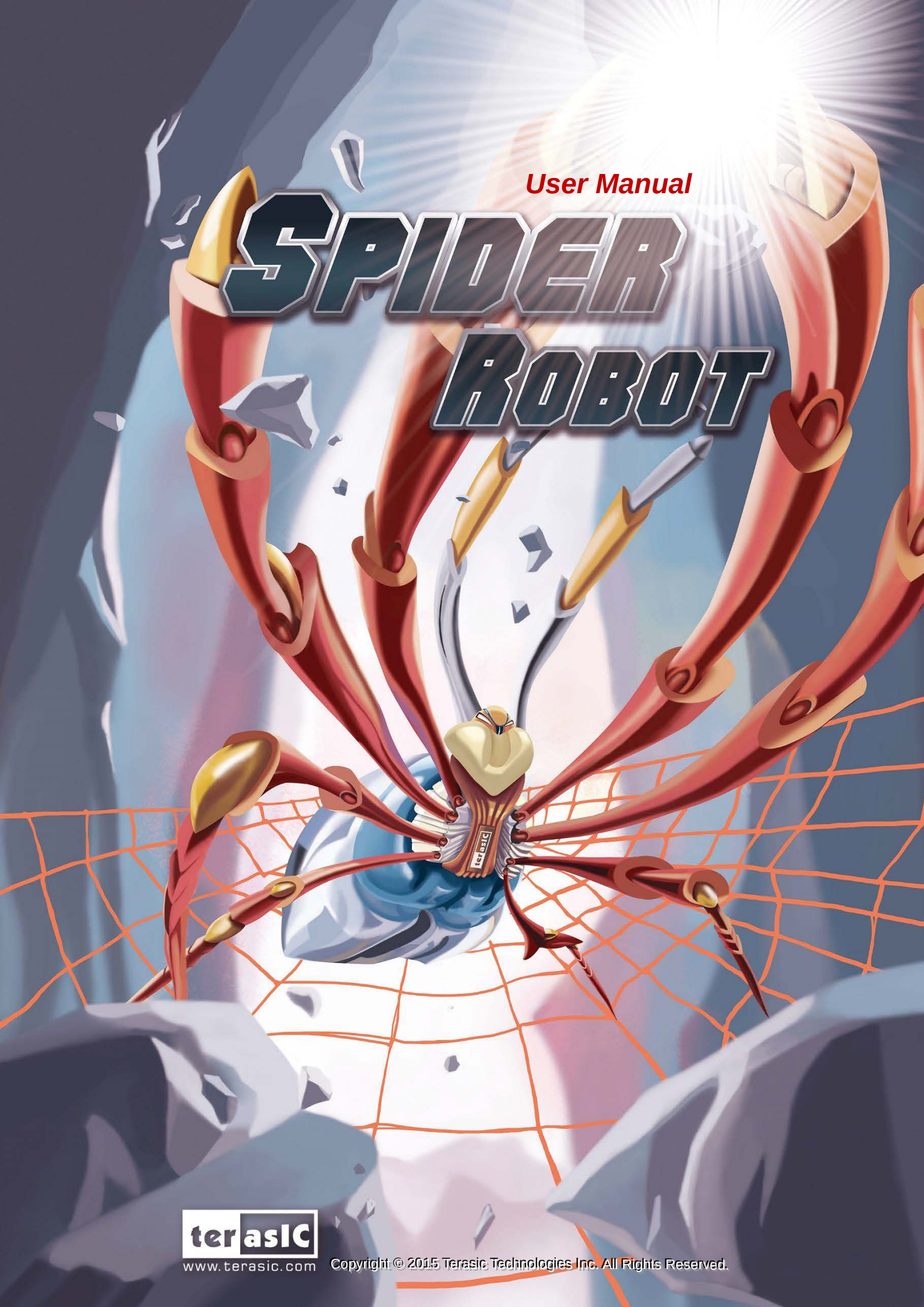

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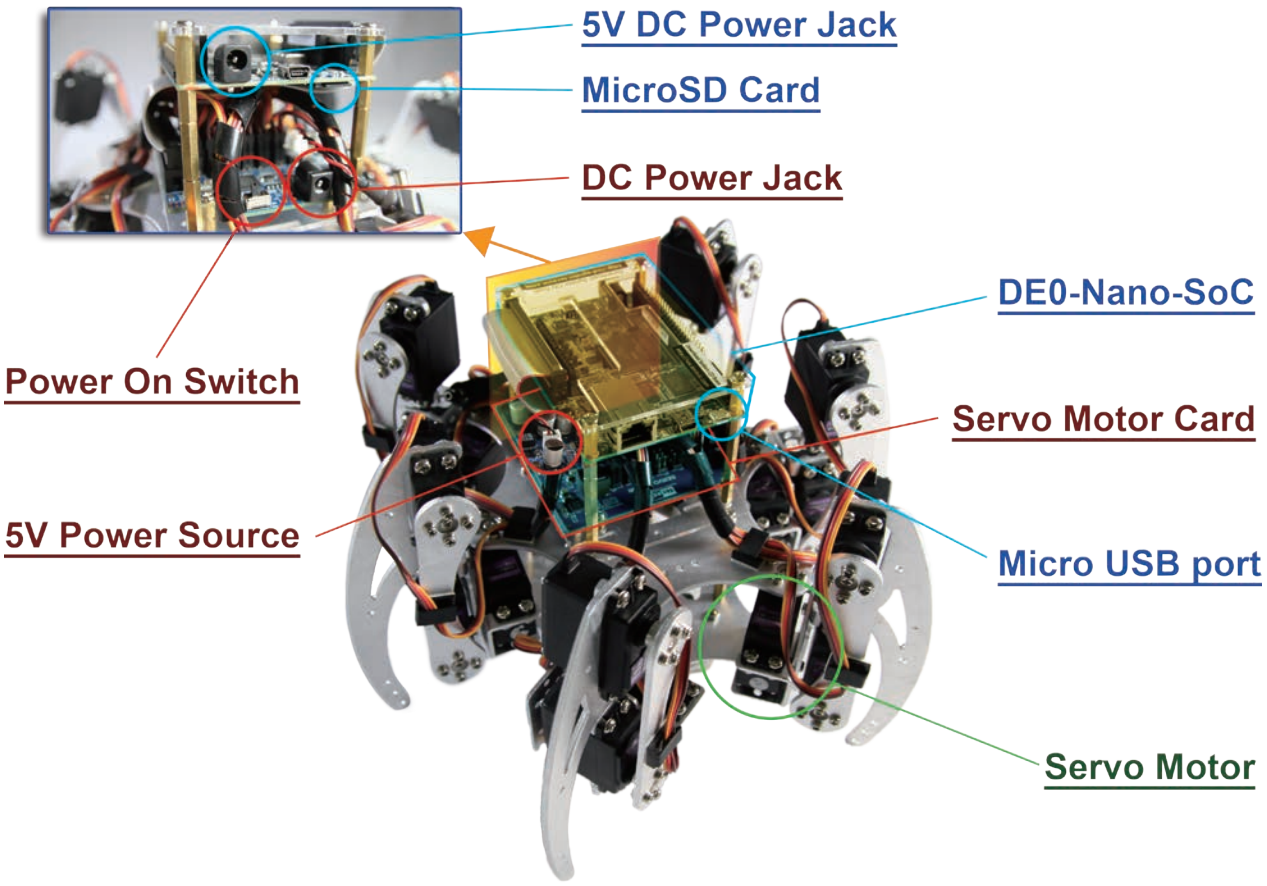
Chapter 1 : Terasic Spider

1-1 Introduction



The Terasic Spider is a six-legged walking robot which is driven with 18 Servo Motors. These 18 Servo Motors are controlled by PWM signals generated from the Altera DE0-Nano-SoC board embedded inside the Terasic Spider. The Terasic Spider itself can be remotely controlled by a bluetooth enabled Android device. The software app we developed can control the Terasic Spider, allowing it to move in four directions, swing based on the g-sensor data, and even complete a dance with pre-defined movements.

All the source codes of the Terasic Spider is available with the kit. You can modify the code to improve or to change the Terasic Spider's functions according to specific applications. The source codes include Andriod project, Linux application project, and a Quartus project.

Note that there is a 2x20 GPIO expansion header available on the DE0-Nano-SoC board. You are free to use it to expand functions, such as camera, ultrasonic, or anything else.

1-2 Package Contents

The kit contains:

1. Spider Box
2. Assembled Spider
3. Battery
4. MicroSD Card (Pre-programmed & Installed)
5. USB Bluetooth Dongle with Adapter
6. 5V to DC Plug Cable
7. Battery to DC Jack Cable
8. Battery Connector Adapter Cable
9. Servo Motor x2 (spares)
10. 12V DC Power Adapter
11. USA 3-pin AC Cord for 12V Adapter
12. 5V DC Power Adapter
13. Mini USB Cable
14. Micro USB Cable
15. Battery Charger
16. User Manual

1-3 Getting Help

These are the different contact methods available to contact us in case you encounter any problems:

- Terasic Technologies

  9F, No. 176, Sec. 2, Gongdao 5th Rd, East Dist, Hsinchu City, 30070, Taiwan

  Tel: +886-3-575-0880

  Email: support@terasic.com

  http://spider.terasic.com

Chapter 2 : Start Up - Instruction

2-1 Power System of Spider

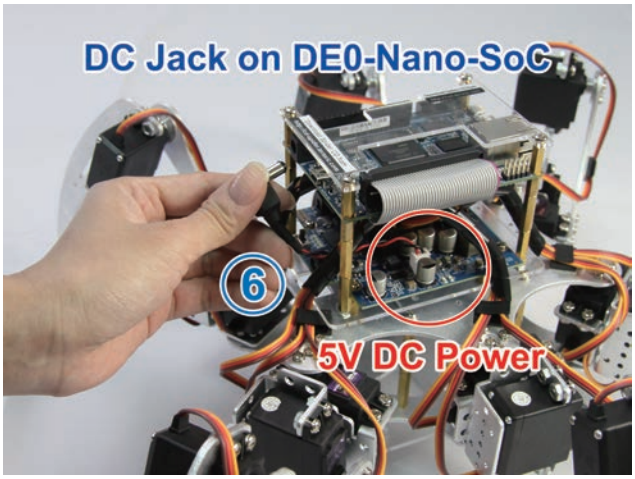
- Main Motor Board is powered by battery pack (two packs at once) or 12V DC adaptor.
- DE0-Nano-SOC board is powered from the DC jack on the motor board.
- When Battery is used as power source, Battery pack must be bundled with the conversion cable to the DC power connector.

2-2 Power up the Spider with DC Power Adaptor

1. Please make sure the Spider is placed on the flat ground and the surrounding area (at least 20 cm radius) is cleared.

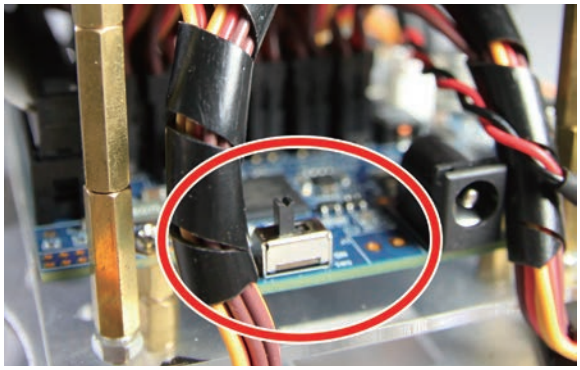
   Note: Avoid the Spider's legs getting obstructed, or the motor may be damaged.

2. Connect 5V DC power from the Servo Motor Card to the DC Jack on the DE0-Nano-SoC via " ⑥ 5V to DC Jack Cable".

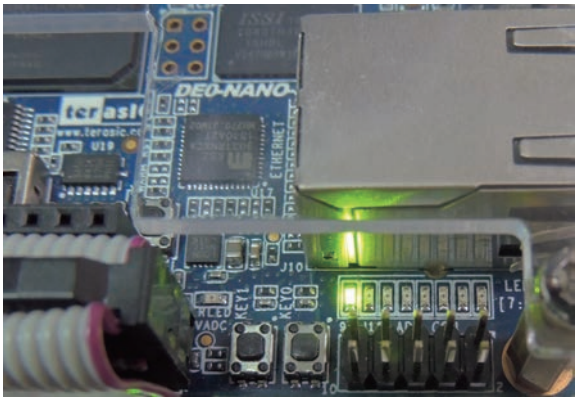


3. Connect " ⑩ & ⑪ 12V DC power" to the DC jack on the Servo Motor Card.

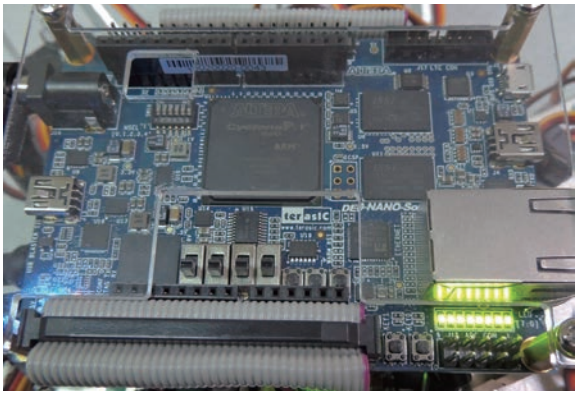
4. Switch the Power Switch on the Servo Motor Card to "ON" position.



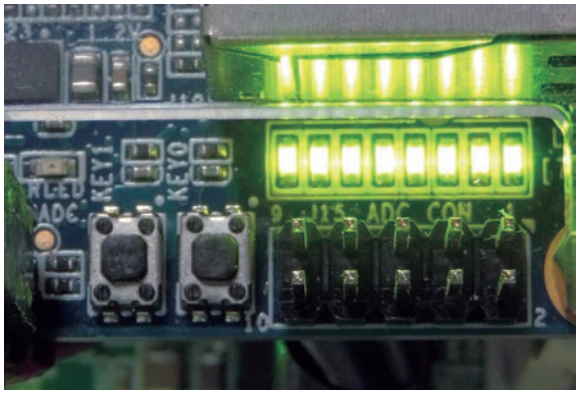
5. After 5 seconds, the LED7 on DE0-Nano-SoC will blink.



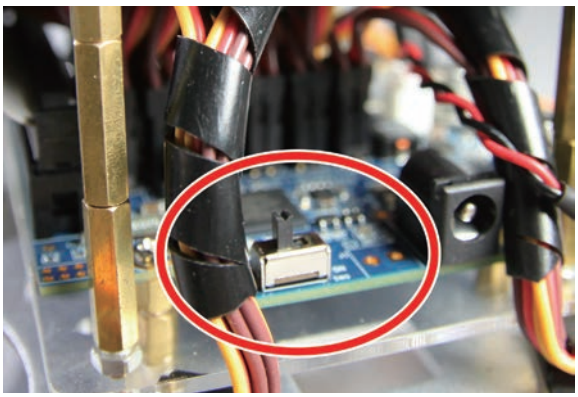
6. The Spider will begin to stand up after LED7 blinks for 10 seconds. LED0~6 will stay on once the initialization is completed.



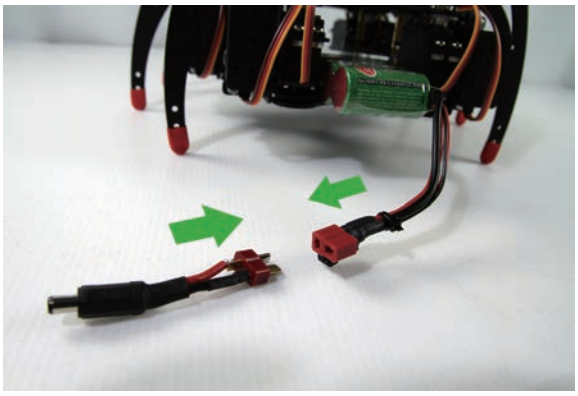
7. Press KEY1 on the DE0-Nano-SoC and the Spider will start the “Dancing” demonstration.



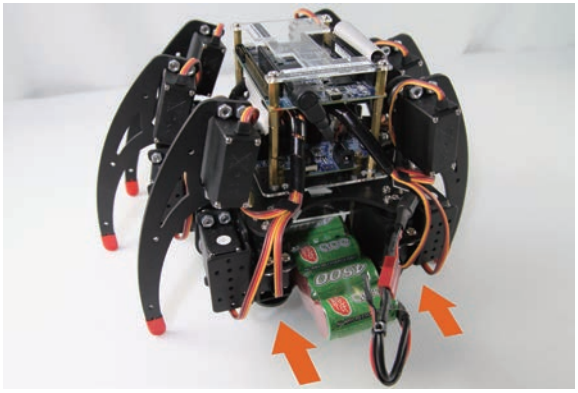
2-3 Power up the Spider with Battery



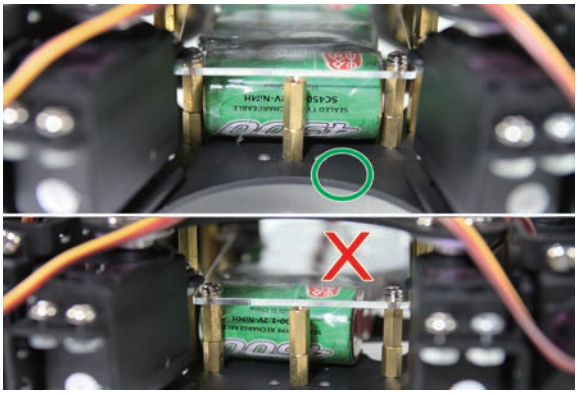
1. Switch the Power Switch on the Servo Motor Card to "OFF" position.
2. Remove the 12V DC Power



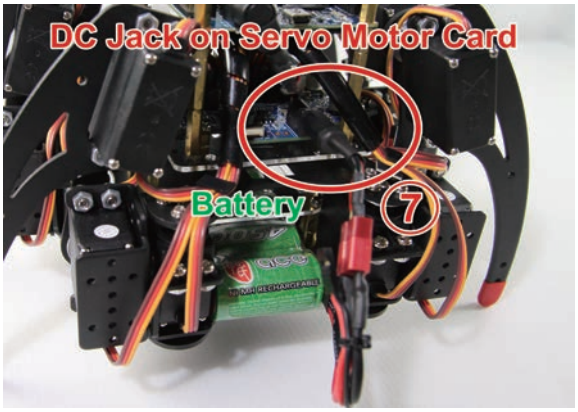
3. Connect the Batter-to-DC jack cable to the battery.



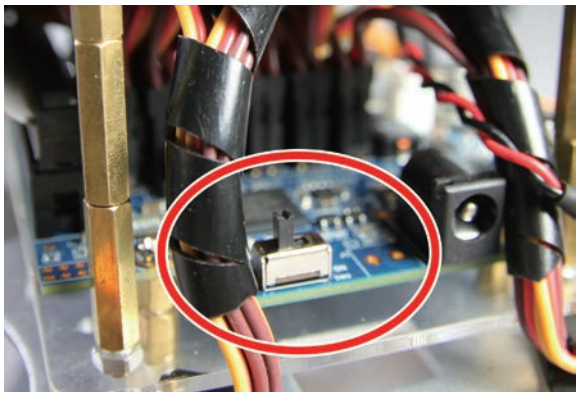
4. Install the battery into the Spider Robot from behind.



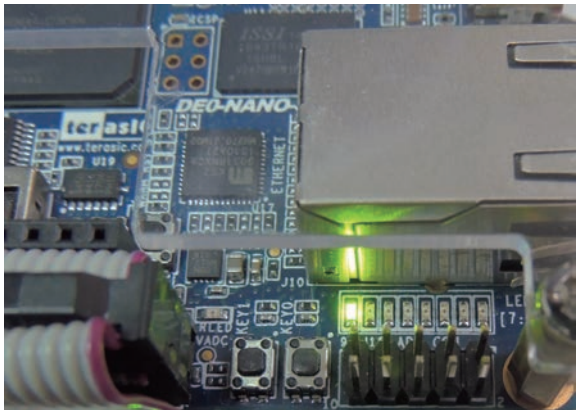
5. Check if the battery is installed properly from the other side. The battery needs to be center placed.



6. Connect the battery to the DC Jack on the Servo Motor Card via " ⑦ Battery to DC Jack Cable".

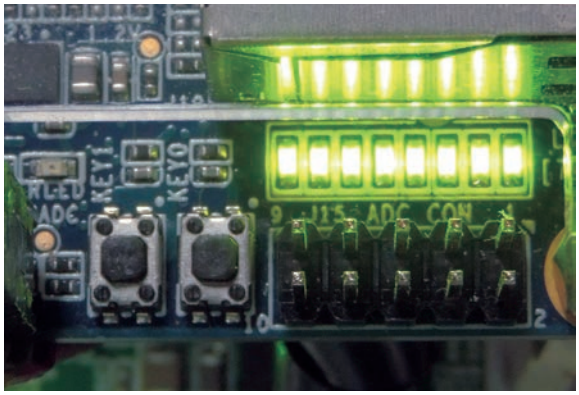


7. Switch the Power Switch on the Servo Motor Card to "ON" position.



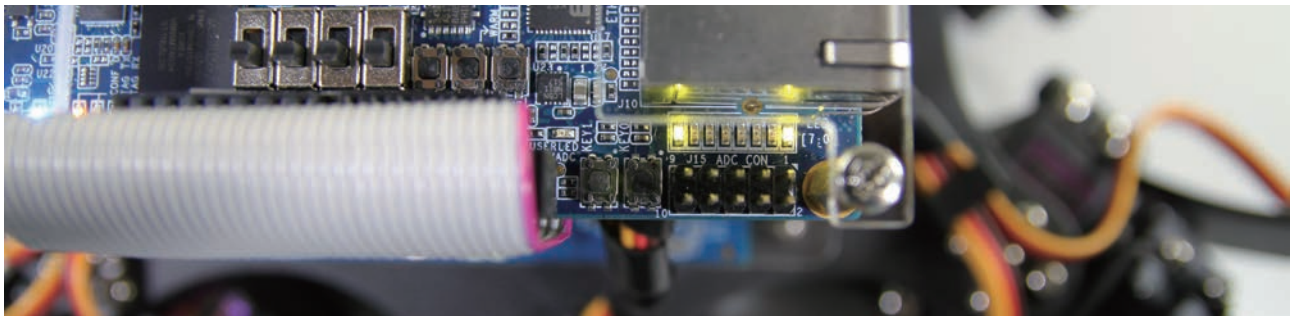
8. After 5 seconds, the LED7 on DE0-Nano-SoC will blink.

9. The Spider will begin to stand up after LED7 blinks for 10 seconds. LED0~6 will stay on once the initialization is completed.



10. Press "KEY1" on the DE0-Nano-SoC and the Spider will start the “Dancing” demonstration.

2-4 Auto Power Saving Mode



1. When the Spider Robot is idle for a while i.e. not receiving any command, it will enter power saving mode automatically. It will remain its current position with all the servo motors turned off.

2. The LED0 on the DE0-Nano-SoC will remain on and the LED7 will be flashing while other LEDs onboard will be turned off.

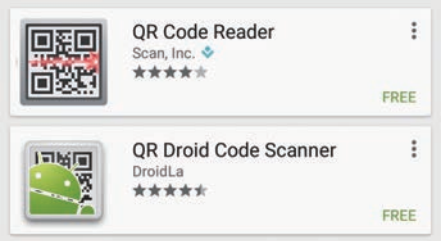
3. The Spider Robot will "wake-up" upon receiving any command either from the push-button onboard or transmitted from your Android device. The status of LED0 and LED7 will remain the same while other LEDs will be turned on.

4. The Spider Robot will return to its last position upon wake-up before executing the new command.

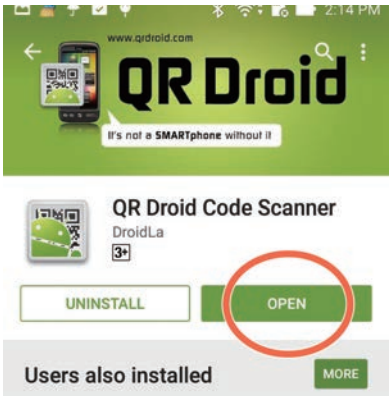
Chapter 3 : Control the Spider with Smart Phone (Android)

Besides using Key1 to make the spider dance, you can also use cell phone application as one of the control methods.

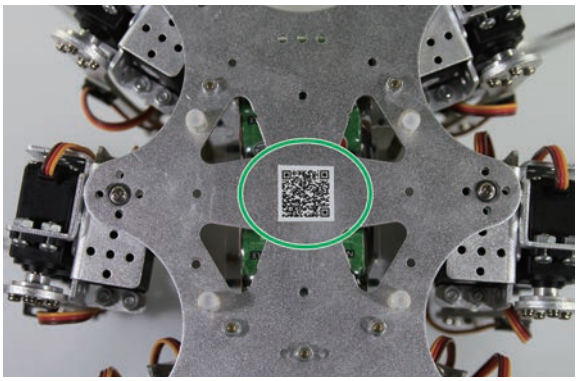
1. Download and install any QR Code application you preferred from your google app store.



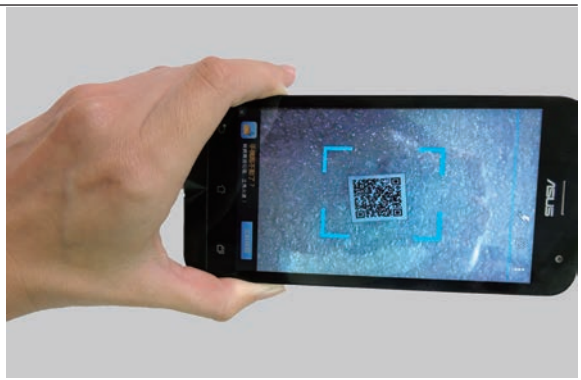
2. After downloading, open the QR code scanner from the cell phone.



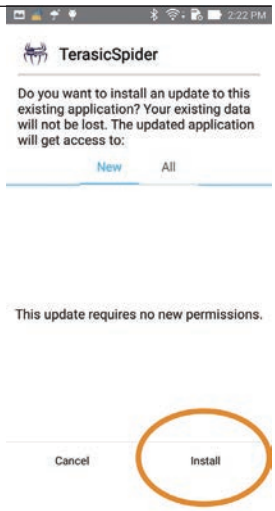
3. You can find the required QR code at the bottom of the Spider.



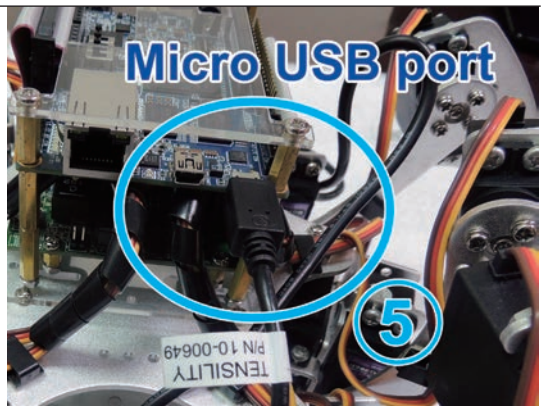
4. Scan the QR code to your cell phone.



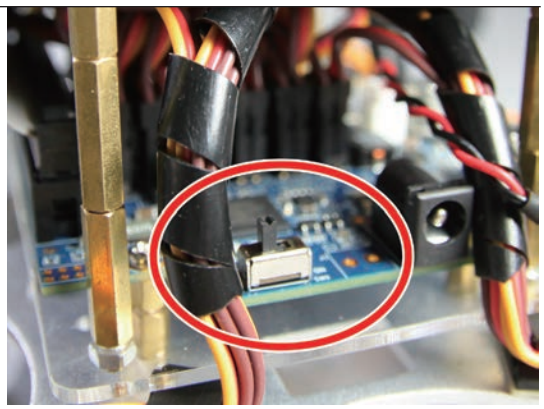
5. Download and install the "TerasicSpider" application into the cell phone.



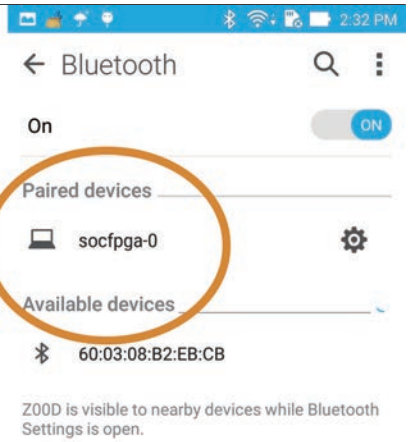
6. Insert the “⑤USB Bluetooth Dongle with the adapter ” into the Micro USB port on DE0-Nano-SoC.



7. Switch the Power Switch on the Servo Motor Card to "ON" position.

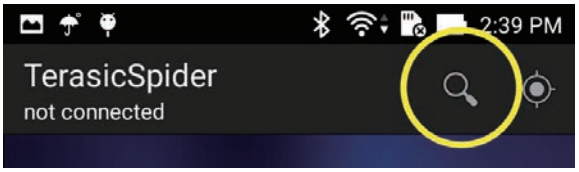


8. After the Spider stretches its legs, then launch Android Bluetooth utility to search "socfpga-0" and pair it with pin code 0000 (if required).



9. Launch the TerasicSpider application on the cell phone.

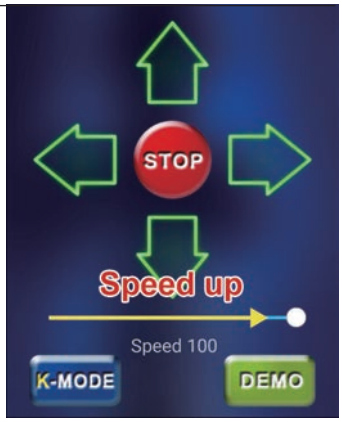
10. Click on the Search Button on the top-right corner.



11. The screen will have a pop up window showing “select a device to connect”, select “socfpga-0”.

12. If the connection is established successfully, the color of Bluetooth logo will turn to green. The Spider can now be controlled from the cell phone.

13. The four Arrow Buttons control the Spider movement in four directions (default mode). Spider's movement speed can be controlled by the Speed Slider. Slide left to slow down the Spider; Slide right to speed up.

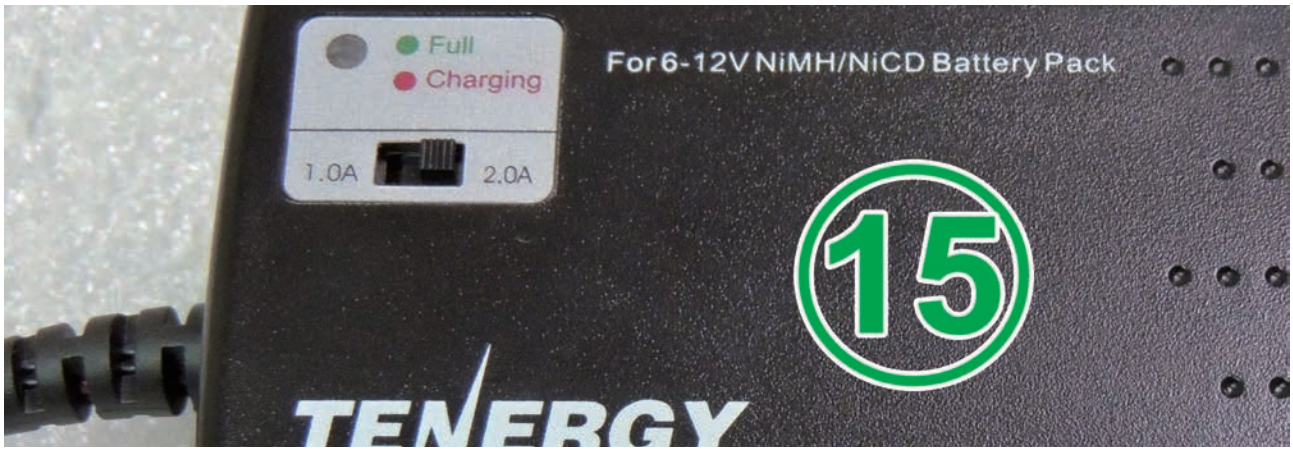


14. Press the "K-Mode" button will switch to "G-sensor" mode. Switch again will return to the default mode controlled by The four Arrow Buttons.

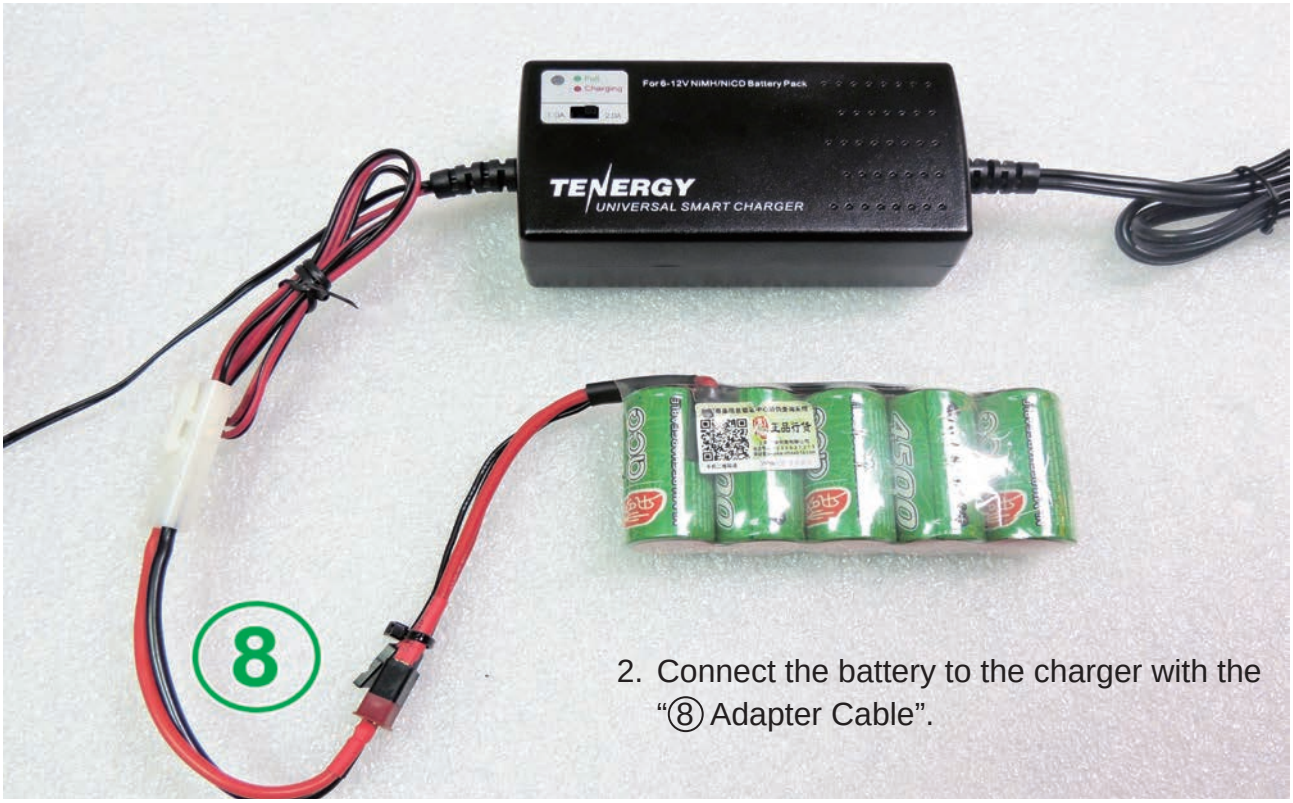
15.Press the "DEMO" button to execute the "Spider Dancing Demo".

Chapter 4 : Charge the Battery

After the battery run out of charge, you can do the following steps to recharge your battery.



1. Switch the current of "⑮Battery Charger" to 2.0A.



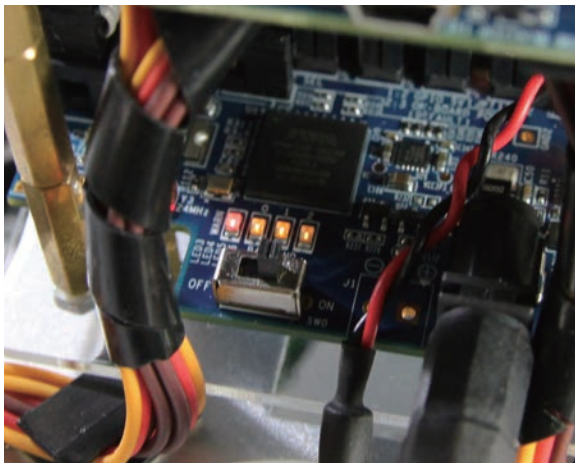
2. Connect the battery to the charger with the "⑧ Adapter Cable".

3. Start charging by connecting power to the charger.

4. The red LED will stay ON when it's charging.

5. The green LED will stay ON when the battery is fully charged.

Chapter 5 : Appendix



There is a CPLD on the Servo Motor Card to manage the power supplied to the Servo Motors. It provides battery level indication and is responsible for powering off the spider when the battery low or power consumption is too large. There are three orange LEDs and one red LED on the Servo Motor Card for the indication of power status. The three orange LEDs indicate the power level of the battery. The red LED indicates the status of power exception.

When the battery is full, the three orange LEDs are lighted. When there's only one orange LED lighted, it indicates the battery power is low and users should recharge the battery. When 12V DC is supplied, the three orange LEDs will always light.

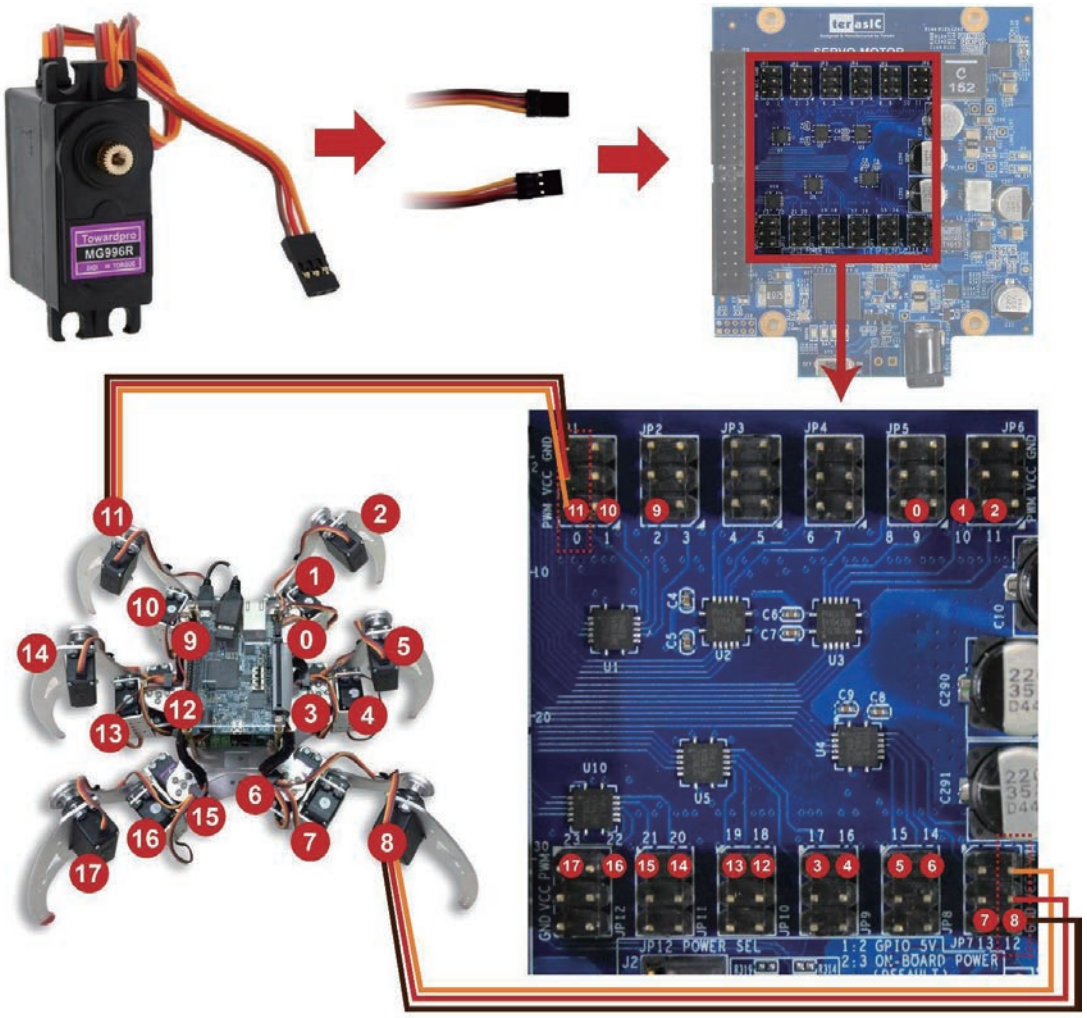
The motor card will turn off the system power automatically when the battery level is approaching the threshold of over discharge. The three orange LEDs will be turned off and the red LED will light up as a reminder. The Servo Motor Card will turn off the power for both Servo Motors and DE0-Nano-SoC immediately. Please turn off the power switch of Servo Motor Card manually to stop the CPLD on the Servo Motor Card from consuming the battery power, as it could over discharge the battery. The battery will not be able to be charged afterwards.

When the power consumption is too large (usually caused by the Servo Motor gets stuck by the obstacle), the Servo Motor Card will also turn off the power for the Servo Motors and DE0-Nano-SoC. The red LED is lighted and the power of Servo Motor Card needs to be reset after removing the obstacle.

All the source codes of the Terasic Spider is available on the Spider System CD. You can modify the code to improve or to change the Terasic Spider's functions according to their specific applications. The source codes include andriod project, linux application project, and a Quartus project. The System CD is available on

http://cd-spider.terasic.com

Servo Motor Connections



Mapping Table

Leg	Right-front			Right-middle			Right-back			Left-front			Left-middle			Left-back		
Motor Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
GPIO Index	9	10	11	17	16	15	14	13	12	2	1	0	18	19	20	21	22	23

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Поставка электронных компонентов

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Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А