$\mathcal{NCC}$ **Request for Proposals**

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Computer
Corporation

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A Hardware Accelerator Module For Image File Format Translation

Abstract

NCC is seeking proposals for the design and implementation of a Hardware Accelerator Module (HAM) for translating between image file formats. Input files will be presented as Microsoft Windows bit map (BMP) files. The output file shall be a Compuserve Graphical Interchange Format (GIF) file. The HAM shall be implemented as a standard expansion card for IBM-PC compatible computers using the parallel port.

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Issue Date: August 23, 1999
Deadline: December 6, 1999

Contents

1 Introduction

NUcomp Computer Corporation (NCC) has an application that requires the repeated translation of image files from one file format to another. This Request For Proposals (RFP) solicits proposals for the design and implementation of a Hardware Accelerator Module (HAM) for performing this translation. The primary objective is to accelerate the translation function relative to a purely software translation program.

Input files will be presented as bitmap (BMP) files compatible with the Windows Bitmap File Format standard [1]. The output file shall be a Compuserve Graphical Interchange Format (GIF) file compatible with the *gif89a* standard [2]. The HAM shall be implemented as a standard expansion card for IBM-PC compatible computers using the parallel port. The parallel port's 8 bits will be used for output only, and the input will be carried by *only* the 4 status pins (note that a fifth pin is available in the port, but it is difficult to use, so you may use only the 4 status pins). In addition, all executive software necessary to manage and operate the HAM card shall also be provided by the contractor.

2 Terminology

In the context of this RFP, the word "shall" indicates a non-negotiable requirement of the specification. Thus, the words "shall" and "must" are treated as synonymous. The word "should" specifies an optional, but highly desirable feature. The intent of this document is that any item indicated by "should" shall be adhered to unless it proves to be impractical or counterproductive. The word "may" indicates an option left entirely to the discretion of the contractor.

3 Functional Specification

The HAM card, and/or its executive software executing in the host PC shall:

1. Receive from the host PC a bitmap (BMP) image file with the following properties:
   (a) A DOS-compatible file name with the extension: ".bmp",
   (b) Total size not to exceed 1 megabyte,
   (c) A 24-bit color image format as specified in [1].
2. Translate the input image into a gif89a [2] image. A key component of this task will be implementation of the Lempel, Ziv, and Welch (LZW) compression algorithm [3].

3. Store the translated image in a file with the following properties:
   (a) The same file name as the input file, but with the extension ".gif",
   (b) Stored in the same directory as the original input file,
   (c) Stored as a single-image file.

It is not necessary to implement any additional translation or storage functions not required for a color gif89a file. When viewed with any industry standard image viewer, the ouput image shall be identical to the input image. In addition, all executive software for the host PC needed to use the HAM shall be developed and provided by the contractor.

4 Performance Objective

The primary performance objective is to minimize the total execution time for the complete file translation. The total execution time shall include the time necessary to download the input data from the host PC to the HAM card and upload results from the HAM to the host PC. The total execution time shall *not* include the time required to transfer input and output files between a mass storage device and the host PC's main memory.

5 Deliverables

At the conclusion of this project, the contractor shall deliver the following items to NCC.

- A final written proposal giving a detailed description of the design. This report shall adhere to the style specifications of Appendix A.
- A final oral presentation, not to exceed 45 minutes in length, summarizing the written proposal. This presentation shall adhere to the style specifications of Appendix B. NCC may also request a demonstration of the prototype at this time, using input BMP file(s) provided on the spot on a 3.5 inch floppy diskette.
- A hardware prototype of the HAM card.
- The source code and executable files for all software required to manage and operate the HAM. All files shall be provided on 3.5 inch floppy diskettes. In addition, the source listings for all software shall be included as appendices to the written proposal.
- A complete user's manual for the hardware and software.

5.1 Deadlines

The written proposal must be delivered to NCC by 5:00 p.m. on the deadline date stated on the cover page[1]. All other deliverable objects shall be presented to NCC during that same work-week, at a time and place yet to be determined.

5.2 Proposal Contents

The written proposal shall contain sufficient detail to permit NCC personnel to understand the design, determine conformance to specification, estimate performance, and evaluate the credibility of claimed attributes. Specific information shall include, but need not be limited to the information listed below.

5.2.1 Design Description

Provide a detailed description of the HAM card functions and design, including a high-level block diagram and sufficient text to explain the functions of and relationships between the main components. Be sure to clearly delineate the partitioning of tasks between the HAM card and its supporting software.

5.2.2 Diagrams

Include flow charts, state diagrams, and or logic diagrams as necessary to adequately illustrate the design. Smaller diagrams shall appear as figures in the main body of the text. Large detailed logic diagrams should be confined to appendices, and referenced where relevant in the text.

5.2.3 Definitions and Signal Naming Conventions

Include tables defining variable names, signal names, module names, and any other naming conventions useful in understanding the design.

5.2.4 Users' Manual

One appendix of the written report shall be a short *Users' Manual*, sufficient to allow NCC personnel to test the prototype themselves.

5.2.5 Performance Analysis

Provide a detailed performance analysis of the HAM, including:

[1] I.e. Monday of dead week. You have now been informed in writing prior to the eighth week of classes.

- The total translation time for several images (as defined in Section 4, above).
- Comparisons to the performance of a software-only translator executing on the host PC.
- Parameterized expressions for the translation time in terms of HAM clock frequency and (if practicable) image size.
- Any other performance data considered pertinent.

References

[1] Microsoft Inc, *Windows Bitmap File Format*.

[2] Compuserve Inc, *Graphical Interchange Format, Ver. 89a*, 1990.

[3] Welch, T.A. “A Technique for High Performance Data Compression”, *IEEE Computer*, V. 17, No. 6, pp. 8–19, Jun 1984.

A Written Report Style

A.1 General Style

1. Use *Only* white 8.5 by 11 inch paper (except as listed in Subsection A.2.5).
2. Typing must be black, high contrast, and letter-quality. Dot-matrix output will *not* be accepted.
3. The report shall be bound *only* by stapling or clamping *in the upper left-hand corner*. No other binders or folders shall be used (except as listed in Subsection A.2.5).
4. Use a professional writing style similar to any IEEE or ACM research journal. If English is not your first language, then find someone to proofread your final draft for grammar and spelling (this is what you have to do for a real journal or grant).

A.2 Report Organization

The report must consist of the following items *in the order listed*:

1. Title Page with Abstract
2. Table of Contents (required if Main Text $>$ 5 pages),
3. List of Figures and List of Tables (optional),
4. Main Text (figures and tables may be embedded in the main text, if desired),
5. List of References (if applicable),
6. Figures and Tables (if not embedded in main text),
7. Appendices (if needed).

More detailed instructions on specific items are given below.

A.2.1 Title Page

1. Title, Author(s), Course Number, and Date.
2. Abstract, not to exceed 200 words (may be single-spaced).

A.2.2 Main Text

1. Must be Double-Spaced or One-and-a-half-Spaced.
2. Default font-size should be 12-point or equivalent.
3. All pages must be uniquely numbered in lexigraphically ascending order.
4. Section headers must be hierarchically numbered and/or lettered such that different levels of headers are distinguishable from each other.

A.2.3 References and Citations

1. Any statements, data, facts, claims, tables and/or figures taken from sources other than your own work *must* be properly cited where they appear in the text.
2. All references must be listed at the end as specified in Subsection A.2.
3. See any IEEE or ACM research journal for reference and citation formats.

A.2.4 Figures

1. May be *either* embedded in the main text *or* collected at end of the report.
2. May be hand-drawn and hand-lettered, but *neatness counts*!
3. May be photocopied, but must be easily readable and free of copier "noise".
4. Must be captioned, uniquely numbered in lexigraphically ascending order, and *referenced by number* in the main text.

A.2.5 Appendices

1. Lengthy detailed information such as source code listings or large complex logic diagrams should be confined to appendices.
2. Limit each appendix to one major item or topic.
3. Each appendix must be referenced at least once in the main text.
4. It is permissible to violate the 8.5 by 11 inch restriction in the appendices.
5. The binding of appendices must not impede the readability of either the main text or the appendices themselves. For example, fan-fold paper must be easy to unfold and lay flat. If desired, appendices may be bound separately from the main text.

B Oral Report Style

- Must be a single cohesive presentation.
- There must be a Title Page stating at least: title, author(s), course number, and date.
- Slides may be neatly hand-lettered, but printed slides are much preferred.
- Warning: in “portrait” format, the top and bottom of a page may not fit on the screen.
- Use a clean, simple font at least 20 points in size (In LaTeX, the “\LARGE \sf” font works nicely; you may also use the `slides` document class).
- Don’t change fonts too frequently.
- Don’t cram too much text onto one slide.
- Allow about 3 minutes per slide.
- Uniquely number all slides in order of presentation.
- Hand out hard-copies of **all** slides to all attendees **before** the presentation begins. 2-up or 4-up format will conserve paper, but is not required.
- Arrange the handout pages in the same order as the presentation slides.