Hand-Controlled Windows Manager

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Inspiration

• Minority Report
Setup & Functionality
Implementation

• Division of tasks

Basic Block Diagram

Camera input → Video Data Interpreter

Calibration

Edges of Screen Hand sizes → Video Data Interpreter

coordinates hand sizes → Windows Manager XVGA Display Generator

XVGA output to projector
Video Input Interpretation

Block Diagram of Video Component

- Camera input
- Decoder
- YCrCb to RGB
- Shape and Coordinates Detector
- Gesture Interpreter FSM

Edges of Screen Calibration
- switch[0] = screen calibration mode

Shape coordinates
- Open pixels
- Side pixels
- Point pixels
- Fists pixels

Hand Size Calibration
- switch[1] = hand calibration

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Shape/Coordinate Detector Module

- Counts number of black pixels in each frame
- Based on calibration, determines shape of hand
- Hand shapes:
  - Open, fist, pointer, edge
- Averages hcount, vcount of black pixels to find coordinate of hand
Gesture Interpreter Module

State Transition Diagram

- Resize
  - RESIZE

- Open
  - OPEN

- Open?
  - OPEN
  - P?
  - ~P?

- Hold?
  - Similar coord?
  - F?
  - ~F?
  - HOLDING

- Closing
  - Similar coord?
  - F?
  - ~F?

- Hold?
  - Similar coord?
  - F?
  - ~F?

- Edge?
  - ~E?
  - E?

- Minimize
  - MINIMIZE

- Reset
  - ~P?
  - P?
  - O?
  - ~O?

- 6.111 Digital Electronics Lab Final Project

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Windows Manager

• A FSM takes in commands and updates a frame buffer.
• Information about the windows, icons, and dock objects are stored in RAM and ROM
• Screen size: 1024x768 pixels
• 8-bit color: requires a color map
  – Use Matlab to convert Bitmaps to .coe files
Block Diagram

VGA

RAM frame_buffer 1Mx8

RAM color_map 256x24

RAM windows_priority 32x5

RAM windows_information 32x20

FSM

Ram icon_information 8x20

RAM dock_information 8x20

ROM images 32Kx8
FSM – modularity

- Divided into smaller modules that communicate with the RAMs and ROMs
- Use mux to between the module and memories
  - find_windows, find_icons, find_dock
  - update_priority
  - add_window
  - update_area