Bell Laboratories

Cover Sheet for Technical Memorandum

Title- **Keymap: A Visual Technique of Keyboard to CRT Mapping**

Date- **April 1,1981**

TM- **81-11356-4**

Other Keywords- **Graphic Input**
Human Factors

Author	Location	Extension	
S.P. Ressler	**MH 7A-206**	**4377**	Charging Case- **011170-0101** Filing Case- **39394**

ABSTRACT

Keymap is a general technique for using the standard keyboard of a CRT computer terminal to address at random a specific area of the screen. One simply considers the keyboard to be an array of buttons which corresponds spatially to the rectangle of the screen. The keyboard can then be used in a manner analogous to a bit pad to randomly access a specific part of the screen.

Pages Text 3 Other 2 Total 5

No. Figures 1 No. Tables 0 No. Refs. 1

DISTRIBUTION
(REFER GEI 13.9-3)

COMPLETE MEMORANDUM TO

CORRESPONDENCE FILES

OFFICIAL FILE COPY
PLUS ONE COPY FOR
EACH ADDITIONAL FILING
CASE REFERENCED

DATE FILE COPY
(FORM E-1328)

10 REFERENCE COPIES

<ALLES,H G
<BARON,ROBERT V
BERGLAND,G D
<CHRISTENSEN,C
CLOGSTON,ALBERT M
+FREEDMAN,BARRY H
FREENY,STAN L
<GIORDANO,PHILIP P
+HANNAY,N B
<KEESE,W M
+KNOWLTON,KEN
KOGELNIK,H
LIMB,JOHN O
LUCKY,R W
<MARKY,GERALDINE A
<MC DONALD,H S
+MC DONNELL,JOHN P
MILLER,STEWART E
<MORGAN,SAMUEL P
NETRAVALI,A N
NINKE,WILLIAM H
PENZIAS,A A
REUDINK,D O
<ROBERTS,CHARLES S
+RUBINSTEIN,CHARLES B
SLICHTER,W P
<TEWKSBURY,S K
+VYSSOTSKY,V A
28 NAMES

COVER SHEET ONLY TO

CORRESPONDENCE FILES

4 COPIES PLUS ONE
COPY FOR EACH FILING
CASE

AAGESEN,JOHN
AARONSON,STEVE M
ABATE,JOSEPH
ABOWD,MARYPAT
ABRAHAM,S A
ACKERMAN,A FRANK
ACKROFF,JOHN M
AHO,ALFRED V

COVER SHEET ONLY TO

AHRENS,RAINER B
<AHUJA,SUDHIR R
ALCALAY,D
ALGER,M J
ALLEN,JAMES R
ALLEN,R C
ALLEN,ROBERT B
ALLISON,C E,JR
ALMQUIST,MILTON L,JR
AMRON,IRVING
ANDERSON,KATHRYN J
ANDERSON,MILTON M
ANDREWS,R J
AN,LINDA H
ARNOLD,GEORGE W
ARNOLD,PHYLLIS A
ARNOLD,SAMUEL L
ARNOLD,THOMAS F
ARTHURS,E
ASELTINE,EDWARD G
ASTHANA,ABHAYA
ATAL,BISHNU S
BACH,MAURICE J
BAGGA,YUDHVEER S
BAILEY,CATHERINE T
BAILEY,R W
BAIN,WILLIAM LAMAR,JR
BAKER,BRENDA S
BAKER,DONN
BAKER,GREGORY
BAKER,MITCHELL B
BALENSON,CHRISTINE M
BALLARD,E D,JR
BARAL,ELLIOTT
BARBATO,ROBERT R
BARNES,CYNTHIA A
BARNETT,MARC B
BAROFSKY,ALLEN
BARR,W J
BARTLETT,RICHARD ANDREW
BARZ,H
BAUER,BARBARA T
BAUER,HELEN A
<BAUGH,C R
BAUMANN,JAMES L
<BAXTER,LESLIE A
BEACHY,MILTON
BEAUCHAMP,HARRY L
BEBLO,WILLIAM
BECKER,CURTIS A
BECKER,DANIEL C
BECKER,RICHARD A
BEDNAR,JOSEPH A,JR
BEHRMAN,J S
BENCO,DAVID S
BENISCH,JEAN
BENJAMIN,PHILIP M
BENNETT,RAYMOND W
BENNETT,RICHARD L
BENNETT,WILLIAM C

COVER SHEET ONLY TO

BERGH,A A
BERK,DONALD A
BERLINER,EDWARD F
BERNOSKE,BEVERLY G
BERNSTEIN,L
BERRYMAN,EDWARD R
BERZINS,ALEXANDER H
BEYER,JEAN-DAVID
BIANCHI,M H
BICKFORD,NEIL B
BILLINGTON,MARJORIE J
BILOWOS,R M
BIRNS,MARY M
BISHOP,J DANIEL
BISHOP,THOMAS P
BISHOP,VERONICA L
BITTNER,B B
BLAKE,GARY D
BLANK,MICHELLE A
BLAZIER,S D
BLEIER,JOSEF
BLEWETT,C DOUGLAS
BLINN,J C
BLOSSER,PATRICK A
BLUM,MARION
BOCKUS,ROBERT J
BODEN,F J
BOGART,THOMAS G
BOIVIE,RICHARD H
BOLICK,LAWRENCE J
BONANNI,L E
BOND,HOLTON C,JR
BORGEL,JEAN-CLAUDE
BORKAR,SURESH R
BOSWELL,PAULA S
BOULIN,D M
BOURNE,STEPHEN R
BOWERS,RICHARD J
BOWMAN,KATHERINE E
BOWYER,L RAY
BOYCE,W M
BOYER,PHYLLIS J
BOYLE,GERALD C
BOZA,L B
BRADFORD,EDWARD G
BRADLEY,M HELEN
BRADY,PAUL T
BRANDAUER,C M
BRANDT,RICHARD B
BRAUNE,DAVID P
BRAUN,DAVID A
BREEN,R S
BREILAND,JOHN R
BRENSKI,EDWIN F
BRESLER,RENEE A
BRIGGS,GLORIA A
BROAD,MARTHA M
BROOKS,CATHERINE ANN
BROSS,JEFFREY D
BROVMAN,INNA

COVER SHEET ONLY TO

BROWN,ELLINGTON L
BROWN,H GORDON
BROWN,LAURENCE MC FEE
BROWN,LOUIS C
BROWN,MARK R
BROWN,W R
BROWN,W STANLEY
BROZ,G C
BRUECKNER,DOUGLAS E
BRUNO,BEVERLY A
BRYANT,DAVID J
BUCHE,CHARLES M
BULLEY,R M
BURGESS,DIANE M
BURGESS,JOHN T,JR
BURG,F M
BURIC,MILORAD R
BURKE,MICHAEL E
BUROFF,STEVEN J
BUSTAD,ERIC KENNETH
BUTLER,THOMAS W
BUTLETT,DARRELL L
BUTTON,BEVERLY
<BUTZIEN,PAUL E
BYRNE,EDWARD R
CABLE,GORDON G,JR
CALESSO,GIULIO L
CALVERT,KENNETH L
CAMPBELL,JERRY H
<CANADAY,RUDD H
CARAM,BRUCE
CAREY,J H
CARFAGNO,JOSEPH A
CARLSON,HELEN V
CARROLL,J DOUGLAS
CARTER,DONALD H
CARUSO,R E
CASELLA,CHARLES R
CASPERS,BARBARA E
CASS,JAMES L
CAUWELS,GERTRUDE M
CAVINESS,JOHN D
CERMAK,I A
CHAFFEE,N F
CHAI,D T
CHAKRIN,LEWIS M
CHAMBERS,B C
CHAMBERS,J M
CHANG,JEAN L
CHANG,JIH JIE V
CHANG,JO-MEI
CHAPMAN,KATHY J
CHAPMAN,LESLEY A
CHENG-QUISPE,ENRIQUE
CHENG,Y
CHEN,E
CHEN,HAN-TEE
CHEN,PING C
CHEN,STEPHEN
CHEN,T L

COVER SHEET ONLY TO

CHERRY,LORINDA L
CHEUNG,ROGER C
CHE,HER-DAW
CHIANG,T C
CHIEN,ANTHONY H
CHILDS,CAROLYN
CHIN,AUGUSTIN Y
CHI,M C
CHODROW,M M
CHONG,PHEE
CHRIST,C W,JR
CHUNG,MICHAEL
CHU,JEAN
CHU,NARISA N
CHU,PAUL H N
CHU,SAI-CHEONG
CICHINSKI,STEVEN
CIEMINSKI,DEBRA F
CIRILLO,C
CLARK,DAVID L
CLAYTON,D P
CLINE,LAUREL M I
CLINE,RUSSELL R
CLOUTIER,J
COATES,KAREN E
COBEN,ROBERT M
COCHRAN,JAMES A
COFFIN,STEPHEN
COFFMAN,JAMES E
COHEN,AARON S
COHEN,H M
COHEN,HARVEY
COHEN,HARVEY S
COHEN,RICHARD L
COKE,ESTHER U
COLABRARO,CHRISTINE A
<COLE,LOUIS M
COLE,MARILYN O
COLLICOTT,R B
CONKLIN,DANIEL L
CONNERS,RONALD R
COOPER,ARTHUR E
COOPER,MICHAEL H
COPP,DAVID H
COREY,D A
COREY,D N
CORIELL,A S
COSTELLO,PETER E
COTTINGHAM,CHARLES F
COTTRELL,JENNIE L
COUGHRAN,W M,JR
<COURTNEY-PRATT,J S
COVINGTON.RALPH L
COY,CORDELL AMOS
CRACOVIA,E V
CRAGUN,DONALD W
CRAGUN,JOAN
CRAIG,JOHN R
CRAIG,N E
CRISTOFOR,EUGENE
...
1312 TOTAL

\+ NAMED BY AUTHOR > CITED AS REFERENCE < REQUESTED BY READER (NAMES WITHOUT PREFIX WERE SELECTED USING THE AUTHOR'S SUBJECT OR ORGANIZATIONAL SPECIFICATION AS GIVEN BELOW)

ERCURY SPECIFICATION...

OMPLETE MEMO TO
1135-DPH 113-DIR 111-EXD 113-EXD 115-EXD

OVER SHEET TO
COCSHE = HUMAN ENGINEERING OF COMPUTER SYSTEMS
COPLGR = COMPUTING/PROGRAMMING LANGUAGES/GRAPHICS
COPLTP = COMPUTING/PROGRAMMING LANGUAGES/TEXT PROCESSING, EDITING

HO CORRESPONDENCE FILES
HO 1A127

TM-81-11356-4
TOTAL PAGES 4

D GET A COMPLETE COPY

. BE SURE YOUR CORRECT ADDRESS IS GIVEN ON THE OTHER SIDE.
. FOLD THIS SHEET IN HALF WITH THIS SIDE OUT AND STAPLE.
. CIRCLE THE ADDRESS AT RIGHT. USE NO ENVELOPE.
. INDICATE WHETHER MICROFICHE OR PAPER IS DESIRED.

PLEASE SEND A COMPLETE

( ) MICROFICHE COPY ( ) PAPER COPY

TO THE ADDRESS SHOWN ON THE OTHER SIDE.

Bell Laboratories

Subject: **Keymap: A Visual Technique of Keyboard to CRT Mapping**

Case- 011170-0101 -- File- 39394

date: **April 1,1981**

from: **S.P. Ressler**

TM: **81-11356-4**

MEMORANDUM FOR FILE

1. Introduction

Keymap is a general technique which allows one to use a keyboard as a low resolution graphic input device. The large rectangle of keys in the center of a standard (qwerty) keyboard is thought of as points on an **x, y** plane. If the x, y plane has x increasing to the right and y increasing from top to bottom, the upper left side of the keyboard will be the lowest x,y coordinate transmitted.

The center of a "normal" (qwerty) keyboard looks as follows:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**
q	**w**	**e**	**r**	**t**	**y**	**u**	**i**	**o**	**p**
a	**s**	**d**	**f**	**g**	**h**	**j**	**k**	**l**	**;**
z	**x**	**c**	**v**	**b**	**n**	**m**	**,**	**.**	**/**

This portion of the keyboard is an x,y grid. Pressing a **1** would result in the lowest x,y coordinate being transmitted to the application program. Now the information coming from the keyboard consists of data which has a *visual* correspondence to the key being pressed.

In figure 1 one can see how a rectangular area of a keyboard is mapped onto the rectangular area of the crt. The locations of the four keys hit, correspond physically to the locations of activity on the screen. The grid on the crt is only for illustrative purposes and corresponds to the resolution of the keyboard x,y grid.

2. Implementation

The following is a short discussion of a particular way of implementing this technique. A *keytable* is created which is used for the conversion of **ASCII** data to a sequential ordering of the keys to be used. The keys are sequentially assigned numbers according to their physical position on the keyboard. The key one is assigned 0, two is 1, q is 10 through / which is 39. When a key is pressed an ASCII value is transmitted to the system and this value is used via the keytable to determine the assigned position number of that key. Keys which are to be ignored, are assigned position number -1. Next we must extract the keyboard x **(kx)** and keyboard y **(ky)** coordinates of the key.

This is done by the equations: (There is also some additional minor code to move the keyboard origin to 1,1.)

kx = (keyposition % numxkeys)

ky = (keyposition / numxkeys)

Where keyposition is obtained from a table lookup into keytable and numxkeys is the number of keys in the x direction.

We must now convert from keyboard coordinates to screen coordinates. This is accomplished in the following manner:

Definition of terms:

xscreen = maximum number of characters on the screen in the x direction
yscreen = maximum number of characters on the screen in the y direction
xkeys = number of keys in the x direction
ykeys = number of keys in the y direction
xrat = xscreen / xkeys the ratio, in x, of screen to key coordinates
yrat = yscreen / ykeys the ratio, in y, of screen to key coordinates
kx , ky = keyboard x and y coordinates
sx , sy = screen x and y coordinates

Equations:

sx = (kx * Xrat)
sy = (ky * Yrat)

These equations produce a smooth mapping of the keys to the entire screen area. The resultant screen x (sx) and screen y (sy) can then be used directly in some screen oriented application.

3. Some Applications

Prior to placing the *Keymap* technique into an actual application one must be aware of some of the limits of this technique. First of all due to the nature of this beast the meaning of each key of the keyboard is changed, which means that one must have a means of entering and leaving a *Keymap* mode of some sort. The way in which you implement the entering and leaving of the mode may determine if the mode has any use at all. If it takes more effort to enter the mode, move to a spot and then leave, as opposed to repetitively hitting some direction keys, the effort will have been wasted. What one would like to do is to integrate a *Keymap* mode into some application in as natural and simple a way as possible.

The *Keymap* technique has been implemented in an experimental version of the text editor TED[1]. TED is a screen oriented text editor which among other things uses some control keys to move the cursor up, down, left, and right. A special key on the keyboard (any function key found on many terminals or an escape sequence) is the *Keymap* entering key and any other cursor movement key such as cntrl u, to move the cursor up, will cause an exit from *Keymap* mode. The technique appears to be useful for quickly positioning the cursor to some distant point on the screen.

Another place where keymap has been implemented is in an experimental VLSI design tool. Here the ability to move a cursor on a bit mapped screen quickly is quite convenient. If one does not have a bit pad or other graphic input device immediately available this keyboard technique is useful. In some cases one might use the keyboard positioning of a cursor even if one did have a bit pad. For example the application might require a lot of typing anyway, and the user may find it simpler to keep using the keyboard rather than diverting attention away from the keyboard to use another device. More study is certainly needed to determine where, in applications which require graphic input, this technique would be beneficial to the user.

4. Acknowledgements

The author would like to thank Aleta Gruchacz for installing *Keymap* into TED and Misha Buric for implementing the VLSI application test.

S.P. Ressler

MH-11356-SPR
Attached
References (1)
Figure 1

References

[1] A.M. Gruchacz, D.K. Sharma, *TED Reference Manual,* TM 81-11359-3.

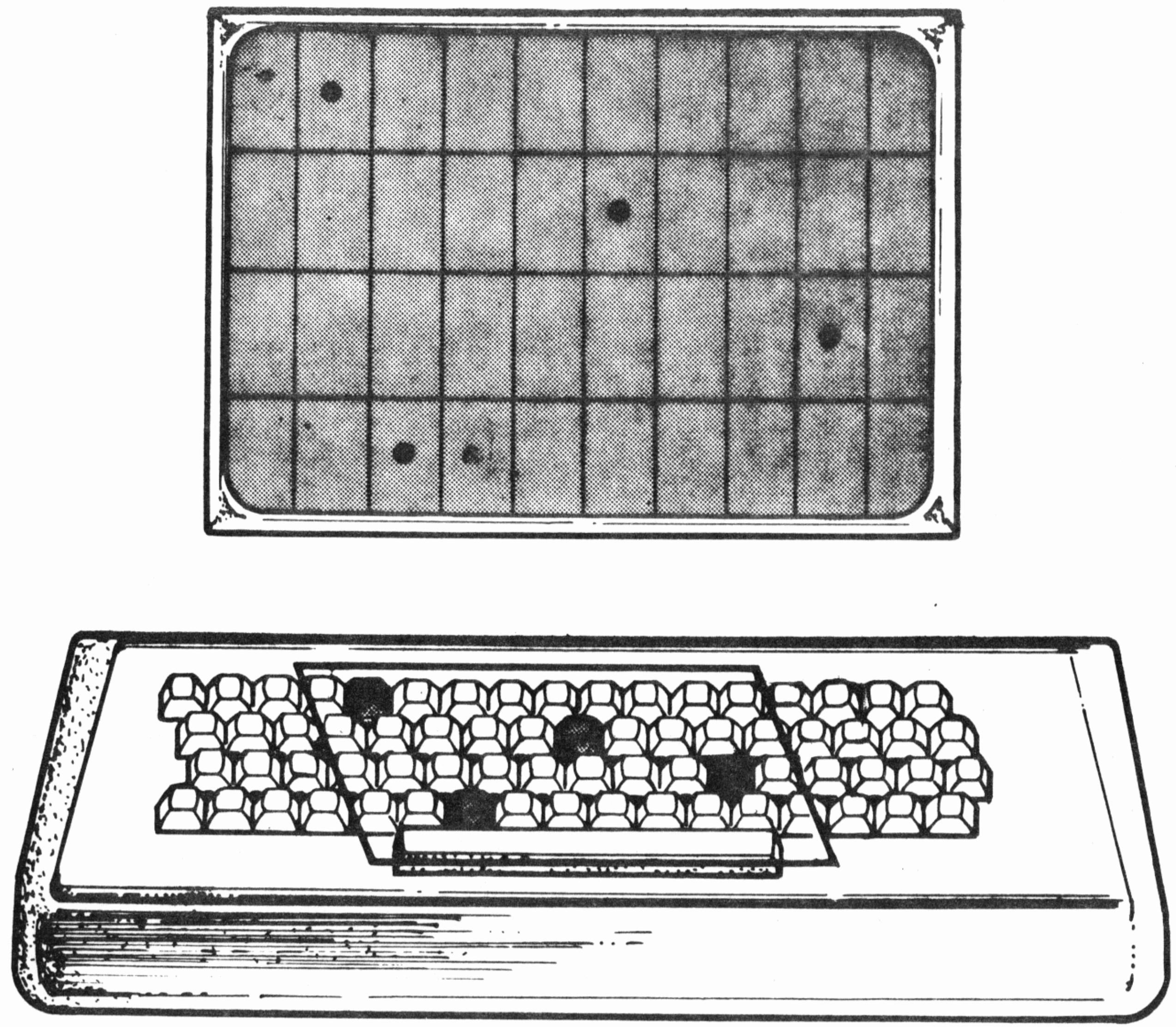

Figure 1