

**DARWIN-OP INTRODUCTION [DASL-104]**

**WEEK 1**

**INSTRUCTOR: JEAN CHAGAS VAZ**



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**Introduction**

**Hardware Overview**

**Safety Manners**

**VNC software**

**OP Architecture**

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- **Introduction;**
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  - Objectives;
- **Hardware Overview;**
  - DARwIn-OP characteristic;
- **Safety Manners;**
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- **VNC software;**
  - Set Up VNC;
- **DARwIn-OP Architecture;**
  - Inverted-Pendulum;
  - DARwIn-op Kinematics

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### ➤ Motivation

➤ This is an introduction course that studies the fundamentals of a bipedal miniature-humanoid.

### ➤ Objectives

➤ The main objective of this course is to investigate the functionality of DARwin-OP (Dynamic Anthropomorphic Robot with Intelligence–Open Platform).



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➤ DARwin-OP characteristic



Source: <http://support.robotis.com>

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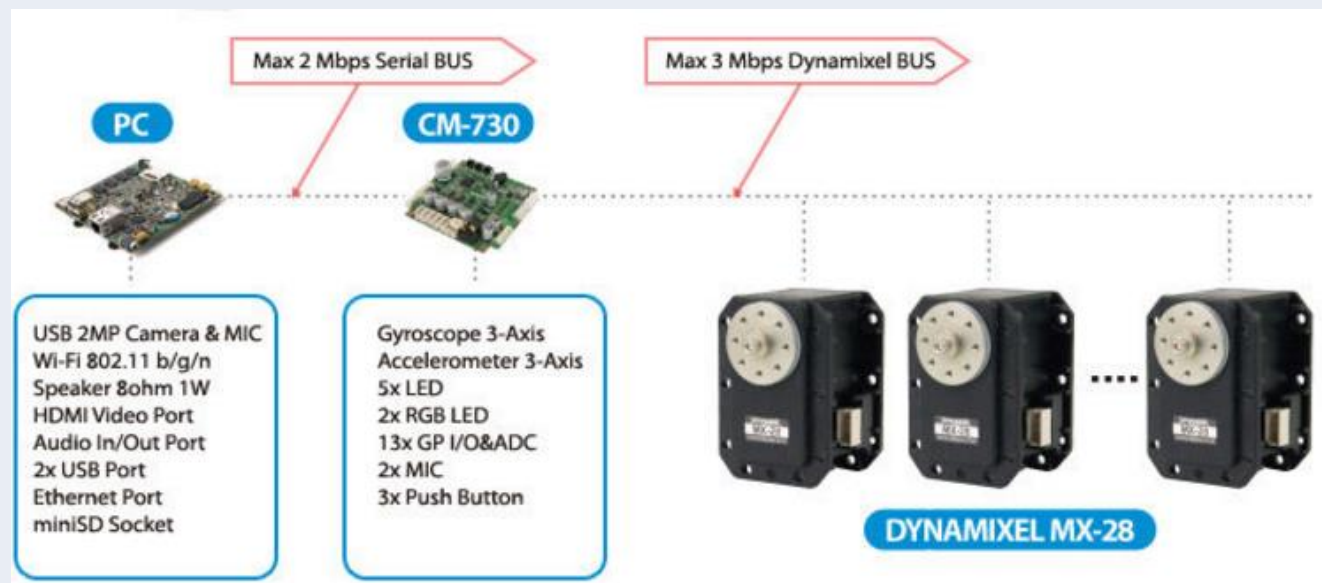
Safety Manners

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➤ **Dynamixel**



Source: <http://support.robotis.com>



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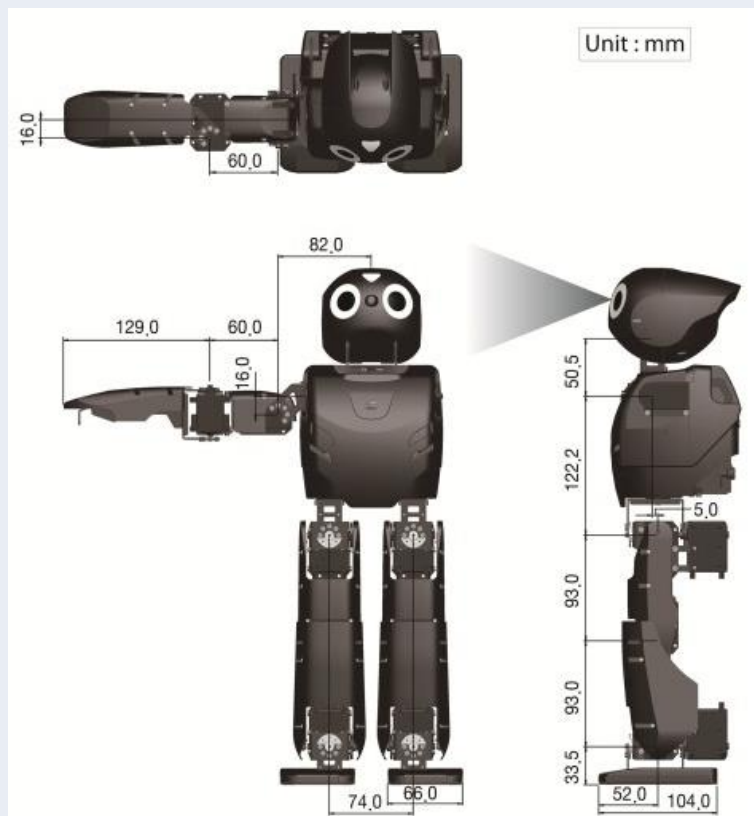
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➤ DARwin-OP specification



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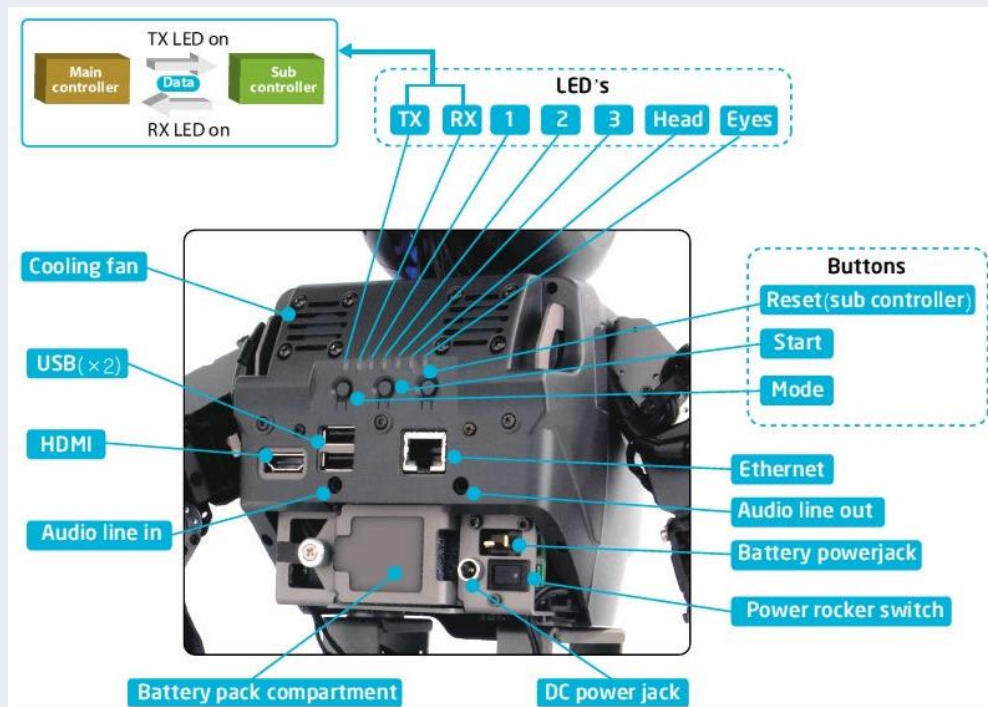
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➤ DARwin-OP specification



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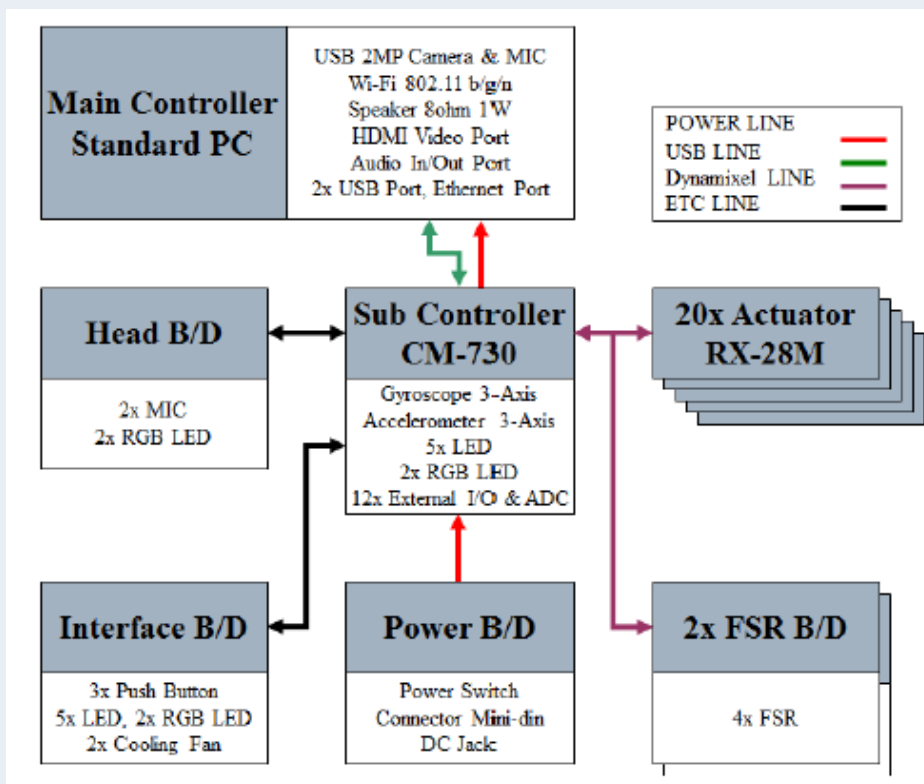
VNC software

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➤ DARwIn-OP specification

➤ Based modular structure and a standard PC architecture of DARwIn-OP.



Source: Development of Open Humanoid Platform DARwIn-OP [Inyong-Ha]



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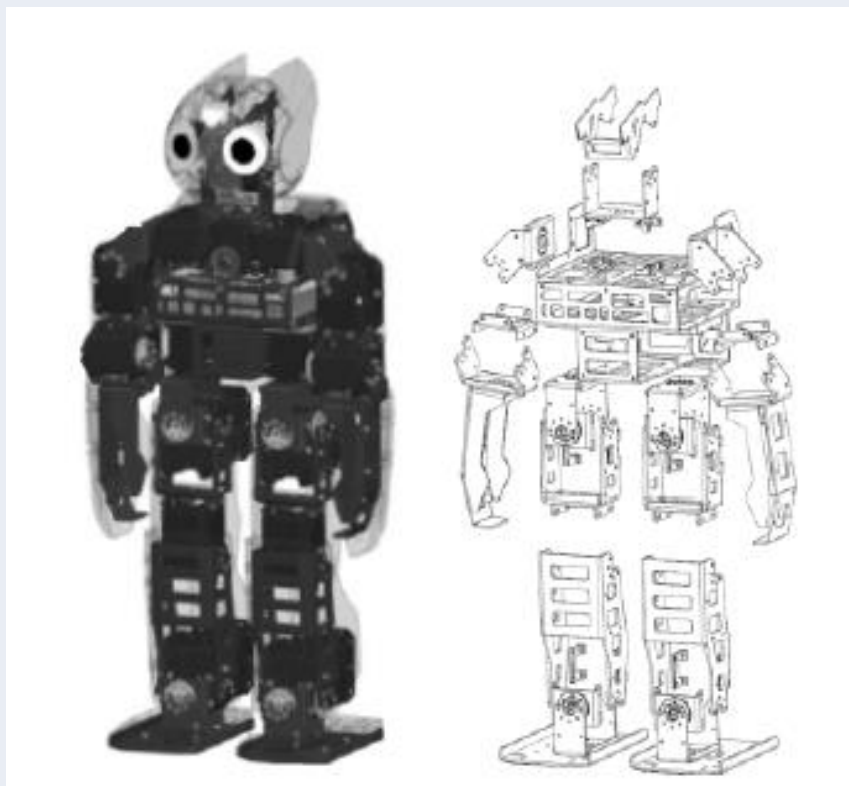
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- DARwIn-OP specification
  - Overall mechanical design scheme of DARwIn-OP.



Source: Development of Open Humanoid Platform DARwIn-OP [Inyong-Ha]

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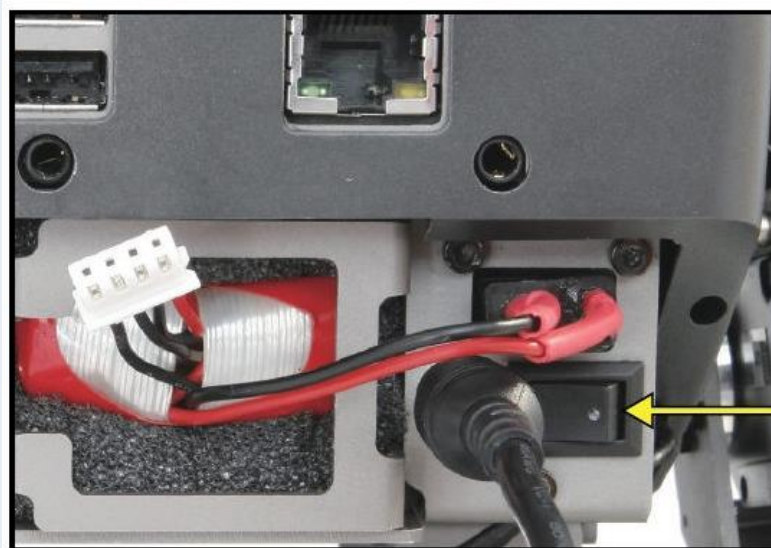
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➤ **Safety Manners**



**ON / OFF  
rocker switch**

Source: <http://support.robotis.com>

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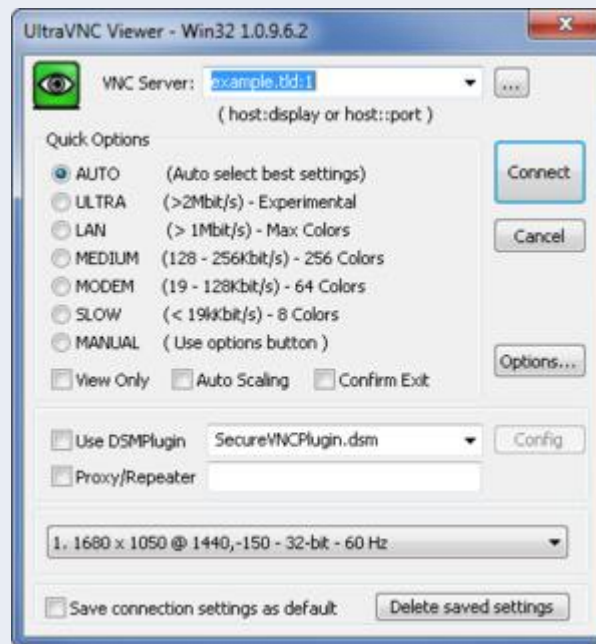
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➤ Microsoft

➤ [http://support.robotis.com/en/product/darwin-op/development/ready/connecting\\_to\\_darwin.htm](http://support.robotis.com/en/product/darwin-op/development/ready/connecting_to_darwin.htm)



Source: <http://support.robotis.com>

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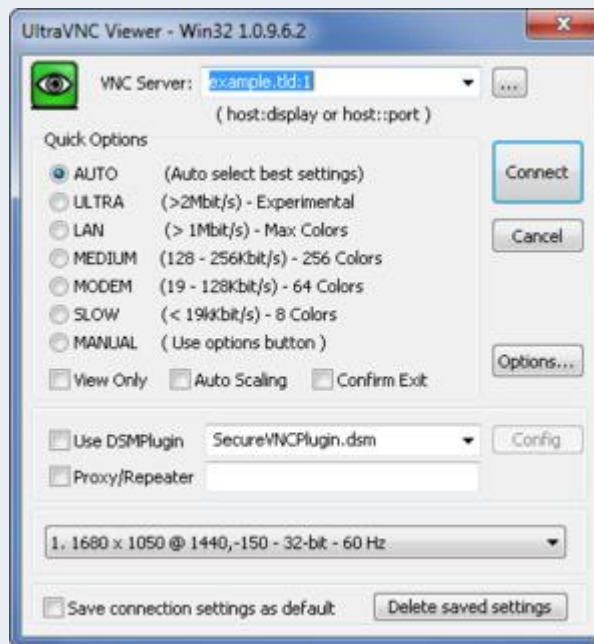
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➤ Ubuntu

➤ <https://www.digitalocean.com/community/tutorials/how-to-install-and-configure-vnc-on-ubuntu-16-04>



Source: <http://support.robotis.com>

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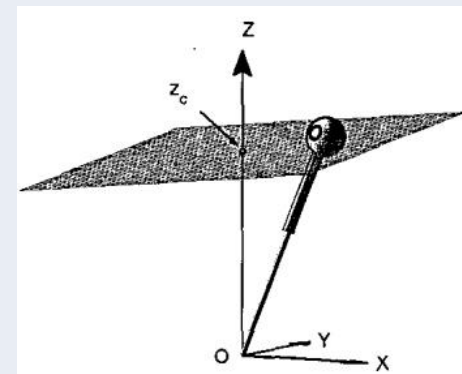
- Biped Walking and Zero-Moment Point
  - Linear Inverted Pendulum

$$z = k_x x + k_y y + z_c. \quad (1)$$

$$\ddot{y} = \frac{g}{z_c} y - \frac{1}{m z_c} \tau_x, \quad (2)$$

$$\ddot{x} = \frac{g}{z_c} x + \frac{1}{m z_c} \tau_y, \quad (3)$$

$$\tau_x x + \tau_y y = 0, \quad (4)$$



Source: Biped Walking Pattern Generation by using Preview Control of Zero-Moment Point [Shuuji KAJITA]



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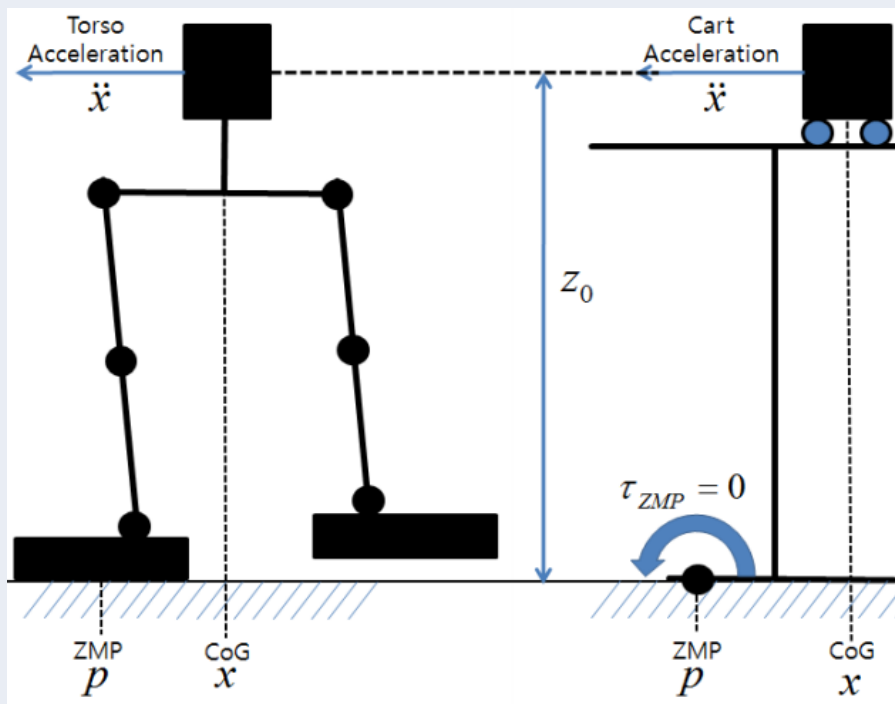
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➤ Biped Walking and Zero-Moment Point

➤ A cart-table model



Source: [[http://www.seas.upenn.edu/~robocup/files/DARwin-OP\\_UPenn\\_Tutorial.pdf](http://www.seas.upenn.edu/~robocup/files/DARwin-OP_UPenn_Tutorial.pdf)]

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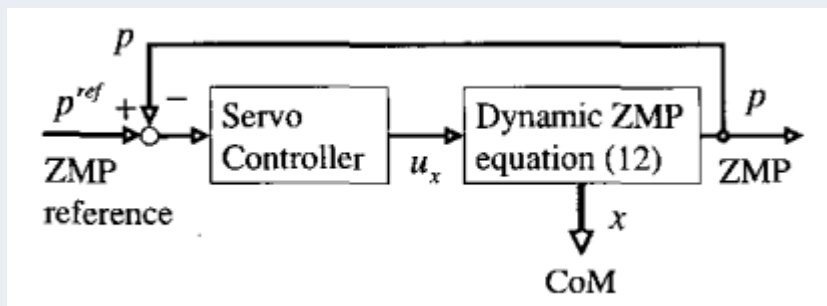
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## ➤ Biped Walking and Zero-Moment Point

## ➤ ZMP



Source: Biped Walking Pattern Generation by using Preview Control of Zero-Moment Point [Shuuji KAJITA]



Wednesday, April 05, 2017, 14:32

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- Kajita, Shuuji, et al. "Biped walking pattern generation by using preview control of zero-moment point." *Robotics and Automation, 2003. Proceedings. ICRA'03. IEEE International Conference on*. Vol. 2. IEEE, 2003.
- Ha, Inyong, et al. "Development of open humanoid platform DARwIn-OP." *SICE Annual Conference (SICE), 2011 Proceedings of*. IEEE, 2011.
- Schwarz, Max, et al. "NimbRo-OP humanoid teensize open platform." *In Proceedings of 7th Workshop on Humanoid Soccer Robots, IEEE-RAS International Conference on Humanoid Robots, Osaka*. 2012.