the SMP3 type is ready to use.

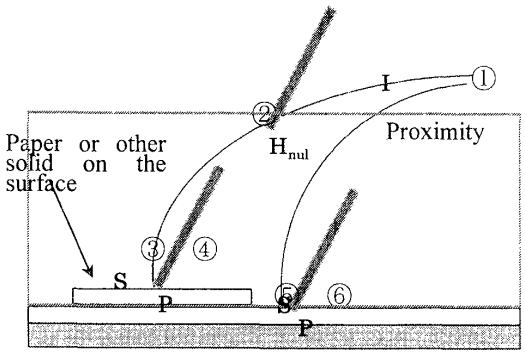

Fig. 3

In Fig.3, because of the lack of height information, when the pen move on the paper gently, with the condition $P<P_{low}$, the based-computer will deem it as H_{nul}, on the other hand, if $P>P_{high}$, it represents P space, otherwise S space.

4.Conclusion:

From this point, a pen-based computer can be described as one of the above 12 types according to their implementations. Our unified model will help to realize the unified data format in the pen-based world.

5.Reference:

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