

Design (E) 314

Technical Report

PV System Efficiency Monitor

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[23/04/2024]

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Abstract

The adoption of solar photovoltaic (PV) power in South Africa has surged in recent years due to improved ROI driven by reduced costs of PV modules, inverters, and batteries. However, the efficiency of PV systems can be compromised by dirty or soiled PV modules, leading to financial losses. This project aims to address this issue by developing a multi-functional light source that helps PV system owners assess the percentage of reduced power output due to dust/soiling. By providing a clear indicator of when cleaning is necessary, this device will enable users to maximize their PV system's performance and ROI. This report outlines the design, implementation, and testing of the device, along with recommendations for further improvements and real-world applications.

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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 - 2023 Report Marking Scheme* document.

Please note that this is a template, please see the PDD Chapter 7 for the full details of what sub-sections need to be covered and where marks will be awarded. Please reference your work properly if you obtained information from any external sources.

# 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*,

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

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).

## Hardware Block Diagram and Description of Interaction

## Power Supply

## LEDs (Debug)

## Buttons

## Etc …

# Software design and implementation

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

## Software Block diagram and description of interaction

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.

## Button bounce handling

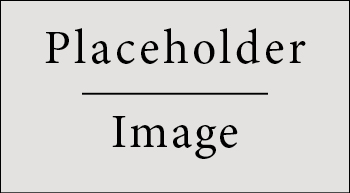


Figure 1: Your figure caption

## UART communications (protocol and timing)

## ADC, Setup, Calibration and processing

## Etc. …

# 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.