DIGITAL DATA, COMPOSITE VIDEO MULTIPLEXER AND DEMULTIPLEXER BOARDS FOR AN IBM PC/AT COMPATIBLE COMPUTER

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ABSTRACT

Work continued on the design of two IBM PC/AT compatible computer interface boards. The boards will permit digital data to be transmitted over a composite video channel from the Orbiter. One board combines data with a composite video signal. The other board strips the data from the video signal.

INTRODUCTION

The design of both boards was started towards the end of the last summer faculty fellowship period and continued under a grant during the academic year. A survey of techniques for multiplexing data with video signals was completed during the summer of 1992 [1]. Most of the specifications for the boards were completed during the academic year grant period [2]. Most of the rest of the design for both boards was completed during the current summer faculty fellowship period, and some of the schematic diagrams were drawn.

Most of the digital logic circuits are 74HC family members. Most integrated circuits can be supplied by two or more manufacturers. Some special function circuits are available from only one source. Alternatives that perform similar functions, but may not be plug-in replacement parts, are discussed in the design documentation.

Some of the designs' features and the documentation that supports some of the design decisions are discussed in more detail below.

DESIGN FEATURES AND DOCUMENTATION

Error Detection and Correction Code

A (2,1,6) convolution code with 171 (octal) and 133 (octal) generator polynomials was selected. The code has a constraint length of 7 and a coding rate of 1/2. Viterbi decoding will be used at the receiver.

The code has the power of the 1/2 rate NASA Interplanetary Standard code used on TDRSS and is supported by commercially available encoder and decoder chips. Punctured versions of the code can be used to reduce the coding (and the error detection and correction) rate.

Several codes that are supported by commercially available encoder and decoder chips were considered. Several hardware and software techniques, besides using commercially available encoder and decoder chips, were considered [3]. A paper will be submitted for publication based on a study of coding techniques and commercially available encoding and decoding chips.

Board Control Processor

The MC68HC16 was selected as the board controller for both the transmitter and receiver boards. A 68HC16Z1EVB single-board development system was ordered to assist in developing the hardware and software for the interface boards. Several microprocessor and microcontrollers were considered, including a dedicated processor constructed from HC family SSI and MSI logic chips [4]. Several of the processors studied, including the DSP56001, MC68HC000, 80C186, and 80C188, could move data quickly enough and address a large enough memory space. However, a system based on the 68HC16 will use less power.

Video Signal Processing

Several circuits that process the video signal are available from only one vendor. Alternative chips or techniques are described in the documentation [5] in case the single-source chips are not available in the future.

How It Works

A brief description of how the interface boards work was written [6].

Schematics

P-CAD was used to start drawing schematics for the transmitter board. Two schematics were completed, the convolutional encoder and the video processor [6]. Part of the video processor circuitry can be used for the receiver board. A conference paper will be submitted for publication about the encoder circuit.

RECOMMENDATIONS FOR FUTURE WORK

The remaining schematic diagrams need to be drawn. Parts need to be ordered so that the design can be tested on protoboards. Printed circuit boards need to be developed once the designs have been tested and verified, and the final design needs to be tested and verified on the printed circuit boards.

REFERENCES

[1] Dean Lance Smith and Walter D. Hanby, "Techniques for transmitting digital data on the Spacelab's analog video channel", *IEEE AES Systems Magazine*, vol. 8, pp. 42-50, May 1993.

[2] Dean Lance Smith, "Digital data, composite video multiplexer and demultiplexer boards for an IBM PC/AT compatible computer," Memphis State University, Memphis, TN, Report NAG 9-646-S, April 1, 1993.

[3] Dean Lance Smith, "Recommended error detection/correction code for the data on composite video system interface boards," memo to Walter D. Hanby, Revised August 9, 1993.

[4] Dean Lance Smith, "Processor for the data on video interface boards," memo to Walter D. Hanby, Revised August 9, 1993.

[5] Dean Lance Smith, "Alternative chips for the data on video interface boards," memo to Walter D. Hanby, August 13, 1993.

[6] Dean Lance Smith, "Data on video interface boards - how they work," memo to Walter D. Hanby, August 13, 1993.