The Design and Construction of an Anthropomorphic Humanoid Service Robot

A thesis presented in partial fulfilment of the requirements for the degree of

Master of Engineering
in
Mechatronics

at
Massey University,
Palmerston North, New Zealand

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2011

1 Abstract

This thesis presents the research, mechanical design and construction of the lower half of a biped robot. In the long run this work will be developed further to build a service robot to perform repetitive (and often dangerous) tasks and to help disabled people to carry out everyday tasks.

The aim of this research project is to develop a humanoid with the agility of a 'high end' robot but on a very low budget in comparison. In order to achieve this, several unique mechanical attributes have been proposed and implemented such as dual push rod actuated joint articulation. This technique produces a larger joint torque and reduces leg inertia allowing for the implementation of WCK serial controlled servo modules for actuation. To further increase human-like similarities a toe joint is implemented. This gives the humanoid the ability to stride more elegantly, increase speed control, and reduce energy used for each step.

All the parts of this robot have been manufactured from scratch and most have been CNC machined. Solidworks is used as a 3D modelling package to produce a simulated version of the humanoid to determine dimensions and dynamics before construction takes place. SolidCAM is a computer aided machining package which was used to specify machining paths to produce G-Code. An additional 4^{th} axis was added to the CNC machine solely for the purpose of this project as many parts were too intricate and complex for the standard 3 axis machine.

A biped humanoid requires several types of sensors for balancing. High accuracy and resolution is of paramount importance for the successful control of the humanoid. Various force sensors are reviewed and their advantages and disadvantages are discussed. Gyroscopes and attitude heading reference systems (AHRS) are investigated and tests are performed on all units to obtain operational characteristics and accuracy.

Visual Basic.net has been used for developing software for controlling and monitoring all sensors and actuator modules. Essentially a humanoid platform has been developed with appropriate software allowing for the next stage of development, the development of the gait control algorithms.

2 Acknowledgments

I would like to acknowledge and express my gratitude to several individuals who provided generous amounts of support and cooperation during this project. Thank you to my supervisor, Gourab Sen Gupta who provided a vast range of knowledge and support regarding control systems and sensors implemented in this project, also his support regarding conferences and article publication. Thank you to Clive Bardell for his precise and extremely fast production of parts, Greig McLeay for his extensive knowledge and help with designing and producing a number of the parts and also for teaching me how to use the CNC machine. Lastly I would like to thank a fellow student, Sanjay David, for his help in research, implementation and testing of various sensors in this project.

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