Lower-Limb Motion Estimation

Modelling the Kinematics of the Human Lower-Limbs using

Cameras and an IMU

Prepared by:

Johann Hendrik Joosten

Department of Electrical and Electronics Engineering
University of Cape Town

Prepared for:

Dr. Amir Patel

Department of Electrical and Electronics Engineering
University of Cape Town

Submitted to the Department of Electrical Engineering at the University of Cape Town
in partial fulfilment of the academic requirements for a Bachelor of Science degree in
Mechatronics.

August 22, 2017

Title

Lower-Limb Motion Estimation - Modelling the Kinematics of the Human Lower-Limbs using Cameras and an IMU.

Description

Recent breakthroughs in the field of artificial intelligence has invigorated the pursuit of humanoid robots. Unfortunately, modern bipedal robots lack the elegance of motion and fluidity observed in nature. Perhaps then a modern take on the lower limb kinematics of humans could provide insight to the field of bio-inspired robotics. By using modern cameras with miniature footprints and accurate sensors data capture systems can be transferred onto the subjects in question. This methodology allows for a much larger spectrum of motion capture and can greatly improve our understanding of motion in the unconstrained real world.

Deliverables

The following items have been identified as critical deliverables for the project:

- functional harness to hold electronics
- data capture equipment
- estimation algorithm
- kinematic model of the human lower-limbs
- computer vision algorithm (!?)

Skills and Requirements

Mechanical Design, Electrical Design, Programming and Modelling.

Area

Computer Vision, Sensors, Biomechanics and Bio-inspired Robotics.

Declaration

1. I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

2. I have used the IEEE convention for citation and referencing. Each contribution to, and quotation in, this report from the work(s) of other people has been attributed, and has been cited and referenced.

3. This report is my own work.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as their own work or part thereof.

Signature:.........................
Hendrik Joosten

August 22, 2017

Acknowledgements

I would like to thank some people...

Abstract

Contents

List of Figures

List of Tables

Chapter 1

Introduction

1.1 Background to the study

review of the area being researched - data capture with onboard data capture equipment, bio inspired robotics, human gait

The field of bio-inspired robotics aims to understand various natural phenomena and incorporate these techniques into the design of modern robotics. Manoeuvrability and mobility are an extremely important part in the design of robots.

current information surrounding the issue

previous studies on the issue

and relevant history on the issue

1.2 Objectives of this study

objectives go here

1.3 Scope and Limitations

scope and limitations

1.4 Plan of development

plan of development

1.5 Report Outline

report outline goes here

Chapter 2

lit review

2.1   human gait

blah [1] blah

Bibliography

[1] A. Patel, C. Fisher, B. Stocks, F. Nicolls, and E. Boje, "Tracking the cheetah tail and spine using animal-borne cameras and a wireless sensor network," in *INTEGRATIVE AND COMPARATIVE BIOLOGY*, vol. 57. OXFORD UNIV PRESS INC JOURNALS DEPT, 2001 EVANS RD, CARY, NC 27513 USA, 2017, pp. E373–E373.