UNIVERSITY OF WATERLOO
Faculty of Engineering

DESIGN OF AN ARM BASED EMBEDDED SYSTEM FOR IN VEHICLE INFOTAINMENT APPLICATIONS

Self Study

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May 8, 2013

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May 8, 2013

Dr. A. Vannelli, Chair
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Waterloo, ON N2L 3G1

Dear Dr. A. Vannelli:

Re: Submission of my work term report.

I have just completed my first work term, following my 4A term. Please find enclosed my first work term report entitled: "Design of an ARM Based Embedded System for In Vehicle Infotainment Applications" for the Software Widgets group at University of Waterloo Alternative Fuels Team. My departmental manager was Rube Goldberg and our group was primarily involved with writing and testing of labour-saving software.

This report focuses on using the unofficial work report documentation class, `uw-wkrpt.cls`, and provides a sample document on which to base your own E&CE report. It is written for fellow classmates who have some working knowledge of LaTeX and TeX.

I have had no direct assistance from anyone. I do wish to thank Leslie Lamport and Donald E. Knuth for inventing such marvellous typesetting tools.

I hereby confirm that I have received no further help, other than what is mentioned above, in writing this report. I also confirm that this report has not been previously submitted for academic credit at this or any other academic institution.

Yours sincerely,

Eric Evenchick, 20339729

Contributions

I worked in the Software Widgets group, which consisted of 2 animators, 6 cartoon characters, 3 software developers and 2 testers. We were to design labour-saving computerised devices, for internal consumption. Being self-sufficient, we were involved in the research, design, implementation and testing for all our software widgets.

Over the course of four months, we created three of these widgets. I was responsible for writing software. I looked at the design specifications, and wrote test-suites and software to meet them. The testers would add to my rudimentary test suites, and report errors to me whenever a test failed.

From the experiences in creating documentation for my programs, I acquired expertise in LaTeX, which I found to be an excellent typesetting system. Armed with this knowledge, I was able to use this wonderful document class which eases the typesetting of work reports, and follows the E&CE guidelines [**?**] and the Co-op student manual [**?**].

From this sample work report, anyone can create a report that looks good, and is easy to read. Acme will benefit, because they now have a document class to provide to future co-op students, thereby reducing the time they spend on formatting reports.

Summary

This document describes the use of the `uw-wkrpt.cls` document class in creating work reports. Written in the LaTeX macro language, this document class is designed to typeset documents that conform to the University of Waterloo co-op student manual [**?**] requirements. The class has been generalised from the earlier `uw-ece-workreport` document class so that it may be used by students of any faculty. This particular report serves as an example for the University of Waterloo, Electrical and Computer Engineering work report guidelines [**?**]. Other example reports for other faculties are included with this package.

I also argue the advantages of using this document class over other more traditional ways of generating a report. I hope to convince the reader that using this technology is superior to writing the document in a WYSIWYG word processor.

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1 Introduction

This pretend report, written by an imaginary student, exists because I got sick of writing a report, and having to check my document over and over again for simple formatting errors. Now, I thought that a work report is useful due to its content; not because my Table of Contents did not have dot leading for page numbers. So, I turned to LaTeX as my saviour.

I, Simon Law, implemented my first work report in LaTeX in early December 2001. Unfortunately, I was feeling my way around and didn't implement my scheme very well. After learning how to create a document class, I have created this document class, which I now offer to you.

If you find a problem with this document class, or have suggestions to offer; please drop me a note. As well, patches and fixes are always welcome. You can find information on how to contact me in Appendix B.

2 Advantages

Using this class has a number of great advantages:

- You no longer have to worry about missing information. If you fill in all the information at the top of this document, your title page and all the important fields in your Letter of Submittal will be properly filled.
- Your references will be all correct. Your Table of Contents, List of Figure and List of Tables will be automatically generated. Citations and references will be done properly, and your bibliography will be automatically formatted in IEEE style.
- You can cross-reference other sections trivially, (*e.g.* One can find the introduction at §1, p.1).
- You no longer have to worry if your document looks good. You can ask the computer to worry about formatting and styles, without having to mess around with differing fonts (roman, sans-serif, `fixed`) or with differing styles (normal, **bold**, *italics*, underlined, *slanted*, SMALL-CAPS). You can concentrate on what you write, and are assured that your text will look great.

- Since the computer formats things for you, you can re-arrange sections trivially. Or you can define new styles to make global changes across the entire document.
- Math output is by far superior in LaTeX. You can write things like $\sum_{i=1}^{\infty} \frac{1}{x}$ or:

$$\int_0^{\infty} \delta(x)\, dx = u(x) + C$$

3 What are TeX and LaTeX?

TeX was designed and implemented by Donald E. Knuth, the famous author of *The art of computer programming* [**?**]. Knuth, shown in Figure 1, decided to create a typesetting language that would handle mathematical output beautifully. This was motivated by the fact that publishers would mangle the formulæof his *magnum opus*. Now, TeX is used by the mathematical, academic, and documentation communities to typeset beautiful documents. The TeX language is designed to provide precise control for text layout.

Figure 1: Donald E. Knuth, the creator of TeX. [**?**]

LaTeX was designed and implemented by Leslie Lamport while he worked at Digital Equipment Corp. LaTeX was his attempt to create a documentation system that was easier to use than TeX. In fact, LaTeX is frequently called a "document processor" as opposed to a "word processor," because it abstracts away the hard details of formatting and typesetting, allowing the author to use a semantic language to describe the output.

4 Learning LaTeX

Unfortunately, using LaTeX is not quite as intuitive as using a word processor. However, if you invest the time in learning it, the payoffs can be great. Unlike a word processor, LaTeX is written like a markup language, which means you use macros[1] to tell TeX how to typeset your document. This means that you can edit your documents in any old text editor, be it as crude as Microsoft Notepad, or something more heavy-duty like vi[2] [**?**] or Emacs [**?**].

[1] The SGML/HTML/XML world calls these tags.

[2] Try Vim [**?**] which is Vi Improved.

There are some good on-line books if you wish to learn LaTeX without having to shell out any hard earned money[3]. The standard reference is *A not so short introduction to LaTeX 2ε* [**?**]. As well, *A simplified introduction to LaTeX* [**?**] is also an excellent reference.

The fundamental resource for learning LaTeX has to be *LaTeX: a document preparation system* [**?**] which is written by Leslie Lamport, the creator of LaTeX. Also of note is *The LaTeX companion* which is the next step up, if you want to become a power user.

How does one get a copy of LaTeX? On Unix systems, the teTeX [**?**] distribution is popular. For Windows users, MiKTeX [**?**] is the distribution of choice. Follow each packages installation instructions for best results[4].

You will probably want a PostScript interpreter to create PDFs or to send PostScript output files to the printer. You can use Adobe Distiller, which you can purchase from Adobe Systems Inc.; or you could download a copy of Ghostscript[5] [**?**].

4.1 How LaTeX works

You create text files that include LaTeX commands to generate the final document. You can consider it similar to writing source code that is compiled to generate the typeset output.

Figure 2 shows the control flow that a typical document follows in order to generate PDF output.

Since LaTeX is a programming languages, it does have some special characters. Specifically, the reserved characters are: `#`, `$`, `%`, `&`, `_`, `{`, `}`, `~`, `^`, `\`. See Table 1 to see them in print.

5 Source

This document, and the documents it uses are available under the GNU General Public License (GPL), reproduced in Appendix C. Note that you do not need to accept the GNU GPL to use this document, or to use the document class. I highly

[3] You are earning money during this work term, right?

[4] On a Debian GNU/Linux system, invoke `aptitude install tetex-bin tetex-extra`

[5] Again, on Debian GNU/Linux, run `aptitude install gs`

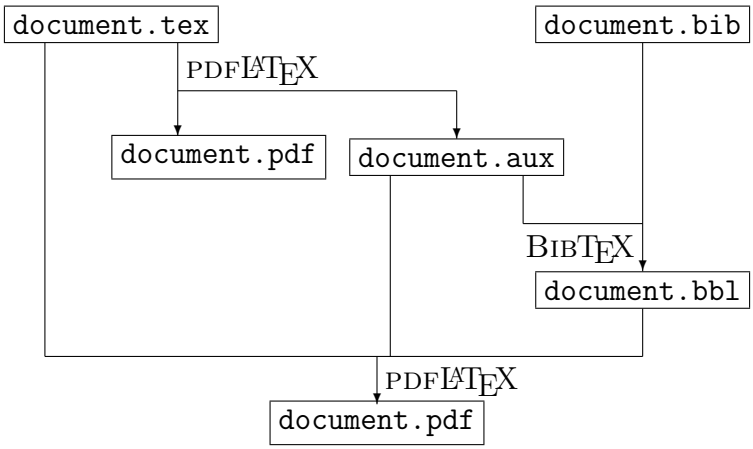

Figure 2: Control flow of a LaTeX compilation.

Table 1: Typesetting special characters.

Name	**Symbol**
octothorpe	#
dollar sign	$
percent sign	%
ampersand	&
underscore	_
left brace	{
right brace	}
tilde	~
circumflex	^
backslash	\
inverted exclaimation	¡
inverted question	¿
less than	<
greater than	>

recommend that you read the GPL so you understand your rights and privledges.

You can find the most recent version of these documents on my website in a tarball at: http://www.eng.uwaterloo.ca/~sfllaw/programs/uw-wkrpt/. Download the latest version, unpack it, and read the enclosed `README` text file.

6 To do

There are still some things I want to do, to improve this example document:

1. Demonstrate the use of GlossTEX to create glossaries.
2. Demonstrate the creation of an index.
3. Look into `ieeetran.bst`.
4. Fix all the bugs listed in Appendix A.

Examples that illustrate this usage are most definitely welcome. Please provide a patch against this document.

Appendix A Bugs

Currently, there are some known problems with this document class.

- It is not officially supported or acknowledged by the E&CE department.
- Not all users have converted to using a typesetting language, and insist on using word processors.
- It does not bring world peace.

Fixes for these bugs are most certainly welcome. Please provide a patch against the document class document.

Appendix B Colophon

This sample document was written by Simon Law, a third-year Computer Engineering student at the University of Waterloo, in Waterloo, ON, CA. When he is not programming, he can be found reading or sleeping; both of which are his favourite activities.[6]

The best way to contact him is by e-mail, at sfllaw@uwaterloo.ca.

This document was implemented using the `ece` variant of the `uw-wkrpt` document class. The document class, and the surrounding documentation is implemented using the LaTeX 2_ε macro package which is built on the TeX typesetting system. The documents were generated by the web2c implementation of TeX, found in the teTeX distribution. The typeface used is Computer Modern.

The entire system was written in the Vim text editor. The operating system used was Debian GNU/Linux which ran on an IBM ThinkPad A20m. This stalwart companion allowed him to work on this report periodically, even during his "off" time up at the cottage.

Appendix C GNU General Public License

[6] OK, so I don't have a life yet. I'm working on it.

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MA  02111-1307  USA
```

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```
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This is free software, and you are welcome to redistribute it
under certain conditions; type ‘show c’ for details.
```

The hypothetical commands ‘show w’ and ‘show c’ should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than ‘show w’ and ‘show c’; they could even be mouse-clicks or menu items–whatever suits your program.

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```
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