
Design and Manufacturing of Humanoid Robot

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ABSTRACT

This paper describes designing of humanoid robot in Spicer India PvtLtd. The aim of the project is to create a humanoid robot to calibrate the behavior of human and going to use this generation of robots in some special purpose like events etc. This mechatronic project includes the combination of Control Algorithms, Mechanical Design, and Electronic Control Boards. In designing of this robot we tried to use Proe and Creo Parametric, control algorithms, mechanical design structures which is used in similar projects. The main aim of this study was to develop an initial understanding of designing of humanoid robots should be carried out. Humanoid robot design is not similar to conventional industrial design. A humanoid robot needs to have personality, character because it interacts with humans. The design process should not be similar to that of machines such as automobiles and airplanes because it moves autonomously by recognizing its environment. As the development of human-computer interaction and interface design owe to the growth of computer industry, humanoid robot design should be studied widely and be accepted as a new design research area. We used Microcontroller Arduino Mega 2560 in this application. There are two types of sensors used in this robot (Infrared and Ultrasonic sensor).

Keywords: *Humanoid Robot, Design, Manufacturing, Microcontroller, Sensor etc.*

1. Introduction

1.1 Research on Humanoid Robot

Humanoid robot, intelligent robot, is regarded as one of the most important growing technology in national economy. The application of humanoid robot is expected to be promising industry in the new generation after the car industry dominant generation. In now days recently developed humanoid robots such as entertainment and personal service robots are required to satisfy a lot of complex conditions such as height, weight, intimacy, safety and flexibility with these reasons the approach of product design starts to be applied in humanoid robot development. Humanoid robot design includes mechanical components structure design and human-robot interaction design as well as appearance constraints.

1.2 Research Outline

This research including different processes for humanoid robot design are suggested. One is the design deployment based on role-character implantation and the other is application of concurrent engineering design method. By completion of different design processes, through the design visualization process, finally design development is completed.

1) Role-character based humanoid robot design

For humanoid robot the need is to have specific type of personality because human tend to treat another human with specific personality. Thus in the design development of humanoid robot, personality design and step wise process is required. The classification of existing robot according to role and environment is explored and they are analysed on their appearance and human-robot interactions are calibrated. Scenario method is applied to design specific personality and role of a humanoid robot. After the completion of scenario design, specific personality and roles are decided and the results are transferred to concurrent engineering design process.

1.2 Idea Sketch

New ideas and sketches were performed one each concept after deciding the concepts and directions in detail. We made rough sketches based on the requirement of Company. And next, we applied our sketches into previous rough sketches because of the calibration between techniques and design. Besides, developed to have marked individuality and emotionality. In this research we planned to take Software-robot development after this research.

2. Manufacturing Processes

2.1 Materials Used

2.1.1 Steel

Steel is alloy of iron and other elements, carbon, that is widely used in construction and other applications because of its high tensile strength and low cost. Steel is used in body parts such as both leg parts below ankle and stomach parts.

2.1.2 Aluminum

Aluminium is an element in the boron group with symbol Al and atomic number 13. It is a silvery-white, soft, nonmagnetic, ductile metal. Aluminium is mostly used in this robot body parts such as upper hand, lower hand, thighs and lower legs.

2.1.3 Laser Cutting

Laser cutting is a method that uses a laser cut materials, and is typically used for industrial manufacturing applications, but is also starting to be used by small businesses, and hobbyists, schools. Laser cutting works directing the output of a high-power laser most commonly through optics. Industrial laser cutters are used to cut flat-sheet material as well as structural materials etc.

2.1.4 Sensors

It is one of the important parts for industrial system is sensor for minimizing control system and make system more smart. Except camera and microphone as vision & voice receivers, we used Touch and Force sensors for some parts of the robot used. In our Project of Humanoid robot we used two sensors. Infrared sensor and ultra sonic sensors in lower leg and in waist respectively.

A) Infrared sensor

An infrared sensor is an electronic component which is used to sense certain characteristics of its surroundings by emitting or detecting infrared radiation. Infrared sensors are also used for measuring the heat being emitted by an object and detecting motion. The infrared waves have wavelengths between 0.75 and 1000 μm . The wavelength region which ranges from 0.75 to 3 μm is known as the near infrared regions. The region between 3 and 6 μm is known as the mid-infrared and infrared radiation which has a wavelength greater higher than 6 μm is known as far infrared. Infrared technology have applications in many daily used products. The main benefits of infrared sensors include their properties such as low power requirements, simple circuitry and portable features.

B) Ultrasonic Sensor

An Ultrasonic sensor is electronic instrument which can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2cm to 400 cm or 1" to 13 feet.

Features

Power Supply : +5V DC

Quiescent Current : <2mA

Working Current: 15mA

Effectual Angle: <15°

Ranging Distance : 2cm – 400 cm / 1" – 13ft

Resolution : 0.3 cm

Measuring Angle: 30 degree

Trigger Input Pulse width: 10uS

Dimension: 45mm x 20mm x 15mm Sensor

3.0 Microcontroller Arduino Mega 2560

The Mega 2560 is a microcontroller board depending on the ATmega2560. It contains 54 digital input/output pins (out of which 15 is used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, a reset button. It contains everything needed to support the microcontroller. simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila. The Mega 2560 is an update to the Arduino Mega, which it replaces.

Technical Features

Microcontroller. ATmega2560
Operating Voltage. 5V
Input Voltage. 7-12V(Recommended)
Input Voltage (limit) 6-20V
Digital I/O Pin 54 (of which 15 provide PWM output)
Analog Input Pin 16
DC Current per I/O Pin 20 mA
DC Current for 3.3V Pin 50 mA
Flash Memory 256 KB of which 8 KB used by bootloader
SRAM 8KB
EEPROM 4KB
Clock Speed 16MHz
LED BUILT IN 13
Length 101.52 mm
Width 53.3 mm
Weight 37 g

4.0 Literature Review

4.1 Humanoid Robot: A Walking Machine

Jun Ho Oh KAIST (Korea Advanced Institute of Science and Technology)

Abstract:

World wide there are so many types of a humanoid robot which continuously on development and in research is taking place on them or some already became highly intelligent and having good communication with human beings. Also some people want them to live with mankind at home or work in coming days. There are some disadvantages of a humanoid robot. Moreover many scientists or researchers advised not to be more practical with future form of a humanoid robot. Then, the dilemmas come to us with these questions; "why do we study about the humanoid and why should we do?" "And how would the biped walking be made and what kind of tantalizing problems do we have to face for it?" These issues will be presented throughout this article. Copyright © 2006 IFAC Keywords: Humanoid robot, biped walking

4.2 Light press of sheet metal edge for reducing residual stress generated by laser cutting considering mechanical properties and intensity of residual stress

Atsushi Maedaa,* , Yingjun Jinb, Takashi Kuboki a

abstract

Laser cutting is used as an effective method for cutting out blanks from rolled sheet metals because of its high flexibility for cutting lines and high productivity. However, residual stresses, which are generated by laser cutting, have been the main hurdle in the popularization of laser cutting method. Another problem is the warp which appears in the sheet metal after being subjected to bending processes after laser cutting. The authors present a light press method for reducing residual stress generated by laser cutting. This present paper primarily focuses upon optimization of working conditions depending on mechanical properties of the blank and the effect of the heat affected zone in laser cutting. The relationship between the optimum pressure and the proof stress was quantitatively and specifically clarified for several sets of mechanical properties. It was also found that the influence of heat-affected-zone area and intensity of residual stress by laser cutting on the optimum press pressure was small. © 2015 The Authors. Published by Elsevier B.V.

5. Conclusion

This research was used to make humanoid robot which will fulfil company requirements, concentrating on the design procedures and lineups of humanoid robot design. The main process was the design procedure depending on role-character and softwares such as Creo and Prodesign process, and these approaches proposed a systematic framework to analyze the design problems of

humanoid robots. Mainly Creo Parametric design process played an important role in integrating the related academic fields in design. In this research, we set the robot design's direction. The technical research and verification of its structure remained for future works to complete the robot design. Realization of robot should be preceded to verify the structure, and we should conduct the simulation using software and for its realization. We can overhaul the expected problems in structure and elements for its combination in a short period of time. The robot was made through above applications as 1st process of robot design and these research was taken forward by taking appearance of robot as main purpose.

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