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E344 Assignment 3

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Report submitted in partial fulfilment of the requirements of the module Design (E) 344 for the degree Baccalaureus in Engineering in the Department of Electrical and Electronic Engineering at Stellenbosch University.

August 30, 2021

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23142251 Studentenommer / *Student number*	 Handtekening / *Signature*
T. Islam Voorletters en van / *Initials and surname*	August 30, 2021 Datum / *Date*

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Nomenclature

Update this list to make it applicable to your project.

Variables and functions

$p(x)$	Probability density function with respect to variable x.
$P(A)$	Probability of event A occurring.
ε	The Bayes error.
ε_u	The Bhattacharyya bound.
B	The Bhattacharyya distance.
s	An HMM state. A subscript is used to refer to a particular state, e.g. s_i refers to the i^{th} state of an HMM.
$\mathbf{S}$	A set of HMM states.
$\mathbf{F}$	A set of frames.
$\mathbf{o}_f$	Observation (feature) vector associated with frame f.
$\gamma_s(\mathbf{o}_f)$	A posteriori probability of the observation vector $\mathbf{o}_f$ being generated by HMM state s.
μ	Statistical mean vector.
Σ	Statistical covariance matrix.
$L(\mathbf{S})$	Log likelihood of the set of HMM states $\mathbf{S}$ generating the training set observation vectors assigned to the states in that set.
$\mathcal{N}(\mathbf{x}\|\mu, \Sigma)$	Multivariate Gaussian PDF with mean μ and covariance matrix Σ.
a_{ij}	The probability of a transition from HMM state s_i to state s_j.
N	Total number of frames or number of tokens, depending on the context.
D	Number of deletion errors.
I	Number of insertion errors.
S	Number of substitution errors.

Acronyms and abbreviations

Update this list to make it applicable to your project.

AE	Afrikaans English
AID	accent identification
ASR	automatic speech recognition
AST	African Speech Technology
CE	Cape Flats English
DCD	dialect-context-dependent
DNN	deep neural network
G2P	grapheme-to-phoneme
GMM	Gaussian mixture model
HMM	hidden Markov model
HTK	Hidden Markov Model Toolkit
IE	Indian South African English
IPA	International Phonetic Alphabet
LM	language model
LMS	language model scaling factor
MFCC	Mel-frequency cepstral coefficient
MLLR	maximum likelihood linear regression
OOV	out-of-vocabulary
PD	pronunciation dictionary
PDF	probability density function
SAE	South African English
SAMPA	Speech Assessment Methods Phonetic Alphabet

Chapter 1

Fuse

1.1. Literature

The fuse is chosen based on the maximum input current of the regulator which is 1A. The fuse will disconnect if more than 1A current is supplied and prevent the regulator from blowing up. This section is aimed at someone at your level of knowledge (the median E&E third year student).

1.2. Design

The resistor design choice was calculated according the equation Vth= Vref*(1+Rin/Rh) where Vth=2.54V and Vref=2.5V was given and Resistor vales were chosen accordingly which are R6=150 ohms and R8=9.98 kilo-ohms.The resistor R4 and R5 add up to approximately 10k ohms and the ration is kept at 1.144, R4=11.86 kilo-ohms R5= 8.18 kilo-ohms.

Chapter 2

Undervoltage battery protection

This chapter answers the question: "Did the student follow a systematic approach to design the sought solution?". You therefore need to follow a systematic/logic path, and did you clearly communicate it.

2.1. Literature

Here you can include stuff you learnt that you will use in the design - e.g. operational amplifiers as comparators, hysteresis, rail-to-rail comparators. If you feel there was nothing you had to learn to do this, feel free to leave this section out.

2.2. Overview

The undervoltage circuit is an electronic circuit used to turn off the power of an electronic device in the event of the voltage dropping below the operational value which can cause the transistor to break. The circuit requires a comperator which will trigger the PMNOS switch to go off as soon as the voltage goes below threshold.

2.3. 5V rail

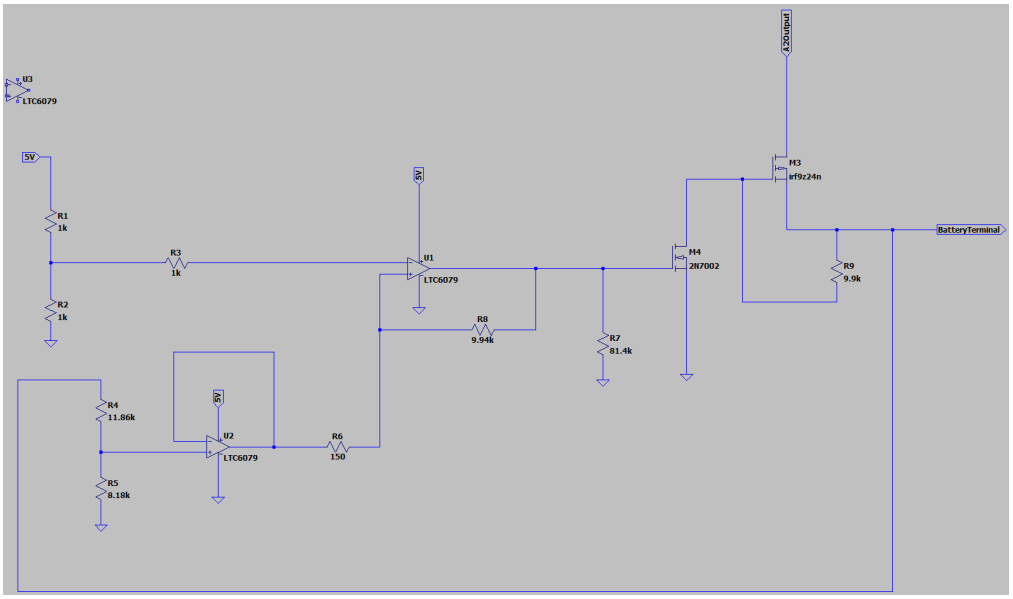
The regulator LM2940x is chosen instead of LM7805 because the former has a minimum input voltage of 6.25V which is less the the input voltage of 7V of the latter.

2.4. High-side switch

The drain of the PMOS is connected to the 10K ohms resistor to measure the voltage across the resistor. The PMOS acts as a switch to stop discharging of the battery in case of undervoltage. The PMOS will help the current flow in the direction of the battery as long as it's charging and current will flow in the opposite direction when the battery is discharging until undervoltage.

2.5. Voltage monitoring with hysteresis design

The 5V voltage coming from the regulator which has been supplied by the battery initially goes through voltage regulation and a fuse to monitor the current so that it doesn't go over



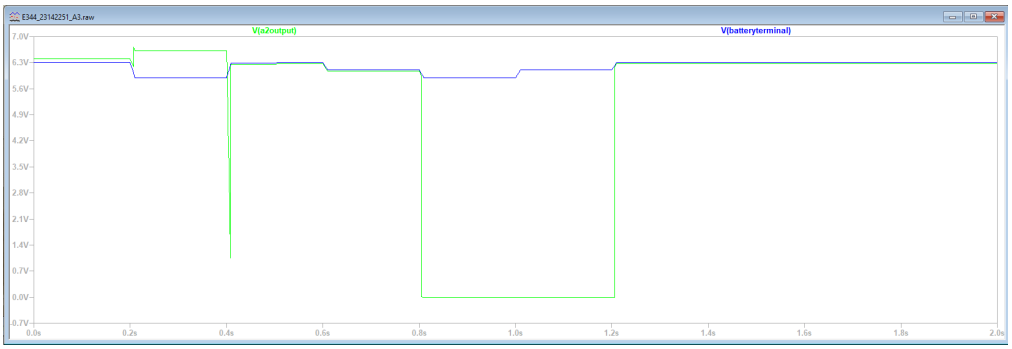
(a) Circuit

the maximum input of the regulator which is 1A. 5V voltage is split into two 2.5V voltage via two equal resistors in series which is then fed to the negative terminal of the op-amp. The resistor design choice was calculated according the equation Vth= Vref*(1+Rin/Rh) where Vth=2.54V and Vref=2.5V was given and Resistor vales were chosen accordingly. The resistor R4 and R5 add up to approximately 10k ohms and the ration is kept at 1.144. The bigger the resistor values are the less current is allowed to pass through. R1 and R2 have each 1 kilo ohms which split V into half and also limits a lot of current.

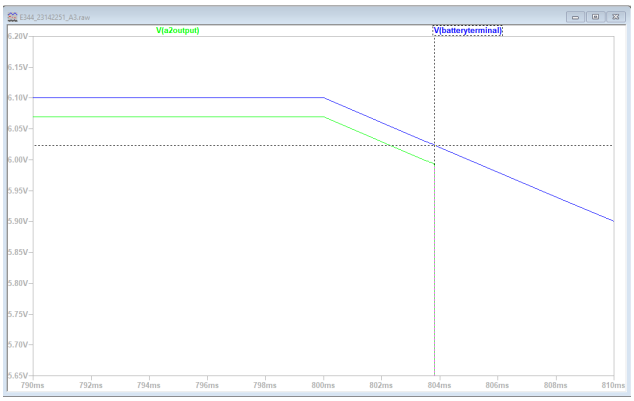
2.6. Circuit diagram

2.7. Results

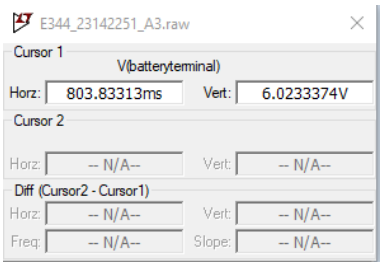
H



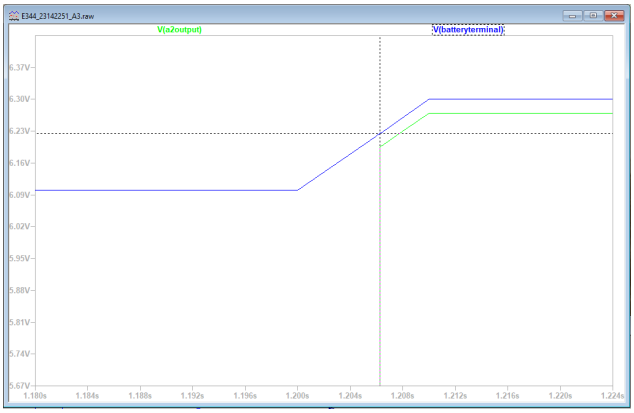
(b) Fig1



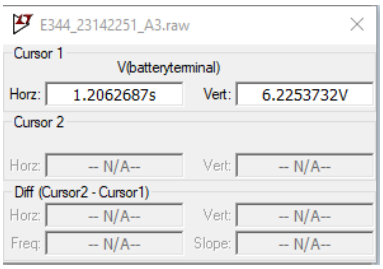
(c) Fig2



(d) Fig3



(e) Fig4



(f) Fig4

Bibliography

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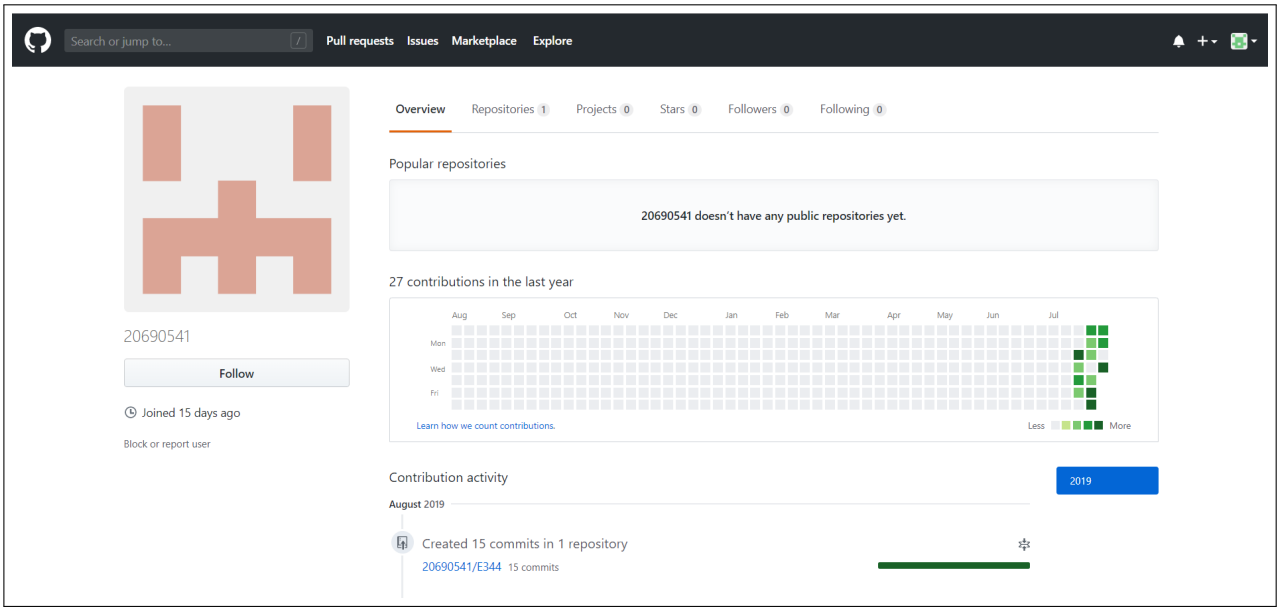
Appendix A

GitHub Activity Heatmap

Take a screenshot of your github version control activity heatmap and insert here.



Appendix B

Stuff you want to include

remove this!!

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