

BeRobot – The Robotic Scientific Education Development Kits

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Abstract

As many humanoid robot in the market, designed on the size of 30 cm tall and 1.5 Kg weight, is too heavy to take along and its 10 kg-cm (servo) torque is too dangerous to the environment. Therefore, GeStream Technology Inc. designed a special mini servo to build the special mini humanoid robot – Be Robot stands at only 15 cm tall with full high tech robotic functions to provide a new era solution for edutainment market.

Keywords: Robotic; Scientific education; Humanoid robot; Development kits

Introduction

BeRobot is a robotic and scientific education development platform, which includes a BeRobot motion commander. It is a user friendly graphic interface that even a beginner can easy control the robot with his imagination, such as: twisting, bending down, bending knees, dancing, pushing up, walking, standing by one foot, Tai ji quan, playing football. The BeRobot can be re-configured as many different types by its re-assembly mechanism design, you can reconstruct your Be Robot as robotic dog, robotic dinosaur, robotic scorpion, robotic arm, even aspiring your dreamed transformer. Besides, you can also programming its CPU firmware to design your request or upgrade its function/sensors by plug-in additional module [1].

With BeRobot, you can learn mechanism design, automatic design, mechanical and electrical design, motion balance, programming design...all the robotic technology. Besides, you can learn how to build and control the BeRobot by the user manual/course CD or download newest motions to upgrade the BeRobot.

BeRobot has multi-function mode:

- Program mode
- Online Control mode
- Remote Control mode
- Interactive mode
- Time Froze mode.

BeRobot intelligent motion designer

Comparing to the complicated Human-Machine Interaction Interface of most robot in the market, we design a user friendly and intelligent graphic control Human-Machine Interaction interface for the BeRobot. It can smartly help you over stride the barrier of robotic technology to design robot motions and reactions with its stability and flexibility intuition control board [2].

The intelligent robotic motion control designer can real-time control and edit 1~16 Degree of Freedom, set up each motion speed, set up each motion travelling time, define 18 function keys of the infrared remote controller, define the reaction of light sensors, touch sensor and expansion IO, to make the robot move as your wish. We also provide Robotic SDK for user to programming their applications in Microsoft MSDN environment (Figure 1).

Multi-functional robotic controller

You can directly communicate with the BeRobot controller via USB, ZigBee, GPIO, blue tooth, Infrared remote controller, mobile phone

(Figure 2). There are 16 DOF controller, 24 DOF controller, and 32 DOF controller which already built-in with sensors and 8 GPIO for connecting our external sensors or controllers such as: Gyro, Speed sensor, Ultra sonic sensor, RC controller, Bluetooth controller, ZigBee controller, Voice command controller, Video controller, 2G/3G mobile phone controller [3].

Mini Robotic Servo Motor

When designing robots, traditional servo motor cannot satisfy the special request of high torque, high stability and reliability, high precision, long time playing, over current protection, over force protection, therefore, we designed the special robotic servo – BeRobot Servo.

By connecting BeRobot Servos with BeRobot Al-Mg alloy Linkages, user can make kinds of transformers and produce lots of interesting robot motions (Figure 3).

Most valuable safety, lightly, variety and functions

BeRobot is a scientific experiment package for all kinds of students/engineers from elementary school to graduate school, research institute. We design it with lightly weight, little servo torque, high quality Al-Mg alloy material and ROHS compatible materials to prevent from harming students [4].

When you learn controlling BeRobot, it means you can control many kinds of multi-degree industrial robot, and even more, you can expand your RC controlling pleasure by expanding many sensors. BeRobot is one of the most valuable robotic development packages with the advantage of safety, lightly, variety and many functions.

BeRobot have a family: 11DOF mini BeRobot, 8DOF BeRobot Legs, BeRobot dogs, BeRobot dinosaur, BeRobot scorpion, BeRobot auto car, BeRobot Arm. Power your imagination now to make the robot to be your dreamed Robot!

Specifications

World's smallest autonomous Humanoid Robots

The BeRobot from GeStream is the current Guinness World

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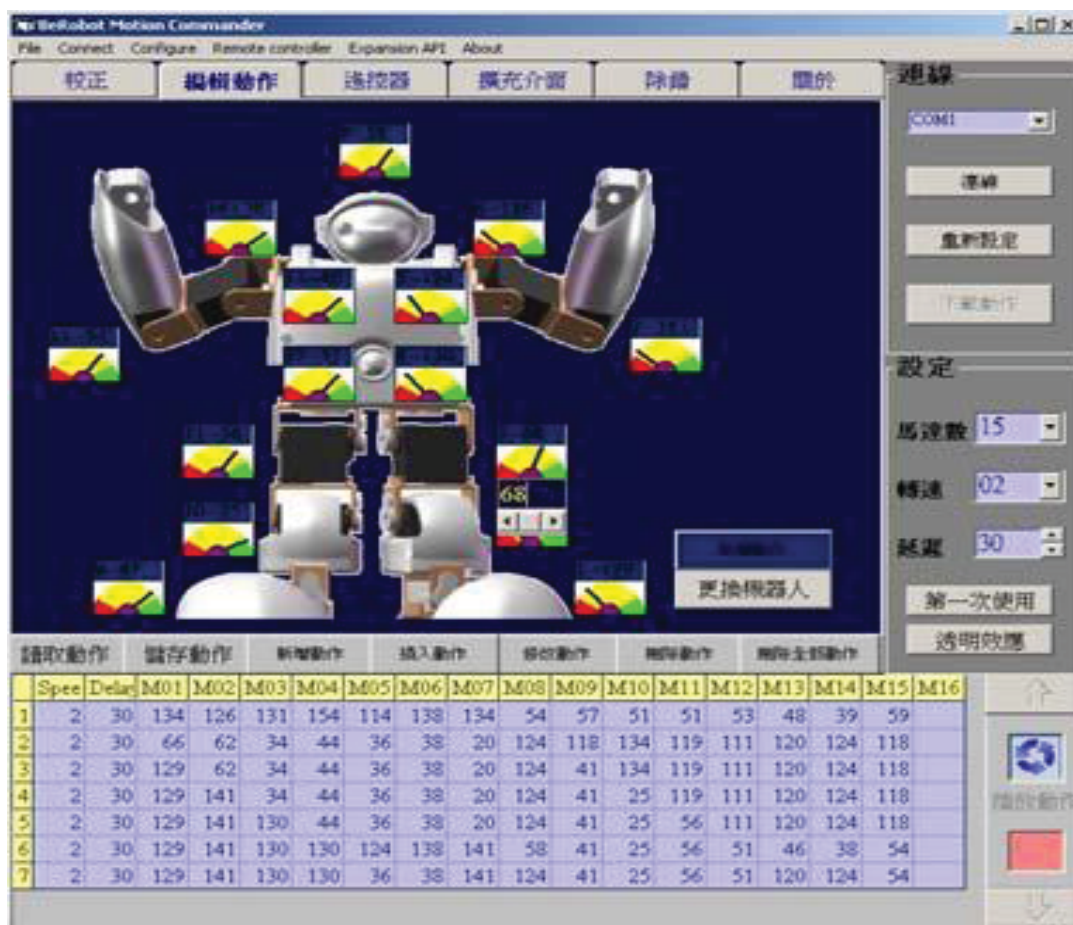


Figure 1: Visual Basoc.

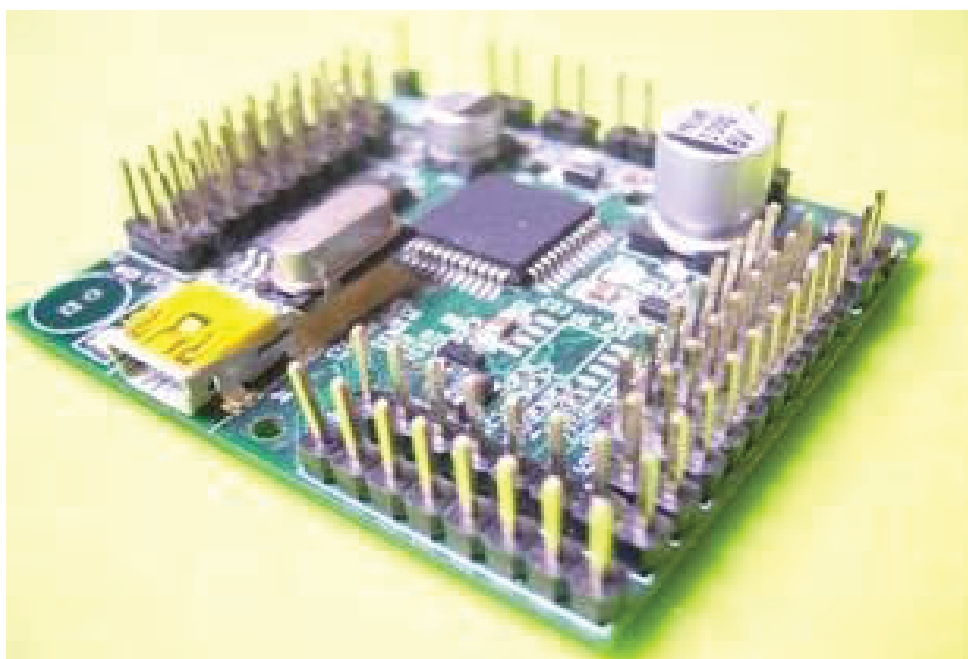


Figure 2: Multi-functional robotic controller.

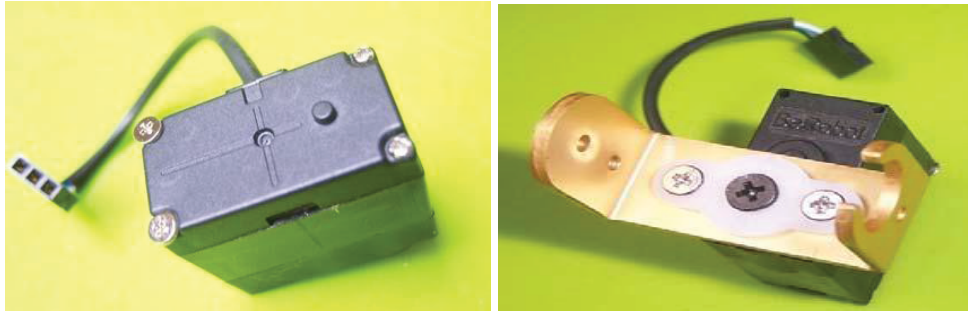


Figure 3: Mini Robotic Servo Motor.

Record holder for the smallest humanoid robot in production since 2007. Though it is very small, but its embedded robotic development platform enables it lots of incredible versatile function and education materials The BeRobot can show you how easy to program and build as various robot types, not just a toy with simple behaviors. It is an educational robotic learning tool kits for students/ engineers of all ages and all abilities, from primary/high school/university students to researchers and experienced hobbyists. It enables everyone to learn all kinds of robotic designs, including robotic mechanism, robotic electronics, robotic control and robotic programming. It is the perfect education robot for parents/ teachers who want their young children/ students to learn about robotics for these key reasons;

- **Safety:** As a result of its small size, the BeRobot does not require powerful motors to perform the same actions as larger robots. This ensures that if a finger is accidentally caught by a moving robot arm or leg, the pressure applied to the finger by the robot is insufficient to cause harm.
- **Many robot types:** BeRobot can be reconstruct as more than hundreds of different types, for examples industrial Arm, dinosaur, dog, scorpion, snake, humanoid...Students or Engineers can learn and enjoy the creation of many fancy robots and learn its motion analysis by steps and steps learning books or 3D assembly animation
- **Many programming languages:** BeRobot Motion Commander is a GUI mouse controlled software for novice users who are just stepping into robotics to easily learn how to design robot motions, BeRobot also provides SDK for experienced users to program in Visual Basic, Visual C++/C#, Assembly, or Java/Android. BeRobot also provide FDK for a hacker to program its embedded CPU firmware.
- **Many expansion abilities:** BeRobot can be upgraded its functions by lots of optional expansion modules (sensors, controller modules).

Features

World record holder: Guinness World Records, International Robot Competition in China, Industrial Innovation Achievement Award, National Quality Assurance Golden Award, Business Start-Up Award, Jin-Yi Award Creative Design Award, Golden PIN Award, Product Insurance from Zurich insurance, Certification by International Design Alliance, Mini Robot Cup.

Graphical user interface: Friendly Game-like Software (Graphic User Interface in both English and Chinese versions) for beginner, to easily learn and program robotic motions. It helps beginners/students

quickly learn robotic programming concepts. Making it an ideal learning platform for all ages and experiences.

BeRobot SDK:

- Advanced version provide SDK and open source codes for engineer to design advanced projects in VB/VC++/VC#/Java or iPhone/Android. It enabling users to develop advanced robotic programming techniques as their skills improved.
- Bluetooth version provides Android APP to control BeRobot without computer.
- Control up to 16/24 servo motors at the same time.
- provides IRDA, UART/USB, 8 GPIO interfaces for user to upgrade functions with modules, such as voice command module, touch sensor, Arduino sensor modules.
- Its firmware on the controller is programmable by FDK.

Servo:

- High performance, High precision, dual bearing Servo Motor
- Embedded with IC protection technology to prevent Servo IC from crash or burn down.
- Embedded with almost zero backlash gear sets
- Embedded Sensor with 500 k times of precision life cycles.

Transformer: BeRobot can be reconstructed as hundreds of types, such as dog, dinosaur, scorpion and crab, humanoid. Rotatable waist design made its performance more stylish. Easy to replace any damaged parts and save maintenance costs.

- **Remote Control:** It's easy to program/define 18 function keys of the fancy small remote controller.
- **Emotion Light:** The BeRobot has a 7 color flashing LED located at its belly as Emotion light.
- **Light Sensor:** BeRobot embedded with two light sensors detecting light intensity changes to trigger motion sequences. For example it could trigger a motion sequence when it detects an object/ person pass between itself and a light source.

Innovative robotic education: Includes 3D DIY animation, Steps by steps User Manual, Teaching Guide (for Assembly/Programming). Experiments for Mechanism design, Mechatronic design, Electronic design, Automatic Control, Sensors Interactive, and Motion Balance. Mini Robot Competition every year.

Long running time: Embedded with battery power saving

technology to save much Power consumption. The BeRobot can operate up to 100 minutes using four 1000 mAh NiMH AAA batteries.

Small and easy: Easy to carry, easy to program robot at small table. Does not need to occupy much space.

Main Objectives of Be-Robot

Dimensions of 15DOF BeRobot

- **Height:** 155 mm
- **Width:** 105 mm
- **Depth:** 65 mm

Body of 15DOF BeRobot

- **Type:** aluminum-magnesium alloy frame with plastic outer shell.
- **Mass:** 280 g

Servo

- **Type:** BeRobot Robotic Servo designed and manufactured by GeStream
- High performance, High precision, Embedded with circuit protection technology, to prevent Servo IC from crash or burn down.
- **Communication:** PWM (pulse width modulation)
- **Life Cycles of Precision Sensor:** 500 K times rotations
- **Speed:** 0.12 seconds/60 degrees (12 speed settings)
- **Torque:** 1.5~2.0 kg-cm torque (electronic protection design)
- **Gears:** plastic and brass (665 times reduction gearbox with dual bearing design and reinforced magnesium alloy shaft)
- **Maximum Operating Angle:** 180 degrees/360 degrees(Optional)
- **Dimensions:** 22.5 mm × 11.5 mm × 22.5 mm (excluding protrusions)
- **Mass:** 8.5 g (not including servo horn)
- **Operating Voltage:** 4.5~6.5 V

Onboard control

- **Type:** 16DOF(Degrees of Freedom) BeRobot Controller (SOC onboard)
- **CPU:** GeStream CPU (Maximum 40 MHz) , Firmware is programmable
- **Memory:** 64 kB (Flash: firmware can be modified), 512byte (RAM)
- **Ports:** 8bit bi-directional/bit-addressable IO port, one 4bit programmable IO port, three 16bit timer/counters, 1 full duplex serial port, USB IO port, IrDA IO port, Speaker IO port, Touch sensor IO port, Light sensor IO port, Expansion IO port, Batteries Input port.
- The BeRobot can connect its optional modules by its external input/output interfaces, such as: gyro module, voice control module, image sensor module, ultrasonic sensor module,

Bluetooth control module, Zigbee control module, 2G/3G mobile phone control module.

- Easy to download and update its newest robot motions from website

Remote control (Advanced package)

- **Wireless:** 18 key wide range infrared controller
- **Modes:** remote control, time freeze, random

LED (Advanced package)

- **7 Colors:** 7 colors flashing LED located at its belly
- **Blue color:** located at its Eyes

Sensors (Advanced package)

- **Optical:** 2x optical light sensors (can sense changes of light intensity).

Conclusion

The BeRobot line is a fully-featured robotic technology development platform with range of artificial intelligence functions that includes programmable movements, sensor functions, wired and wireless remote control, an easy-to-use graphical user interface, and easy access to programming functions. Robust functionality and ease of use makes BeRobot a world-class solution for technology educators to enhance training in industrial engineering, robotics and artificial intelligence.

BeRobot is a scientific robot development platform, leading the future innovative technology and education.

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