

# Team Description Paper: Aaron Humanoid Robot for RoboCup 2016 Humanoid League

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**Abstract.** Aaron is an adult size humanoid robot made in Taiwan National Kaohsiung First University of Science and Technology. Aaron mechanical structure is consisted of 24 DOF, 2 on head for Camera, 10 for each hand, 12 for each leg, respectively. To support body, the joints of legs install many extra gears for boosting walking stability. Tall 130cm and weight 15Kg let Aaron be able to participate adult size humanoid league in RoboCup. Aaron, is designed for RoboCup. In addition, the topics for adult-sized robot, self-adjustment walking gait, much powerful joint, etc., are our research focuses in the future.

**Keywords:** Adult-Sized Humanoid Robot, Walking Gait, Inertia Motion Unit Sensor, Force Sensor, Center of Pressure (COP).

## **Introduction.**

Humanoid robot is an interesting research in recent decades. In recent, small-sized humanoid is popular, and commercialized, but adult-sized is still a research challenge. Intelligent Robotics Laboratory at National Kaohsiung First University of Science and Technology focuses humanoid robot research for many years. We developed many different kind small-sized humanoid. In recent years, we face the big challenge of adult-sized humanoid robot. On 2010, our adult-sized robot participated RoboCup humanoid league competition at Singapore. We captured lots of key points to improve the implementation of adult-sized robot. Therefore, we are successful to build Aaron for RoboCup 2016.

Over 20-year history, RoboCup is successful to promote robot research, especial humanoid robot. In every year, the organizers of RoboCup upgrades competition rules for the boosting of humanoid robot research. The annual competition, RoboCup, becomes a popular activity for researchers and expert.

For the humanoid competition in RoboCup, stable walking gait, computer vision, etc. are the fundamental function of adult-sized robot. We design and implement many special features in Aaron. For example, we install many extra gear boxes at some special joints. We believe Aaron will have good score in adult-sized robot games.

### Mechanical Design

The idea of Aaron's structure is come up from our experience in the research of small-sized humanoid robot. The mechanical and kinematic model of Aaron are shown in Fig. 1. We install lots of extra gears on each leg's joints as shown in the right picture of Fig. 1. The extra gears are designed to cover Aaron heavy body. In addition, some parts of Aaron hand are printed by 3D printer. Table 1 is the specification of Aaron.

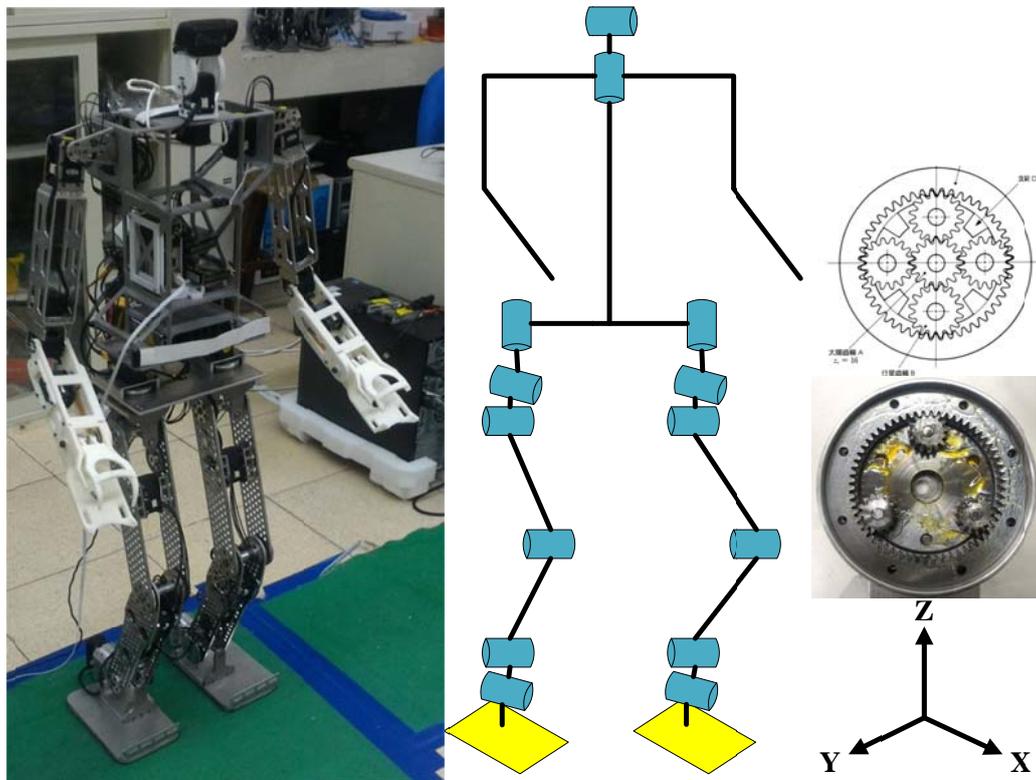


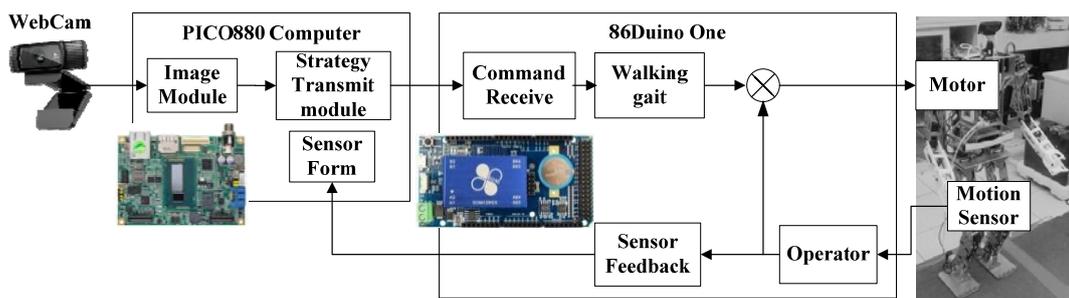
Fig. 1. Aaron's Structure

**Table 1.** Aaron specification.

Height(cm)		130	
Weight(kg)		15	
DOF	Leg	12	
	Arm	10	
	Head	2	
Servo		Robotis MX106	
		Robotis MX64	
		Robotis MX28	
Sensor		Gyro	MPU-6050
		Acceleration	
Control System	Main Controller	PICO 880	
	Motion Controller	86duino One	
Walking Speed		9 meters/minute	

### Control System

In our design, the control system of Aaron consists of two boards as shown in Fig. 2. One is PICO 880 for computer vision process and strategy command, and another is 86duino for motion control and sensor feedback. PICO 880 can catch the image from webcam, and send strategy commands according to different game. Then the motion controller 86duino will receive the command for servo motor control and adjust walking gait based on sensor feedback.



**Fig. 2.** The control system block of Aaron.

### Conclusion

RoboCup is a fantastic competition. It's a chance we can make the AI robot by ourselves and sharing different knowledge with the other team which come from the whole world. We prepare to participate RoboCup 2016 for almost one year. We believe we will have good performance in RoboCup for Adult-sized humanoid league.