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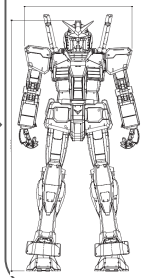
Development of GUNDAM Research Open Platform

Outline: Develop an open robot platform for software and hardware being based on a real GUNDAM MOBILE SUIT and establish a system that allows the young generation around the world to freely pursue their dreams into robot development, contributing to the development of the field of robotics and connecting it to the realization of REAL GUNDAM.

GUNDAM Research Open Platform

Development of a GUNDAM Research Open Simulator

Development of a Human size GUNDAM Research Open Simulator



full body with 28-degrees of freedom
weight 100kg
Corei7 CPUx2
801.11 WiFi
battery-powered

evolving application research using an open platform

- Distributing hardware to international research organizations
- Creation of a GUNDAM research communities

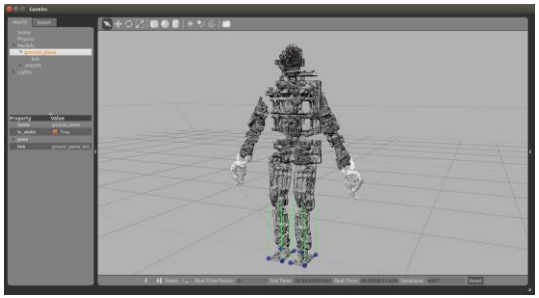
realizing a full-scale GUNDAM

development under this plan

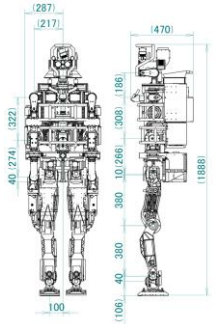
existing technology

robot research environment infrastructure

dynamics and sensor simulation environment



Human size robot



application research for disaster response tasks

- wheel operation
- opening door
- turning valve

Project development

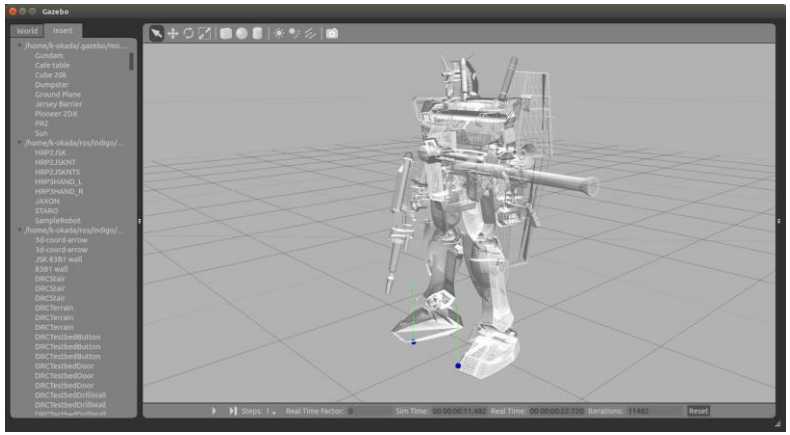
This project seeks to develop an open platform for GUNDAM robot software and hardware for wide distribution and to attract a wider range of people into this challenge. This project's characteristic is to establish the focal point of leading edge robotics technology centered on GUNDAM and construct a foundation to realize REAL GUNDAM by creating an open platform adopting technology that supports the world's leading robot development. In order to realize this REAL GUNDAM in 2020, it is necessary to create an open robot platform by 2016 at the latest. Therefore we perform the following two development items by using existing technology: A) develop a GUNDAM simulator that enables a complete real robot simulation (drive system, recognition system, motion system, physics engine), B) develop a human-sized test model that demonstrates that walking and standing up motion shown by the simulator is possible in the real world.

A. Development of a GUNDAM simulator that enables a complete real robot simulation (drive system, recognition system, motion system, physics engine)
B. Development of a human-sized test model able to demonstrate in the real world the walking and standing up operations possible with a simulator.

A)　Development of GUNDAM simulator

Develop a robot simulator for developing GUNDAM that simulates the motion of GUNDAM from a human-sized type to a full-scale type. This simulator is based on the Gazebo software.　Modeling the drive unit or force such as motors and gears, and the sensor unit such as balance and vision is possible in this simulator. In the field of robotics research, success of modeling some motion in this simulator has been a great boon to the development because it suggests the feasibility of motions performed by real robots. This development includes creating a simulator, a GUNDAM model that operates in the simulator, a basic action library (standing up, walking, etc.). We are going to release the simulator to the public with an interface supporting ROS open middleware, generally used in the global robotics research industry.

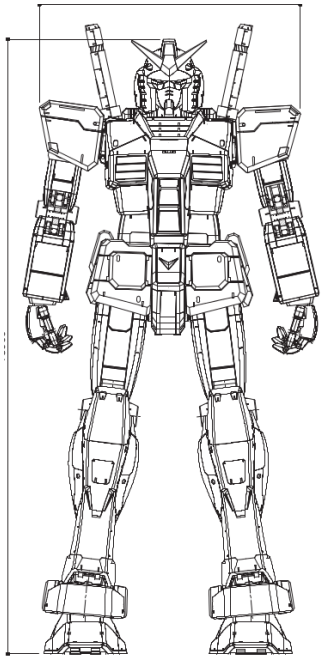
This aims to help the GGC members develop technologies by releasing the simulator to the public.



simplified programming for everyone using an open platform.

B)　(A REAL GUNDAM)
Development of Human-sized test model

Develop a human-sized (Approx. 2m) GUNDAM robot to test the feasibility of the body, motions and actions created in the simulator. After developing lower and upper body test models and demonstrating the basic movements, develop a mechanism to join with the cover without impairing design for full body assembly. Then, the following about the developed robot will be confirmed: support the similar ROS interface as the simulator; stand up and walk without changing the motion program demonstrated in the simulator.

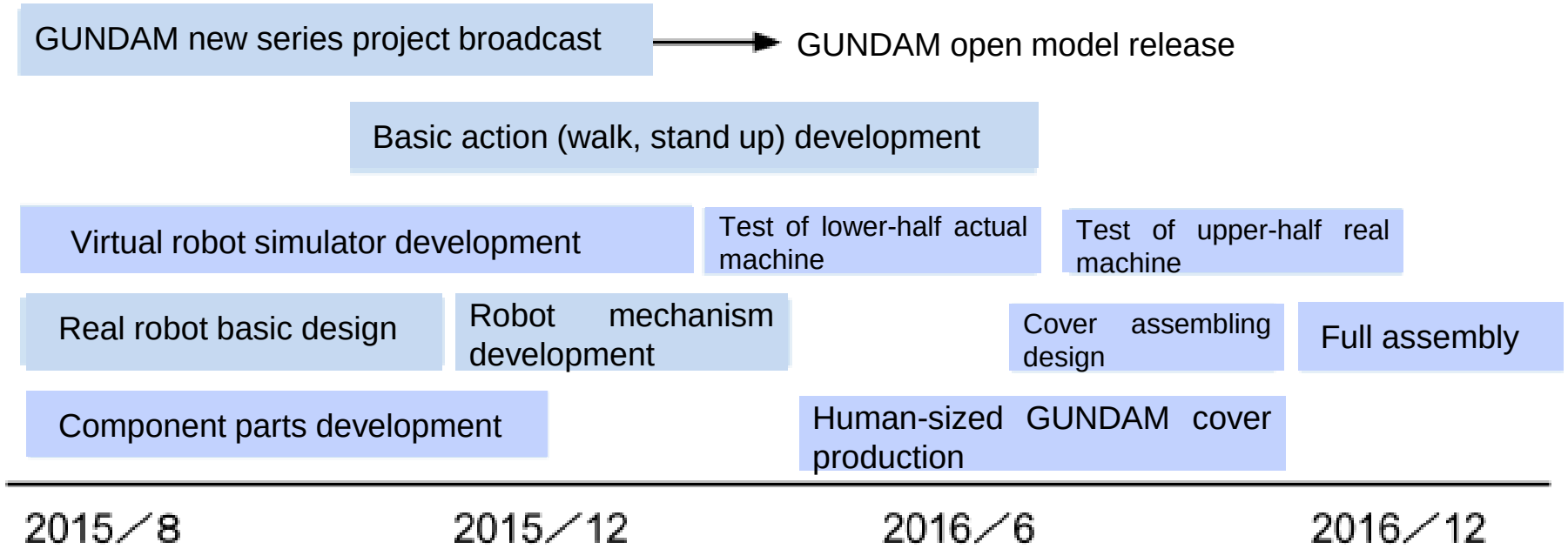


full body with 28-degrees of freedom
Legs: 6-axis
Arms: 7-axis
Neck: 2-axis
Height: 170cm (approx.)
Weight: 100kg (approx.)
Sensors:
　IMU
　Distance camera
　force sensors
Corei7 CPUx2
801.11 WiFi
LiFe battery 72V drive

Double motors used for knee pitch axis
Motor torque　250Nm-500Nm
Motor　：EC-4pole 30, 200W
Gear　：CSD20-160, CSD25-150, SD32-100
　and others

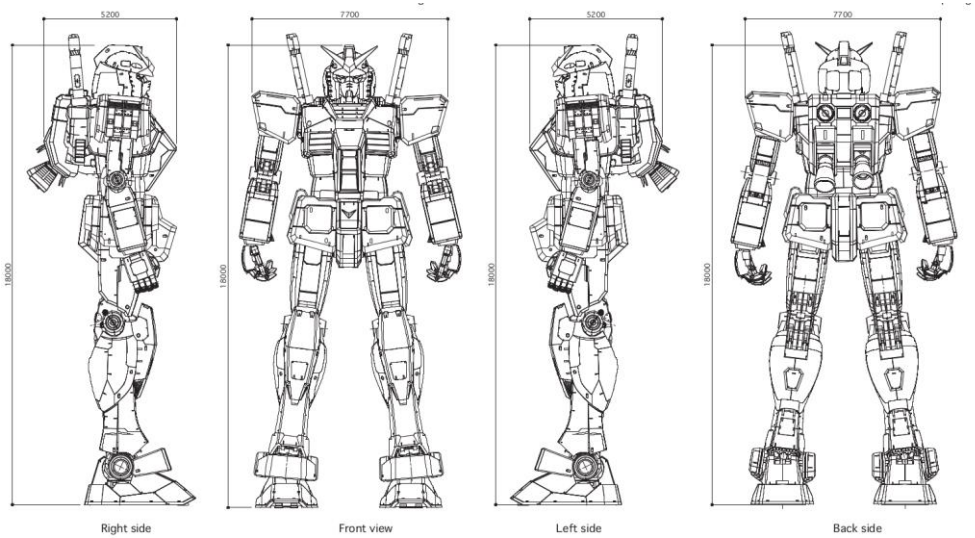
Development schedule

The aim of this project is to develop a GUNDAM simulator and a human-sized GUNDAM robot, by which we can research and develop real and virtual robots. This leads to realizing an open platform that allows the researchers, programmers and hobbyists around the world to take part and chase their dreams in making a REAL GUNDAM. Therefore, it is necessary to develop and distribute the simulator environment in a half year after starting the project, and then develop a human-sized GUNDAM robot for another year so as to be widely used by the GGC members.



Development schedule：Open MOBILE SUIT model

Evolution of the open platform requires RX-78-2 GUNDAM 3D model data (link data, joint data, appearance and shape). Furthermore, to evolve 3D model data as an open platform, it must be provided under an open license (e.g. Creative Commons https://creativecommons.org/licenses/by-nc-sa/3.0/deed.ja) If it proves difficult, the plan is to develop a new MOBILE SUIT which can be provided with an open license, and broadcast the new TV series to involve the viewers, while conducting development and expansion of the open platform.



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Development schedule：Evolve

After the open platform is completed in a year and released, for real robot creation, further research will be conducted to solve the technical problems for a full-scale GUNDAM in the virtual environment, including: establishing a simulation software support consortium, holding Virtual GUNDAM Challenge conferences, and expanding the research platform for the human-sized GUNDAM robot globally.