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Development of Cashless Vending Machine

by

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Mechatronic Project 488

Final Report

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September 2013

Declaration

I, the undersigned, hereby declare that the work contained within this report is my own, original work.

Handtekening: .....
JC Lock

Datum: .....

MECHATRONIC PROJECT 488: SUMMARY

Student: JC Lock
Co-worker:

Title of Project
Objectives
Which aspects of the project are new/unique?
What are the findings?
What value do the results have?
If more than one student is involved, what is each one's contribution?
Which aspects of the project will carry on after completion?
What are the expected advantages of continuation?
.
What arrangements have been made to expedite continuation?

Student	Date	Lecturer

Abstract

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Nomenclature

Constants

g =	$9.81\,\mathrm{m/s^2}$	

Variables

Re_{D}	Reynolds getal t.o.v. deursnit	[ ]
x	Koordinaat	[m]
$\ddot{x}$	Versnelling	[$\mathrm{m/s^2}$]
θ	Rotasiehoek	[rad]
τ	Moment	[N·m]

Vectors and Tensors

$\vec{\boldsymbol{v}}$	Fisiese vektor, sien vergelyking ...

Subscripts

a	Adiabaties
a	Koordinaat

Chapter 1

Introduction

1.1 Problem Statement

1.2 Existing Solutions

1.3 Goal of Final System

1.4 System Objectives

1.5 Report Structure

Chapter 2

Background Study

2.1 Quick Response Codes

Quick Response Codes (QR Codes) are two dimensional bar codes that were initially used in Japanese car factories to allow computers to track the progress of an item on a production line [?]. The technology has since evolved and matured and is today widely used in the media industry for storing some data, such as a web address or phone number. See figure 2.1 for an example of a QR code.

Figure 2.1: Example of simple QR Code.

QR Codes can store up to 2,953 [?] bytes of data, which is accessible by scanning the code, with either a laser or a digital camera. To scan a QR Code requires a camera that can produce a digital image of appropriate quality. This image is then processed by a QR Code library, e.g. the well-known ZXing library (see section 2.1.1), which decodes the picture and outputs the data inside the code. Cellphones are commonly used today because of its portability, increasingly powerful hardware

and the QR Code technology's simplicity. However, an image with a QR Code in can be decoded by any computer with the relevant hardware and libraries installed.

2.1.1 Zebra Crossing Library

The Zebra Crossing Library (ZXing for short) is a well-known QR Code coding and decoding library. It is commonly built into smart phone applications to decode a static image or a video stream, but a desktop version of the library, called ZBar, is also available and works in a similar manner.

To date there has been at least 50 million downloads of the ZXing bar code scanner app on the Android platform alone, and is currently lies 98^{th} in the top 100 of the Google Play Store's most downloaded list [**?**].

2.2 Near Field Communication

Near Field Communication (NFC) is a relatively new communication standard in the world of wireless technology. It allows two NFC-enabled devices to wirelessly transmit data to one another by bringing them to close to one another, typically around 4 t.

NFC and Radio Frequency Identification (RFID) work on the same principle: when two devices (e.g. cellphone, RFID tag, MiFare card, etc.), equipped with an antenna tuned to a frequency of 13.56MHz, come into close proximity, they transmit some form of data to one another.

However, there are some important difference between the two technologies. For example, a NFC system is an active system, meaning that the device's antenna is always powered and runs off its own power supply. NFC devices also have peer-to-peer (p2p) capabilities, meaning that the two devices can communicate with one another by both sending and receiving data. RFID systems on the other hand, work by having one device act as a listener and the other as a sender [**?**] (e.g. the current SU's student entry control system).

Adding a NFC payment option allows an user with a NFC-capable smart phone, running on Google's Android operating system (OS), to make their payments simply by running an app and swiping their phone across the receiver. Also, due to the similarities between NFC and RFID technologies, it may also be possible to add the option of paying for a product with a SU student or personnel card. However, this needs to be investigated further before work can start.

2.2.1 libnfc

nfcpy

2.2.2 Android

2.2.3 Radio Field Identification and Stellenbosch University Student Cards

2.3 Web Server

2.3.1 Django Web Framework

2.3.2 Elastic Cloud Computing

2.3.3 Apache2

2.4 Encryption

2.4.1 Asymmetric Encryption

ElGamal

RSA

2.4.2 Base 64

Chapter 3

System Design

Chapter 4

Detail Design

4.1 Transistor Switch

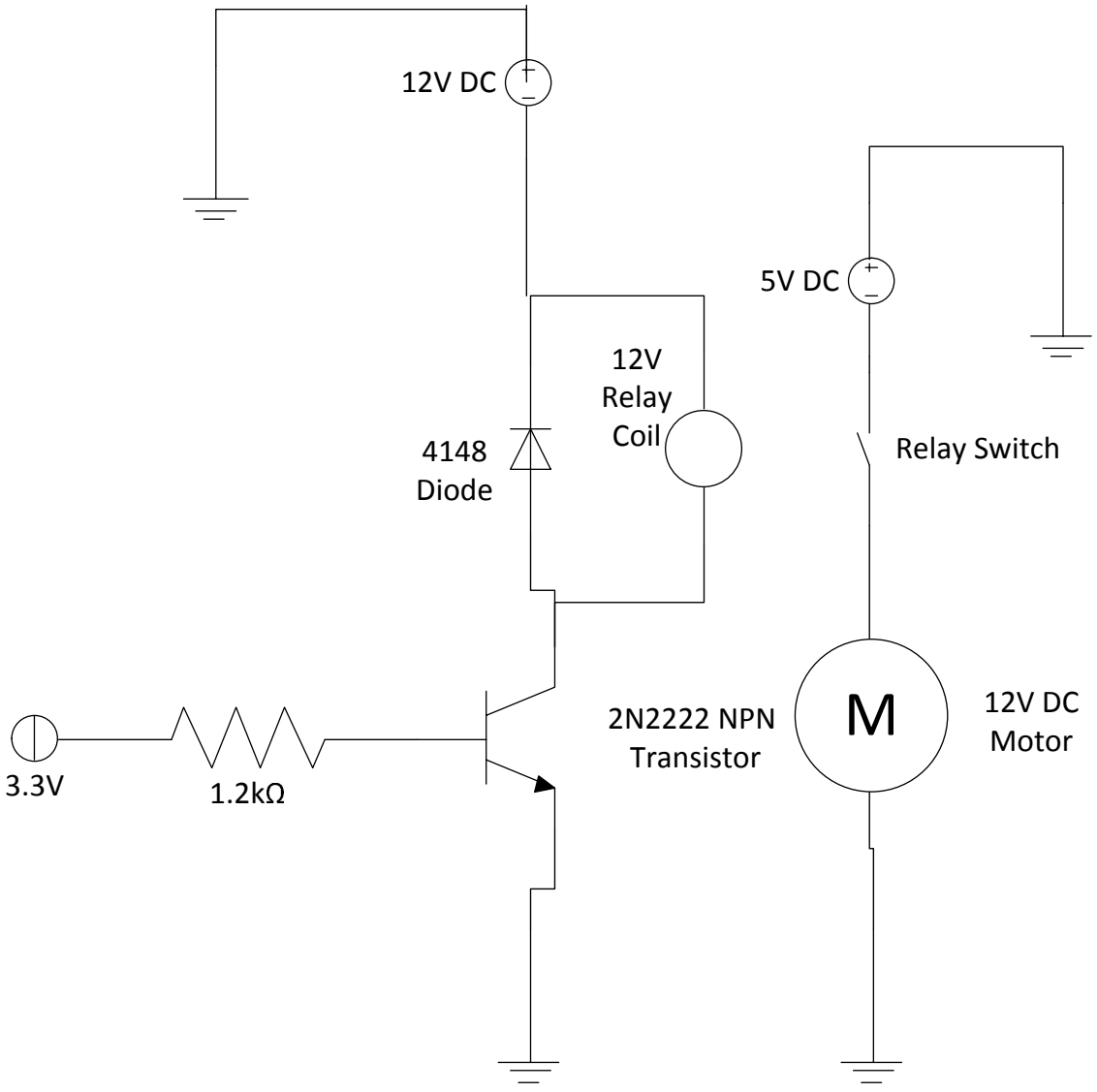

Figure 4.1: Test

Chapter 5

System Tests

5.1 Transistor Switch

5.1.1 Current and Voltage Limits

5.1.2

Chapter 6

Conclusion