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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.

October 10, 2020



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

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I also understand that direct translations are plagiarism.

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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.

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E. Stewdent	October 10, 2020
Voorletters en van / <i>Initials and surname</i>	Datum / <i>Date</i>

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Nomenclature

update these

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

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

System design

1.1. System overview

Here you insert a block diagram of your voltage regulation and signal conditioning system, including the temperature sensor and heart beat subsystems. Try to explain **what** configuration you chose and **why**. There is no need to specify the capacitor and resistor values here, but you want to capture the higher-level functional arrangement you have opted for. The diagram ties together the other chapters in this and the previous report and helps the reader understand how you have connected the different functional blocks together to produce the outputs. For example, a block could be “Differential amplifier” or “level shifting op-amp” or “Low-pass filter” or “Linear regulator” and the like. Please use a drawing application, such as draw.io, MS Visio, or Power Point and export it as a PDF, so it looks good. If you feel brave, draw them in L^AT_EX using Inkscape/TikZ. Fig. 1.1 is a bad example that is completely irrelevant and just holds space for your beautiful system diagram [1]. Remember to state what your power budget is, based on Assignment 1 and 2’s results.

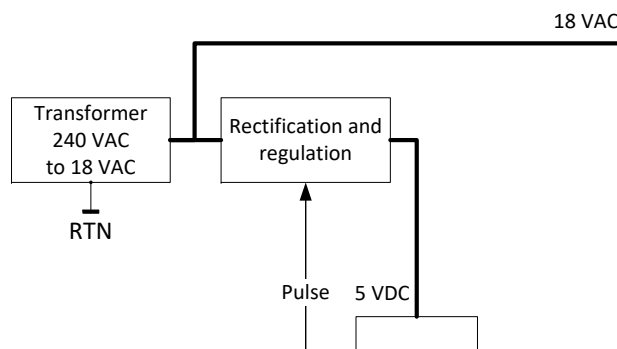


Figure 1.1: System diagram

Chapter 2

Voltage regulation

2.1. Introduction

2.2. Design

NB: do not confuse empirical design (trial and error) with proper design.

2.3. Results

2.4. Summary

Chapter 3

Temperature sensor conditioning circuit

3.1. Intro

3.2. Design

3.3. Results

3.4. Summary

Chapter 4

Heart rate sensor

4.1. Introduction

4.2. Design

4.3. Results

4.4. Summary

Chapter 5

Calibration and digitisation

5.1. Temperature sensor

Include flow diagram of code or pseudocode as a list.

5.1.1. Analytical Design

Analytical expectations (calculations of what you expected the calibration to be) Please include a 10-bit make-believe ADC in your calculations

5.1.2. Empirical Design

Based on measurements, calculate calibration (to adapt or replace analytic design. Compare analytic solution to empirical solution (plot?))

Include assessment of your calibration.

5.2. Heart rate sensor

No need to include the 10-bit ADC in this section.

Bibliography

- [1] M. J. Booysen, S. J. Andersen, and A. S. Zeeman, “Informal public transport in Sub-Saharan Africa as a vessel for novel Intelligent Transport Systems,” in *16th International IEEE Conference on Intelligent Transportation Systems (ITSC 2013)*, Oct 2013, pp. 767–772.

Appendix A

Social contract

Sign and include.




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E-design 344 Social Contract

2020

The purpose of this document is to establish commitment between the student and the organisers of E344. Beyond the commitment made here, it is not binding.

In the months preceeding the term, the lecturer (Thinus Booysen) and the Teaching Assistant (Michael Ritchie) spent countless hours to prepare for E344 to ensure that you get your money's worth and that you are enabled to learn from the module and demonstrate and be assessed on your skills. We commit to prepare for the module, to set the tests and assessments fairly, to be reasonably available, and to provide feedback and support as best and fast we can. We will work hard to give you the best opportunity to learn from and pass analogue electronic design E344.

Signature:  Date: 13 July 2020

.....
I, have registered for E344 of my own volition with the intention to learn of and be assessed on the principals of analogue electronic design. Despite the potential publication of supplementary videos on specific topics, I acknowledge that I am expected to attend the lectures and lab sessions to make the most of these appointments and learning opportunities. Moreover, I realise I am expected to spend the additional requisite number of hours on E344 as specified in the yearbook.

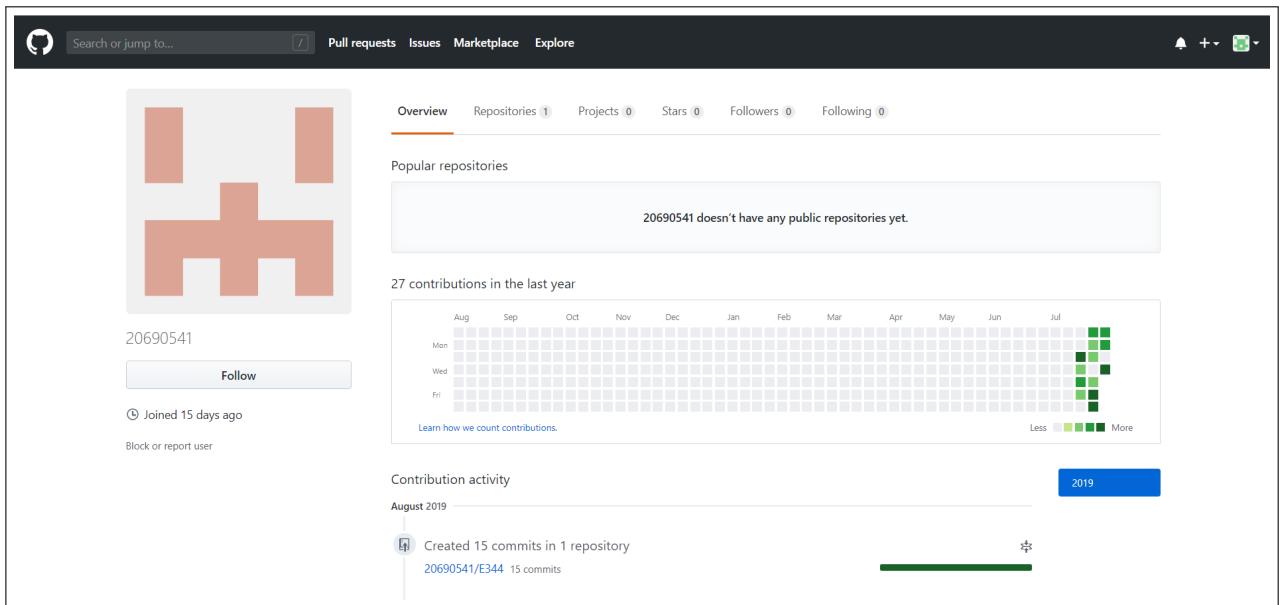
I acknowledge that E344 is an important part of my journey to becoming a professional engineer, and that my conduct should be reflective thereof. This includes doing and submitting my own work, working hard, starting on time, and assimilating as much information as possible. It also includes showing respect towards the University's equipment, staff, and their time.

Signature: Date:

Appendix B

GitHub Activity Heatmap

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



Appendix C

Stuff you want to include

remove this!! Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

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