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Design and construction of a two leg walking robot

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Abstract

This paper describes designs of the two leg robot walking mechanism, hardware architecture and the leg control methods for walking machines. The body of knowledge that applies to mobile walking robots is quite well developed. However, autonomous walking robots are still relatively new, and the body of knowledge concerning their development is not as well defined. The difficulty factor in building a legged robot is also considerably higher than that for a wheeled robot. In this report a brief introduction is given regarding the designing of the two leg walking robot. Brief guidelines for the design of various parts of two leg robot have been shown. Then a study of various robot leg mechanisms is made to identify their applications and advantages. At the end this paper describes the designing, challenges and construction of two leg walking robot.

Keywords - Two leg robot, Walking mechanism, hardware architecture, designing, leg control method, walking machines

Introduction

Legged robots are a type of mobile robots which use mechanical limbs for movement. They are more versatile than wheeled robots and can traverse many different terrains, though these advantages require increased complexity and power consumption. Legged robots often imitate legged animals, such as humans or insects. Legged robots can be categorized by the number of limbs they use, which determines gaits available. Many-legged robots tend to be more stable, while fewer legs lends itself to greater maneuverability. Bipedal or two-legged robots exhibits bipedal motion. As such, they face two primary problems:

1. Stability control, which refers to a robot's balance.
2. Motion Control, which refers to a robot's ability to move.

Stability control is particularly difficult for bipedal systems, which must maintain balance in the forward-backward direction even at rest.Some robots, especially toys, solve this problem with large feet, which provide greater stability while reducing mobility. Alternatively, more advanced systems use sensors such as accelerometers or gyroscopes to provide dynamic feedback in a fashion that approximates a human being's balance. Such sensors are also employed for motion control and walking. The complexity of these tasks lends itself to machine learning.

Simple bipedal motion can be approximated by a rolling polygon where the length of each side matches that of a single step. As the step length grows shorter, the number of sides increases and

the motion approaches that of a circle. This connects bipedal motion to wheeled motion as a limit of stride length.

For our project we have designed a two legged robot with the help of Autocad software. After the designing in software, a hardware of the working robot is proposed.

Literature Review

1. "Postural Stability of Biped Robots and the Foot-Rotation Indicator (FRI) Point"
Ambarish Goswami has worked on the problem of foot rotation in biped robots during the single-support phase. Foot rotation is an indication of postural instability, which should be carefully treated in a dynamically stable walk and avoided altogether in a statically stable walk.

2. "Design and development of research platform for perception-action integration in humanoid robot".
A humanoid robot "H6" is developed as a platform for the research on perception-action coupling in intelligent behaviour of humanoid type robots. The H6 has the features such as each joint has enough torque for full body. It is self-contained and connected to a network via radio ethernet. The H6 is expected to be a common test-bed for experiment and discussion for various aspects of intelligent humanoid robotics.

3. "The development of Honda humanoid robot"
The work has been done to understand the mechanism, system configuration, basic control algorithm and integrated functions of the Honda humanoid robot. Like its human counterpart, this robot has the ability to move forward and backward, sideways to the right or the left, as well as diagonally.

4. "Evaluation of Various Walking Patterns of Biped Humanoid Robot"
The work describes the evaluation of three different walking patterns of a biped humanoid robot. Stretch-walking patterns with straight legs for a biped robot are compared with conventional walking patterns with bent legs in terms of energy consumption. This paper discusses walking pattern generation for various walks.

5. "Minimum energy force distribution for a walking robot"

In this study, geometric work loss for a walking machine with articulated legs is minimized by controlling interaction forces at the foot-ground interface

Conclusion:

The design of foot have to be of proper dimension and shape in order to properly distribute the weight of the robot during its motion. The various configuration for the two leg robot used are of rectangular shape or of I shape. The stability provided by this are though good but it increase the weight which has to be lift, hence the solution to this is the use of C section legs which are inter crossed to each other. They are more rigid and provides better stability during the static as well as in dynamic condition.

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