The University of New South Wales

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The Élan Am386SC300 Portable Computer

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Chapter 1

Introduction

One of the fastest growing areas of computing today is the area of portable, often hand-held, devices. These highly-integrated computers are used in increasingly many areas, especially as Personal Digital Assistants, including hand-held data loggers, bar code scanners and meter readers.

This thesis describes the design of one such portable system, based on the Élan microprocessor. This system features the use of the current state-of-the-art technology, including high-density surface-mounted components, low battery power consumption, and directly integrated support for the new PCMCIA standard.

Acknowledgements

The acknowledgment is the place to thank the faculty, staff, family, and friends who have assisted you in preparing your thesis or dissertation. You may also acknowledge any financial support or special research materials given you. Copyright permissions may also be acknowledged here by stating that: (1) permission has been granted for reproduction of tables, tests, and other copyright protected items and (2) gives the source of the permission. Use a Preface rather than Acknowledgments when the research is discussed, for example, "the motivation for the study, the background of the project, the scope of the research, and the purpose of the paper" (Turabian, 1996, p. 7-8).

Chapter 2

Applications

2.1 Biomedical Applications

The rôle of the Élan Portable Computer, the system this thesis describes, in such biomedical systems would be to actually take the place of the hand-held device taking data readings, or as part of the instrumentation modules placed around the house. The requirements of the Élan Portable Computer in such systems are described in the next chapter.

This paragraph is so important that we'll repeat it for emphasis. The rôle of the Élan Portable Computer, the system this thesis describes, in such biomedical systems would be to actually take the place of the hand-held device taking data readings, or as part of the instrumentation modules placed around the house. The requirements of the Élan Portable Computer in such systems are described in the next chapter.

Chapter 3

Alternatives

In Chapter 2, we saw a number of applications in which a portable computer may be used.

...

The Élan CPU chooses the configuration mode at reset time, on the rising edge of $\overline{\text{RESIN}}$, by sampling the state of three pins: $\overline{\text{DTR}}$, $\overline{\text{RTS}}$ and SOUT. These pins are usually used for serial port output, except for their special function at reset. To select one of the modes, we place 10 kΩ pull-up or pull-down resistors on these pins, as per Table 3.1. In this table, a "1" indicates pull-up, "0" indicates pull-down, and "X" indicates that no resistor is required.

3.0.1 Level 1 ISA Bus Support

Table 3.2 shows the meaning of the pins used in this mode.

Before we continue, a few points to note about the notation:

- A pin name like PIN indicates either an *active-high* pin (i.e., where the pin is asserted when it is at a HIGH level, generally either 3.3 V or 5 V), or a *rising-edge*

Pin state at reset			Mode Selected
$\overline{\text{DTR}}$	$\overline{\text{RTS}}$	SOUT	
0	0	X	Internal CGA
1	0	0	Local bus, 1 × clock
1	0	1	Local bus, 2 × clock
X	1	X	Maximum ISA

0 = pull-down resistor (to GND)
1 = pull-up resistor (to VCC5)
X = no resistor

Table 3.1: Selection of the Élan operating mode

Pin Name	Type[a]	Function
AEN	O	DMA address enable (DMA cycle)
TC	O	DMA terminal count
SYSCLK	O	System clock [b]
PIRQ1	I	Programmable interrupt request 1
DRQ2	I	DMA channel 2 request
X1OUT / BAUDOUT	O	Video clock or serial port clock
$\overline{\text{MCS16}}$	I	Memory device is 16-bit[c]
$\overline{\text{IOCS16}}$	I	I/O device is 16-bit[c]
$\overline{\text{SBHE}}$	O	Byte high enable[c]
IRQ14	I	Interrupt request 14[c]

Table 3.2: ISA bus support, common subset

pin (i.e., where the pin is asserted on the rising edge, from LOW to HIGH, of a pulse).

- A name like $\overline{\text{PIN}}$ is the opposite: it indicates an *active-low* pin, or one that is asserted on the *falling-edge* HIGH to LOW of a signal.
- A name like PIN[3:0] is *shorthand* for pins individually named PIN0, PIN1, PIN2 and PIN3.
- All pins are with reference to the microprocessor, i.e., "Output" means output *from* the processor to external peripherals.

The following is a description of the pins listed in Table 3.2. Much of this information is from pages 39 to 49 of the *Data Book* [2], although some critical information is not listed in *any* part of the supplied documentation...

These modes are summarised in Table 3.3; see also pages 9–15 of the *Data Book* [2].

3.0.2 Other Remarks

One of the additional features of the internal video controller is that it may be programmed to appear in the I/O location for a CGA controller (3D4h–3DAh) or in the I/O location for a Hercules Graphics Adapter (3B4h–3BFh).

Mode	Description
Full speed	All clocks are at fastest speed and all peripherals are powered up.
Low speed	CPU clock is reduced to a lower speed; all other clocks are at full speed.
Doze	CPU, system and DMA clocks, as well as the high-speed phase-locked loop, are stopped.
Sleep	Additional clocks and peripherals are stopped (depending on the programmed settings), as is the serial port controller (UART).
Suspend	A special BIOS routine is invoked to save the system state, then virtually all of the system is powered down. The phase-locked loops are turned off.
Off	A powered-down mode in which PGP2 and PGP3 are set to a predefined state. Memory refresh is still active. No activity can cause the processor to leave this state, except for a power-on reset.

Table 3.3: Power Management Unit operating modes

Chapter 4

Sample Mathematics and Text

4.1 In-line and Displayed Mathematics

The expression $\sum_{i=1}^{\infty} a_i$ is in-line mathematics, while the numbered equation

$$\sum_{i=1}^{\infty} a_i \tag{4.1}$$

is displayed and automatically numbered as equation 4.1.

Let H be a Hilbert space, C be a closed bounded convex subset of H, T a nonexpansive self map of C. Suppose that as $n \to \infty$, $a_{n,k} \to 0$ for each k, and $\gamma_n = \sum_{k=0}^{\infty} (a_{n,k+1} - a_{n,k})^+ \to 0$. Then for each x in C, $A_n x = \sum_{k=0}^{\infty} a_{n,k} T^k x$ converges weakly to a fixed point of T [**?**].

Two sets of LaTeX parameters govern mathematical displays.[1] The spacing above and below a display depends on whether the lines above or below are short or long, as shown in the following examples.

A short line above:

$$x^2 + y^2 = z^2$$

and a short line below.

A long line above may depend on your margins

$$\sin^2 \theta + \cos^2 \theta = 1$$

as will a long line below. This line is long enough to illustrate the spacing for mathematical displays, regardless of the margins.

[1] LaTeX automatically selects the spacing depending on the surrounding line lengths.

4.2 Mathematics in Section Heads $\int_\alpha^\beta \ln t dt$

Mathematics can appear in section heads. Note that mathematics in section heads may cause difficulties in typesetting styles with running headers or table of contents entries.

4.3 Theorems, Lemmata, and Other Theorem-like Environments

A number of theorem-like environments is available. The following lemma is a well-known fact on differentiation of asymptotic expansions of analytic functions.

Lemma 1 *Let $f(z)$ be an analytic function in $\mathbb{C}_+$. If $f(z)$ admits the representation*

$$f(z) = a_0 + \frac{a_1}{z} + o\left(\frac{1}{z}\right),$$

for $z \to \infty$ inside a cone $\Gamma_\varepsilon = \{z \in \mathbb{C}_+ : 0 < \varepsilon \le \arg z \le \pi - \varepsilon\}$ then

$$a_1 = -\lim z^2 f'(z),\ z \to \infty,\ z \in \Gamma_\varepsilon. \tag{4.2}$$

Proof. Change z for $1/z$. Then $\Gamma_\varepsilon \to \overline{\Gamma}_\varepsilon = \{z \in \mathbb{C}_- : \overline{z} \in \Gamma_\varepsilon\}$ and

$$f(1/z) = a_0 + a_1 z + o(z). \tag{4.3}$$

Fix $z \in \overline{\Gamma}_\varepsilon$, and let $C_r(z) = \{\lambda \in \mathbb{C}_- : |\lambda - z| = r\}$ be a circle with radius $r = |z| \sin\varepsilon/2$. It follows from (4.3) that

$$\frac{1}{2\pi i}\int_{C_r(z)} \frac{f(\lambda)\,d\lambda}{(\lambda - z)^2} = \sum_{m=0}^{1} a_m \frac{1}{2\pi i}\int_{C_r(z)} \frac{(\lambda - z_0)^m\,d\lambda}{(\lambda - z)^2} + R(z), \tag{4.4}$$

where for the remainder $R(z)$ we have

$$\begin{aligned} |R(z)| &\le r^{-1} \max_{\lambda \in C_r(z)} o(|z|) = r^{-1} \max_{\lambda \in C_r(z)} |\lambda| \cdot O(|z| + r) \\ &= \frac{|z| + r}{r} \cdot O(|z| + r) = \frac{1 + \sin\varepsilon}{\sin\varepsilon} \cdot O(|z|). \end{aligned}$$

Therefore $R(z) \to 0$ as $z \to \infty$, $z \in \overline{\Gamma}_{\varepsilon/2}$, and hence by the Cauchy theorem (4.4) implies

$$\frac{d}{dz} f(1/z) = a_1 + R(z) \to a_1, \text{ as } z \to \infty,\ z \in \overline{\Gamma}_{\varepsilon/2},$$

that implies (4.2) by substituting $1/z$ back for z. ■

Chapter 5

Features of this Shell

5.1 Section Headings

Use the Section tag for major sections, and the Subsection tag for subsections.

5.1.1 Subsection

This is some harmless text under a subsection.

Subsubsection

This is some harmless text under a subsubsection.

Subsubsubsection This is some harmless text under a subsubsubsection.

Subsubsubsubsection This is some harmless text under a subsubsubsubsection.

5.2 Tags

You can apply the logical markup tag *Emphasized*.

You can apply the visual markup tags **Bold**, *Italics*, Roman, Sans Serif, *Slanted*, Small Caps, and `Typewriter`.

You can apply the special, mathematics only, tags $\mathfrak{fraktur}$, $\mathbb{BLACKBOARD\ BOLD}$, and $\mathcal{CALLIGRAPHIC}$. Note that blackboard bold and calligraphic are correct only when applied to uppercase letters A through Z.

You can apply the size tags tiny, scriptsize, footnotesize, small, normalsize, large, Large, LARGE, huge and Huge.

This is a Body Math paragraph. Each time you press the Enter key, Scientific WorkPlace switches to mathematics mode. This is convenient for carrying out "scratchpad" computations.

Following is a group of paragraphs marked as Body Quote. This environment is appropriate for a short quotation or a sequence of short quotations.

> The only thing we have to fear is fear itself. *Franklin D. Roosevelt,* Mar. 4, 1933
>
> Ask not what your country can do for you; ask what you can do for your country. *John F. Kennedy,* Jan. 20. 1961
>
> There is nothing wrong with America that cannot be cured by what is right with America. *William J. "Bill" Clinton,* Jan. 21, 1993

5.3 List Environments

You can create numbered, bulleted, and description lists using the tag popup at the bottom left of the screen.

1. List item 1
2. List item 2
   (a) A list item under a list item.
   The typeset style for this level is different than the screen style. The screen shows a lower case alphabetic character followed by a period while the typeset style uses a lower case alphabetic character surrounded by parentheses.
   (b) Just another list item under a list item.
      i. Third level list item under a list item.
         A. Fourth and final level of list items allowed.

- Bullet item 1
- Bullet item 2
  – Second level bullet item.
    ∗ Third level bullet item.
      · Fourth (and final) level bullet item.

Description List Each description list item has a term followed by the description of that term. Double click the term box to enter the term, or to change it.

Bunyip Mythical beast of Australian Aboriginal legends.

Chapter 6

Conclusions

In conclusion, this project has been *very* challenging, but very interesting as well. Although we were not able to proceed with the implementation, we are more than reasonably satisfied that the design is sound and thorough. If the project is continued in the next year, the Élan Portable Computer will eventually emerge as a symbol of today's modern computing.

Bibliography

[1] "*Development of a Range of PCMCIA Type III Instrumentation Modules for Clinical Measurement, based on the PoqetPad Plus Pen-based Computer*", Branko Celler, Biomedical Systems Laboratory, University of NSW, Australia, 23rd June 1993.

[2] "*Élan Am386SC300 Microprocessor Data Sheet*", Mobile Computing Products Division of Advanced Micro Devices, Inc.

[3] "*Élan Am386SC300 Microprocessor Programmers' Reference Manual*", Mobile Computing Products Division of Advanced Micro Devices, Inc.

[4] "*PC Interrupt List*" Ralf Brown, Release 47, August 1995. Available as `ftp://ftp.cs.cmu.edu/afs/cs.cmu.edu/user/ralf/pub/inter47*.zip`

[5] "*PCMCIA Standards*", "*PC Card Standard 2.1*", "*Socket Services Specification 2.1*", "*Card Services Specification 2.1*", "*PC Card ATA Specification 1.02*", "*AIMS Specification 1.01*", "*Recommended Extensions 1.0*", Personal Computer Memory Card International Association, July 1993.

Appendix A

Élan Computer Schematics

The following pages show the final Élan Portable Computer schematics. The actual schematics are in the following order:

1. System Block Diagram
2. Élan Microprocessor
3. Miscellaneous
4. System Memory
5. Display Interface
6. PCMCIA Buffers
7. PCMCIA Connectors
8. Parallel Port
9. Serial Port
10. Keyboard Connector
11. Expansion Connector
12. DC/DC Power
13. Power Switching