

Design (E) 314

Technical Report

Digital Multimeter and Signal Generator

Author: Student Number:

Luke Kingwill 20725728

April 1st 2022

**Plagiaatverklaring / Plagiarism Declaration**

1. Plagiaat is die oorneem en gebruik van die idees, materiaal en ander intellektuele eiendom van ander persone asof dit jou eie werk is.

*Plagiarism is the use of ideas, material and other intellectual property of another’s work and to present is as my own.*

1. Ek erken dat die pleeg van plagiaat ’n strafbare oortreding is aangesien dit ’n vorm van diefstal is.

*I agree that plagiarism is a punishable offence because it constitutes theft.*

1. Ek verstaan ook dat direkte vertalings plagiaat is.

*I also understand that direct translations are plagiarism.*

1. Dienooreenkomstig is alle aanhalings en bydraes vanuit enige bron (ingesluit die internet) volledig verwys (erken). Ek erken dat die woordelikse aanhaal van teks sonder aanhalingstekens (selfs al word die bron volledig erken) plagiaat is.

*Accordingly all quotations and contributions from any source whatsoever (including the internet) have been cited fully. I understand that the reproduction of text without quotation marks (even when the source is cited) is plagiarism.*

1. Ek verklaar dat die werk in hierdie skryfstuk vervat, behalwe waar anders aangedui, my eie oorspronklike werk is en dat ek dit nie vantevore in die geheel of gedeeltelik ingehandig het vir bepunting in hierdie module/werkstuk of ’n ander module/werkstuk nie.

*I declare that the work contained in this assignment, except where otherwise stated, is my original work and that I have not previously (in its entirety or in part) submitted it for grading in this module/assignment or another module/assignment.*

|  |  |  |
| --- | --- | --- |
|  |  | 20725728 |
| Handtekening / *Signature* |  | Studentenommer / *Student number* |
| LEV Kingwill |  | 01-04-2022 |
| Voorletters en van / *Initials and surname* |  | Datum / *Date* |

Abstract

This will be where you write your abstract, eg:

New York (NY), central processing units (CPUs) and United Nations (UN) are abbreviations whereas The number of angels per unit area (), The number of angels per needle point () and The area of the needle point () are part of the symbols. Repeat after me: NY, CPUs and UN are abbreviations whereas , and are part of the symbols.

Contents

[1 Introduction 4](#_Toc966942)

[2 System description 4](#_Toc966943)

[3 Hardware design and implementation 4](#_Toc966944)

[3.1 Power supply 4](#_Toc966945)

[3.2 UART communications 4](#_Toc966946)

[3.3 etc. 4](#_Toc966947)

[4 Software design and implementation 4](#_Toc966948)

[4.1 LCD driver 4](#_Toc966949)

[4.2 Timers and timing… etc 4](#_Toc966950)

[5 Measurements and Results 5](#_Toc966951)

[6 Conclusions 5](#_Toc966952)

[6.1 Chemistry 5](#_Toc966953)

[6.1.1 Code efficiency 5](#_Toc966954)

[6.1.2 Notes on references 6](#_Toc966955)

List of Figures

1. [Your figure caption 5](#_Toc510783785)

List of Figures

1. [Your table caption 4](#_Toc510783786)

List of Abbreviations

**CPU** central processing unit

**NY** New York

**UN** United Nations

List of Symbols

The number of angels per unit area

The area of the needle point

The number of angels per needle point

# Introduction

Here you describe your overall project briefly, context, requirements, aims etc. For more details on the marks that will be awarded per section see the, *Design (E) 314 - 2022 Report Marking Scheme* document.

# System description

Here you will describe your system, eg: The system diagram is shown in Figure 1. The power supply provides regulated 5V power to the STM32 board, while the 3.3V output of the power supply is used for…

An example table is shown in Table 1.

Table 1: Your table caption

|  |  |
| --- | --- |
| Component | Operating Voltage |
| STM32 module | 2.0 V - 5.5 V |
| PC1601 – LCD Module | 3.0 V - 5.0 V |

# Hardware design and implementation

Here you will describe your design motivations, calculations and implementation, also using equations where applicable, eg: A player faces a dynamic optimization problem of 5 periods. Let denote the player’s action in period *t*,

|  |  |
| --- | --- |
|  |  |

## Power supply

This section describes a sub-circuit/component of your design. Circuit diagram (schematic) or description, with relevant requirements, assumptions, design details, motivations and calculations. (to two significant digits after the decimal point, or more accurately where needed).

## LCD display

## etc.

# Software design and implementation

Discuss top-level software design and implementation, using design tools, like flow diagrams and timing diagram, where needed.

## LCD driver

For each driver code segment discuss requirements, design, assumptions, describe/explain implemented code functionality (do not give a code listing!). Use applicable diagrams/charts to communicate detail eg: The flowchart of the LCD driver is shown in Figure 1.

## Timers and timing… etc

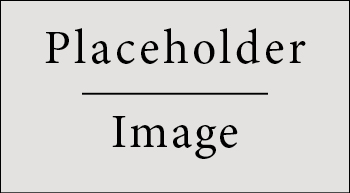


Figure 1: Your figure caption

# Measurements and Results

Describe your measurements and results to determine where your system meets, or don’t meet the requirements/specifications. A fake discussion follows as partial example:

The accepted value (periodic table) is 24:3 g mol-1 [1]. The percentage discrepancy between the accepted value and the result obtained here is 1.3%. Because only a single measurement was made, it is not possible to calculate an estimated standard deviation.

The most obvious source of experimental uncertainty is the limited precision of the balance. Other potential sources of experimental uncertainty are: the reaction might not be complete; if not enough time was allowed for total oxidation, less than complete oxidation of the magnesium might have, in part, reacted with nitrogen in the air (incorrect reaction); the magnesium oxide might have absorbed water from the air, and thus weigh “too much”. Because the result obtained is close to the accepted value it is possible that some of these experimental uncertainties have fortuitously cancelled one another.

# Conclusions

Use experimental results, design limitations and system performance, explain your conclusions drawn.

## Chemistry

1. The *atomic weight of an element* is the relative weight of one of its atoms compared to C-12 with a weight of 12.0000000…, hydrogen with a weight of 1.008, to oxygen with a weight of 16.00. Atomic weight is also the average weight of all the atoms of that element assuming:
   * we are working with nature
   * all measurements are calibrated
2. The *units of atomic weight* are two-fold, with an identical numerical value. They are g/mole of atoms (or just g/mol) or amu/atom.
3. *Percentage discrepancy* between an accepted (literature) value and an experimental value is

|  |  |
| --- | --- |
|  |  |

### Code efficiency

A fake discussion follows as example:

The code is not very efficient if it takes 50s to write “Hello World” over the UART. Future designs should focus on improving the code listed in Listing 1, to execute in less than 20ms.

Listing 1: Useless code

|  |  |
| --- | --- |
| 1  2  3  4  5  6  7 | **#include** <stdio.h>  **void** main (**void**)  {  //This will probably not work.  a = a + 1;  b = bear;  } |

### Notes on references

Don’t forget to reference ALL REFERENCES in text using IEEE Documentation Style [2].

All applicable documents should be in references list, specifically datasheets, like the 7805 datasheet [3] and FT230X datasheet [4], used as references for designs, explanations of device operation etc.

**References**

1. J. M. Smith and A. B. Jones, *Chemistry*, 7th ed. Publisher, 2012.
2. Graffox, D. (2009, Sep). IEEE Citation Reference. [Online] Available: https://www.ieee.org/documents/ieeecitationref.pdf.
3. *µA7800 SERIES POSITIVE-VOLTAGE REGULATORS,*  7805 datasheet, Texas Instruments, Nov. 2003
4. *FT230X USB to Basic UART IC*, FT230X Datasheet, Future Technology Devices International Ltd, 2016.