

|  |
| --- |
| School of Computing  Faculty of Engineering |

Control System (AI) for Wrestling Robot

Fanhui Meng

Submitted in accordance with the requirements for the degree of  
MSc Advanced Computer Science (AI)

**Session 2019/2020**

The candidate confirms that the following have been submitted*:*

*<As an example>*

|  |  |  |
| --- | --- | --- |
| **Items** | **Format** | **Recipient(s) and Date** |
| *Deliverables 1* | *Report* | *SSO (xx/xx/xx)* |
| *Deliverables 2* | *Code and URL* | *SSO (xx/xx/xx)* |
| *Deliverable 3* | *Youtube video URL* | *Supervisor, assessor (xx/xx/xx)* |
| *Deliverable 5* | *User manuals* | *Client, supervisor (xx/xx/xx)* |

Type of Project: Exploratory Software

The candidate confirms that the work submitted is their own and the appropriate credit has been given where reference has been made to the work of others.

I understand that failure to attribute material which is obtained from another source may be considered as plagiarism.

(Signature of student)

© 2020 The University of Leeds and Fanhui Meng

# Summary

*<Concise statement of the problem you intended to solve and main achievements (no more than one A4 page)>*

***<Reminder about basic requirements of layout and format:***

***The report must be in typescript, sequentially page numbered, on A4, single or double-sided, with 1in margins. Point size 11 and one-and-a-half line spacing should be used.***

***Page Numbering: The pages preceding the body of the text, i.e. from "Summary" to "Contents" inclusive, should be sequentially numbered in Roman numerals. All the remaining pages should be numbered in a single sequence of Arabic numerals.***

***Length: The main body of a 60 credit project report must be no longer than 60 pages (i.e. excluding appendices and references). The limit for 40-credit projects is 50 pages.>***

# Acknowledgements

*<This page should contain any acknowledgements to those who have assisted with your work. Where you have worked as part of a team, you should, where appropriate, reference to any contribution made by others to the project.*

*Note that it is not acceptable to solicit assistance on ‘proof reading’ which is defined as “the systematic checking and identification of errors in spelling, punctuation, grammar and sentence construction, formatting and layout in the text”; see* [*http://www.leeds.ac.uk/qat/documents/policy/Proof-reading-policy.pdf*](http://www.leeds.ac.uk/qat/documents/policy/Proof-reading-policy.pdf)*. >*

# Table of Contents

Summary iii

Acknowledgements iv

Table of Contents v

List of Figures

List of Tables

Chapter 1 Introduction

1.1 Overview 1

1.2 Aim and Objectives

1.3 Problem Statement

1.4 Deliverables

1.5 Methodology

1.6 Project timeline

1.7 Report Structure

Chapter 2 Tables and Figures 2

2.1 Tables using the ‘table caption’ and ‘table description’ Styles 2

2.2 Figures using the ‘figure caption’ and ‘figure description’ Styles 2

List of References 3

Appendix A External Materials 4

A.1 Level 2 Heading with ‘heading 2’ Style Applied by Pressing Ctrl Shift 2 4

A.1.1 Level 3 Heading with ‘heading 3’ Style Applied by Pressing Ctrl Shift 3 4

A.1.1.1 Level 4 Heading with ‘heading 4’ Style Applied by Pressing Ctrl Shift 4 4

Appendix B Ethical Issues Addressed 5

B.1 Level 2 Heading 5

**List of Figures**

1.1 Main features of the Zumo 32U4 robot

**List of Tables**

# Chapter 1 Introduction

## Project Aim

The aim of this project is to design a fine robot high-level control system, which is the ‘brain’ of the Zumo robot. The main goal of this project is to make the Zumo robot be competitive and perform well in the Sumo robot competition. In addition, this project will find out if the idea of control system can be applied to a wider range of different robot, such as other robot competition or the robot in daily life.

Sumo robot league is a very popular international robot wrestling competition, which is two robots attempt to push each other out of the ring. The last stand robot in the ring is the winner.

This project is going to use the Zumo 32U4 robot, which is a complete, versatile robot controlled by an Arduino-compatible Atmega32U4 microcontroller. Therefore, extra hardware structure and improvement is not considered in the project. The Zumo robot has two motors, one Atmega32U4 chip as the brain and a variety of sensors, including proximity sensors, line sensors and accelerometer. So the Zumo robot can detect the opponent and run towards or away from it, which satisfy every requirement of a robot in the Sumo league.



Figure 1.1: Main features of the Zumo 32U4 robot

### Objectives:

* To get familiar with the hardware functions of Zumo robot.
* Conduct a theory study to compare different control system in the wrestling case.
* Implement two or more different control system and compare it’s advantages and disadvantages.
* Create wrestling simulation environment. (Due to the lockdown policy, it’s hard to find the opponent in the real world)
* Evaluate the results with it’s performance in different simulation cases.

#### Deliverables

1. A software product that can simulate the Sumo robot wrestling. Built using BEAST.
2. A Github repository that contains the source code of the system.
3. A developer documentation that provides:

* An overview of the simulation, algorithm used, programming languages and style.
* Instructions for setting up the project in a local development environment. (Provide VM for Mac or Windows user)

1. The MSc project report.

#### Ethical, legal, and social issues

No Ethical, legal and social issues related to this project.

# Chapter 2 Background Research

## 2.1 Literature Survey

Text before table. Text before table. Text before table. Text before table. Text before table. Text before table. Text before table. Text before table. Text before table. Text before table.

**Table 2.1** Caption of Table — automatically appears in the List of Tables when that is updated The ‘table caption’ style has been applied to this paragraph by pressing Ctrl Shift T.

This is the table description in the ‘table description’ style. It is optional text to give more information about the table and does not appear in the List of Tables.

|  |  |  |
| --- | --- | --- |
| **Heading One** | **Heading Two** | **Heading Three** |
| 1.1 | 1.2 | 1.3 |
| 1.21 | 1.22 | 12.3 |
| 12.31 | 12.32 | 12.33 |

## 2.2 Figures using the ‘figure caption’ and ‘figure description’ Styles

Figures can be added using the Illustrations section of the Insert tab.



**Figure 2.1** Caption of Figure — automatically appears in the List of Figures when that is updated. The ‘figure caption’ style has been applied to this paragraph by pressing Ctrl Shift F.

This is the figure description in the ‘figure description’ style. It is optional text to give more information about the figure and does not appear in the List of Figures.

# List of References

*<It is expected that the list would reflect the breadth and depth of scholarly research undertaken by the student during the course of the project.>*

# Appendix A External Materials

<Level 1 Heading with ‘heading 1’ Style Applied by Pressing Ctrl Shift 1> Text under appendix heading. Text under appendix heading. Text under appendix heading. Text under appendix heading. Text under appendix heading. Text under appendix heading.

## A.1 Level 2 Heading with ‘heading 2’ Style Applied by Pressing Ctrl Shift 2

Text under level 2 heading. Text under level 2 heading. Text under level 2 heading. Text under level 2 heading.

### A.1.1 Level 3 Heading with ‘heading 3’ Style Applied by Pressing Ctrl Shift 3

Text under level 3 heading. Text under level 3 heading. Text under level 3 heading. Text under level 3 heading.

#### A.1.1.1 Level 4 Heading with ‘heading 4’ Style Applied by Pressing Ctrl Shift 4

Text under level 4 heading. Text under level 4 heading. Text under level 4 heading. Text under level 4 heading.

# Appendix B Ethical Issues Addressed

Text under appendix heading. Text under appendix heading. Text under appendix heading. Text under appendix heading. Text under appendix heading. Text under appendix heading.

## B.1 Level 2 Heading

Text under level 2 heading. Text under level 2 heading. Text under level 2 heading. Text under level 2 heading.