

Considerations for Microprocessor-based Terminal Design

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Abstract

We discuss the design of hardware and software for inexpensive microprocessor-based terminal/microcomputers. Such devices are fundamentally microcomputers that have been adapted, with specialized software, to operate as remote terminals for a host computer. The discussion centers on a specific video terminal designed and constructed by the authors. This terminal is based on the **Intel 8080** microprocessor and is equipped with software sufficient to emulate the characteristics of standard video terminals required by several available *screen-oriented* text editors in common use at sites throughout the **ARPAnet**. We have found that the microprocessor adequately serves as the controller for such terminals, and that a *software-based* approach to the design of such terminals offers substantial advantages in capabilities, flexibility, and cost over the *hardware-based* approach. We suggest guidelines for future designs of microprocessor-based terminals on the basis of our experience designing and using the terminal described here.

In order to take full advantage of the flexibility afforded by microprocessor-based designs, we have implemented the capability to *download* and execute **8080** programs written and assembled on a host computer. This allows the user to customize and extend the features of his terminal. At the same time, it provides access to the **8080** as a microcomputer with the software development tools and mass storage provided by the host computer. The terminal is thus a complete, stand-alone microcomputer system specially configured for its role as a terminal.

For more detail, see:

Reid G. Smith and Tom M. Mitchell, *CONSIDERATIONS FOR MICROPROCESSOR-BASED TERMINAL DESIGN*. STAN-CS-78-696 (Stanford Heuristic Programming Project Memo HPP-78-22), Dept. of Computer Science, Stanford University, November 1978.

A Microprocessor-based Terminal

**A MICROCOMPUTER ADAPTED VIA SPECIALIZED
SOFTWARE TO OPERATE AS A REMOTE TERMINAL**

**MICROPROCESSOR FOR EMULATION OF TERMINAL
(SOFTWARE-BASED DESIGN)**

MICROPROCESSOR FOR LOCAL COMPUTATION

Terminal Requirements

SUPPORT SCREEN-ORIENTED EDITORS

(TV-EDIT or E)

FULL-ASCII CHARACTER SET

80-CHARACTER LINE WIDTH

8-BIT TRANSMISSION

INSERT AND DELETE CHARACTER

INSERT AND DELETE LINE

ERASE TO END OF LINE

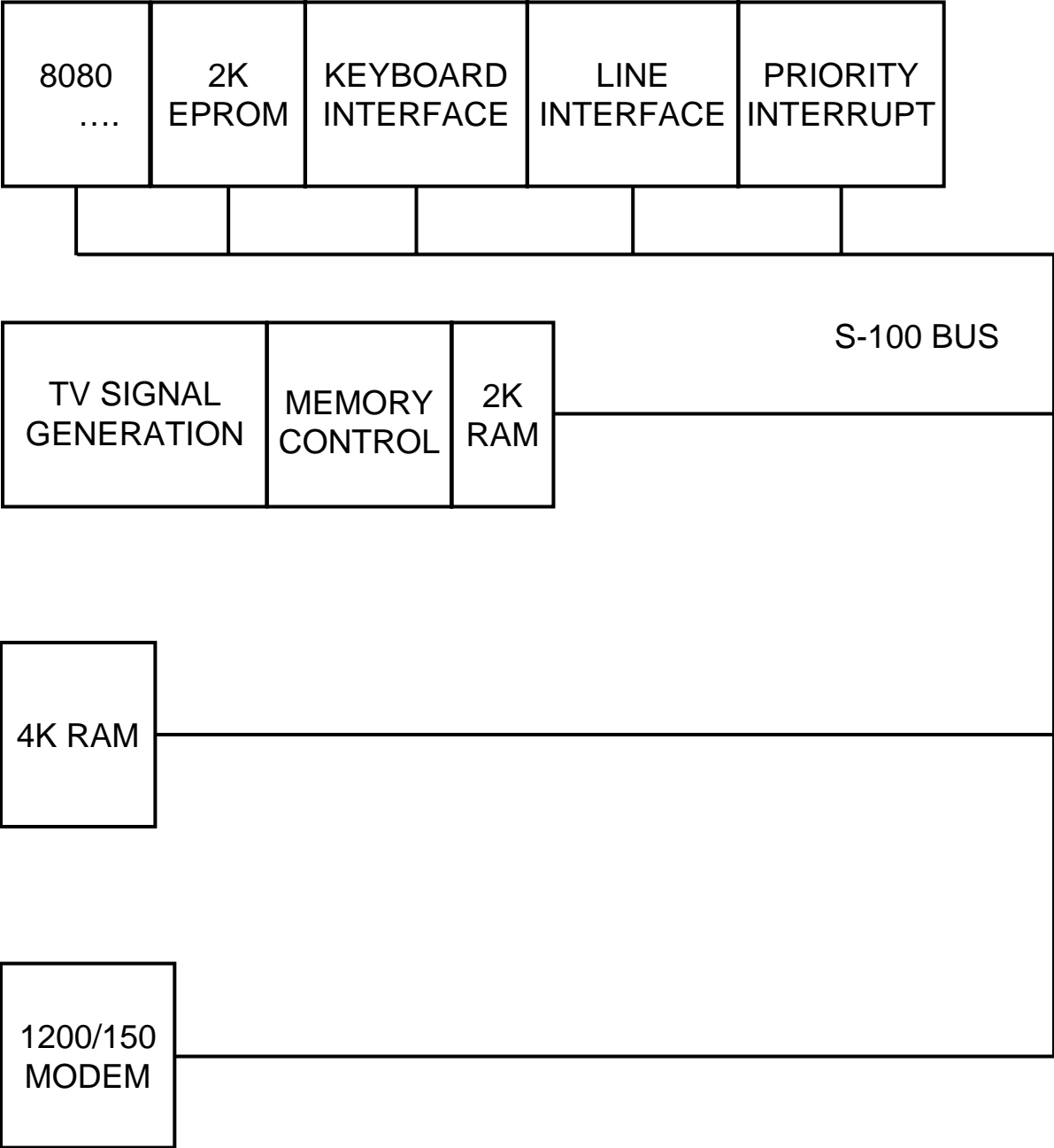
BLANK SCREEN

CURSOR ADDRESSING (relative and absolute)

DISPLAY MODES (e.g., dual intensity)

LOW-COST

Block Diagram



Software

PRIMITIVE TEXT-PROCESSING OPERATIONS

(e.g., insert and delete line)

LOCAL MONITOR

STORE SCREEN

RECALL SCREEN

TRANSMIT SCREEN

SELECT DISPLAY MODE

LOGOUT JOB

GO TO ADDRESS

The System As A Terminal

ADVANTAGES OF A SOFTWARE-BASED DESIGN

COST

(for primitive text-processing operations)

CAPABILITIES

(e.g., macros)

FLEXIBILITY

(e.g., customized functions)

DISADVANTAGE

SPEED ??

The System As A Microcomputer

**SOFTWARE DEVELOPMENT ON THE HOST
VIRTUAL TERMINAL**



**LOCAL EDITING
SHARED EDITING**

(GOOD LOCAL FILE SYSTEM ESSENTIAL)

Using The Host For Software Development

WHY?

MASS STORAGE – FILE SYSTEM

HIGH-QUALITY EDITORS

COST

REQUIRMENTS:

CROSS-ASSEMBLER

DOWNLOADER

USEFUL IDEAS:

TERMINAL SOFTWARE FOR LOCAL USE

VIRTUAL TERMINAL

Suggestions For Future Designs

ESSENTIAL FEATURES

HARDWARE

80-CHARACTER LINES

AT LEAST 24 LINES

VARIABLE DISPLAY MODES

SOFTWARE

INSERT AND DELETE CHARACTERS AND LINES

CURSOR ADDRESSING

DESIRABLE FEATURES

HARDWARE

VARIABLE TYPE STYLES

STORAGE AND RECALL OF MULTIPLE SCREENS

SOFTWARE

SPLIT-SCREEN MODE

TREND

TOWARD LONGER WORD-LENGTH PROCESSORS

AS TERMINAL CONTROLLERS

Summary

MICROPROCESSOR-BASED TERMINALS

SOFTWARE-BASED DESIGN

**CLOSE INTERACTION BETWEEN HOST AND MICROCOMPUTER
FOR SOFTWARE DEVELOPMENT AND
DYNAMIC CUSTOMIZATION OF
TERMINAL FEATURES**