Screen Implementation for Plan 9 on the Raspberry Pi4

Charlie Stuart

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ABSTRACT

Plan 9 is a unique operating system used primarily by researchers and hobbyists. In 2012, Richard Miller ported Plan 9 to the Raspberry Pi. This quickly became a popular platform for the lightweight operating system. The port is missing many hardware implementations. My research will first focus on building functionality for the Rasberry Pi 7 inch Touch Screen to open general communication across the DSI connectors. From there, I will explore how to best implement the unique mouse behavior with the touch screen.

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BACKGROUND

Early 1980s: Plan 9 developed at Bell Labs
An experimental operating system for research addressing UNIX issues
Developed enough to be use as a standalone environment

2000: Released as open source

2012: Richard Miller writes his port for the Raspberry Pi4

2015: Fourth edition released

PROBLEM

The Raspberry Pi is a popular platform for Plan 9

Missing many hardware implementations

- Audio Support
- DSI and CSI connectors
- GPIO Pins

No solutions currently

- Compatible with standard monitors
- Henri Tuhola wrote an SPI driver for a 7.8 inch e-paper display
- Compatible with the Compaq Ipaq on models H3630 and H3650 with 32MB of RAM

GOAL

Implement the Raspberry Pi 7 inch touch screen on GPIO and DSI ports

- Treat as a standard monitor

Explore adding the touch functionality that aligns with the unique mouse usage of Plan 9

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originaldesign.txt
8andahalf.txt
rio.txt
rc.txt
sam.txt
acme.txt

DEBATE

Plan 9 is unique and polarizing

Mouse usage and design philosophies are highly debated

No intent of joining the discussion, researching it, or forming a conclusion

My Goals:

- Seamlessly extend Richard Miller's port
- Follow design patterns set forth by original authors
- Follow 9legacy model

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9LEGACY

Started as an alternative distribution of Plan 9 from Bell Labs

Transitioned into a continuation of Plan 9 from Bell Labs

Centralized Plan 9 patches

Patches do not rely on each other and are updated as Plan 9 from Bell Labs updates

“We strongly believe it is not a good idea to fork Plan 9 from Bell Labs. Too many communities is the enemy of the community. Plan 9 from Bell Labs is and will always be the reference distribution of Plan 9.”

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PLAN 9 ORIGINAL DESIGN

Considered “more-Unix-than-Unix”

Everything is a file

Compatibility is not a priority, keep some UNIX things, replace others. Design consistently for the programmer

Consistent appearance across set ups

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8 ½

Original window manager for Plan 9

Some core design principles

- Three Button Mouse
- Overlapping Windows
- Built-in Terminal Program

UNIX has `/dev/tty` Plan 9 has `/dev/cons`, `/dev/mouse`, and `/dev/window`

- `/dev/tty` : Same file, different contents
- `/dev/cons` : Different file, same name, different contents

Allows for mouse based creation of windows and mouse based text editing

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RIO

Replaced 8 ½ as the window system for Plan 9
Requires 3 button mouse. Can emulate with a 2 button mouse and shift key.

Button 3 is pressed and held to pull up a window menu including “New, Resize, Move, Delete, Hide” While holding button 3, hover over the command. Release to select. Use button 3 again to perform the selected action.

On the edge of a window, buttons 1 and 2 will resize the window. Button 3 will move it.

In a shell, button 1 is used to select text and direct input. Button 2 brings up a text editing menu with “cut, paste, snarf, plumb, send, scroll”

Double clicking selects a block of text

Clicking anywhere on the scroll bar with Button 1 will scroll up. Button 3 will scroll down.

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ACME

Interface built for the Plan 9 workflow

Button 1 selects text

Button 2 executes textual commands

Button 3 combines context search and file opening functions

All buttons can click, double click, and sweep text

Windows are not clicked in to type in. Text is inserted in windows the cursor hovers over

When new windows are created, the mouse is automatically moved

Mouse buttons can be strung together as chords

Multi-Touch

How to differentiate between button 1, 2, and 3?

How to differentiate between a click, sweep, hover, and chord?

Through forums, users have suggested:

- Relating to the MacOS port, use a trackpad like approach where ALT and CMD change to button 2 and 3 respectively
- Using the placement of multiple fingers to indicate buttons

Fingers too large and inaccurate for a 7 inch 800x480 screen

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Stylus

Follow the Ipaq “bitsy” approach and use a stylus

Stylus allows for more precise taps than much larger fingers

Introduces new hardware - a compatible stylus with three buttons

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Buttons

In a mailing list, user unobe talks about running a Plan 9 port on their PinePhone. They utilized the volume keys to toggle Button 2 and Button 3. They were able to perform basic key presses and some chording. They were not able to perform sweeps.

Requires less external hardware than the stylus

How to implement this to allow for sweeps?

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