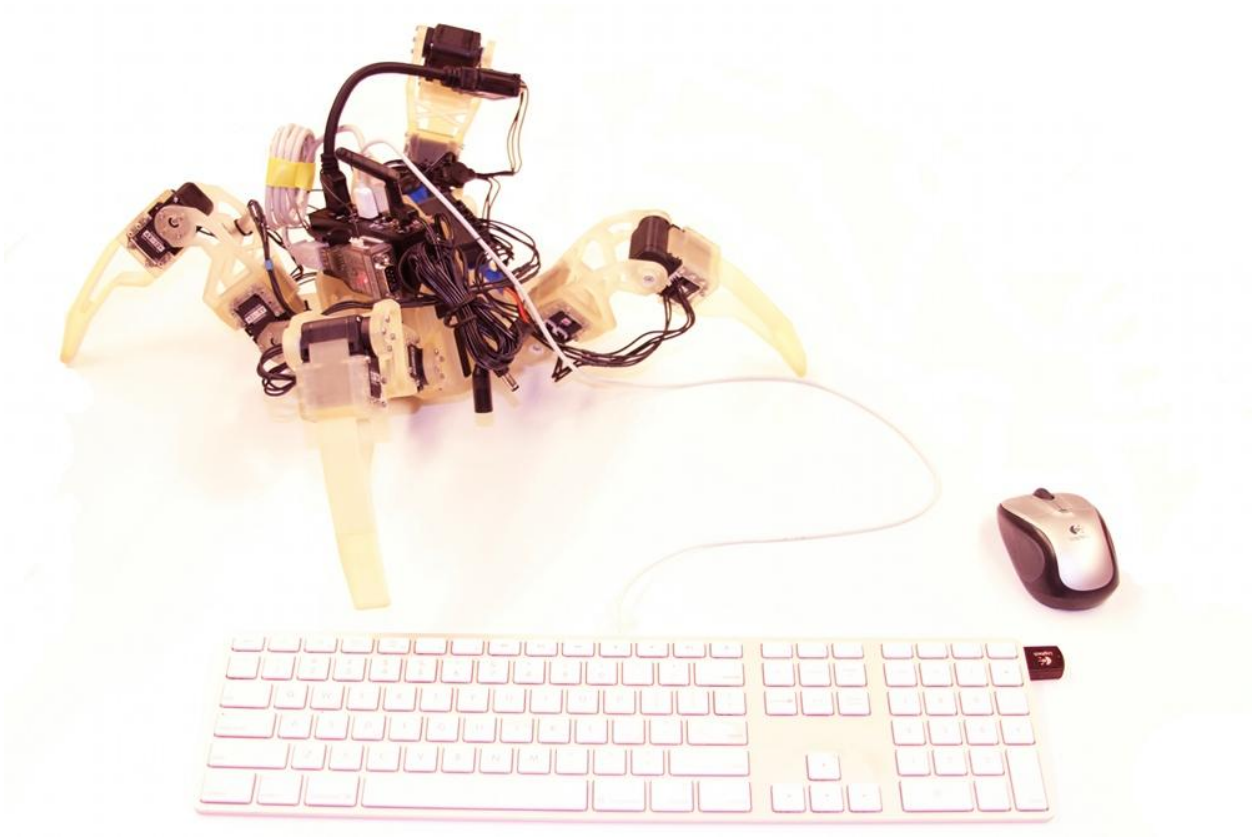

Trepen Robot

User Manual

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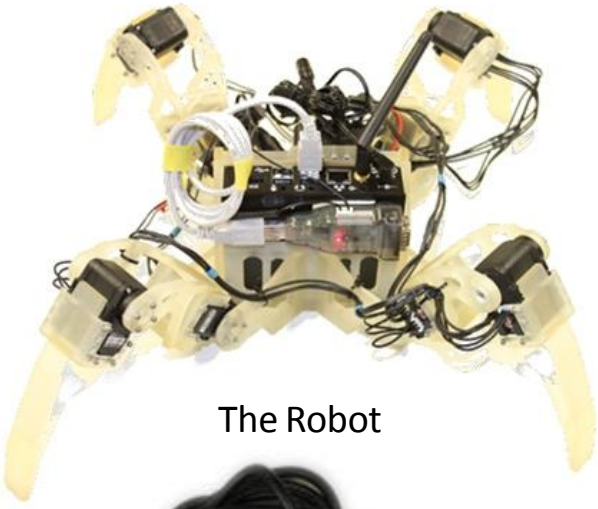
A general purpose 9-DOF legged robot

Contents

1. Item Check List

Before starting, check that all the following items have been included with your Trepen robot. If anything is missing contact Juan Cristobal Zagal {jcz35@cornell.edu, jczagal@gmail.com}.



The Robot

12v Battery Charger

12v FitPC2 power source

The robot itself contains the following elements:

- FitPC2: An Intel Atom Z530 1.6GHz PC with 1GB DDR2-533 memory, DVI up to 1920x1200, 160GB hard disk, 802.11b/g wifi, 6 USB ports. The computer is powered by a 12v DC source.
- A WiFi antenna attached to the PC.
- An HDMI to DVI adapter.
- 9 AX-12+ servo motors.
- An USB2Dynamixel adapter.
- A USB extension cord.
- 2 Li-Ion Rechargeable Battery Packs 12VPK4.5A. Output: 10.8V~12V DC 4.5AH.
- 10 3D printed body parts.

2. Requirements

To use the robot you will need:

- A display with DVI or HDMI input + DVI or HDMI cable.
- USB keyboard and mouse.
- A soft surface of operation to avoid over stress on the servo motors.

3. Warnings

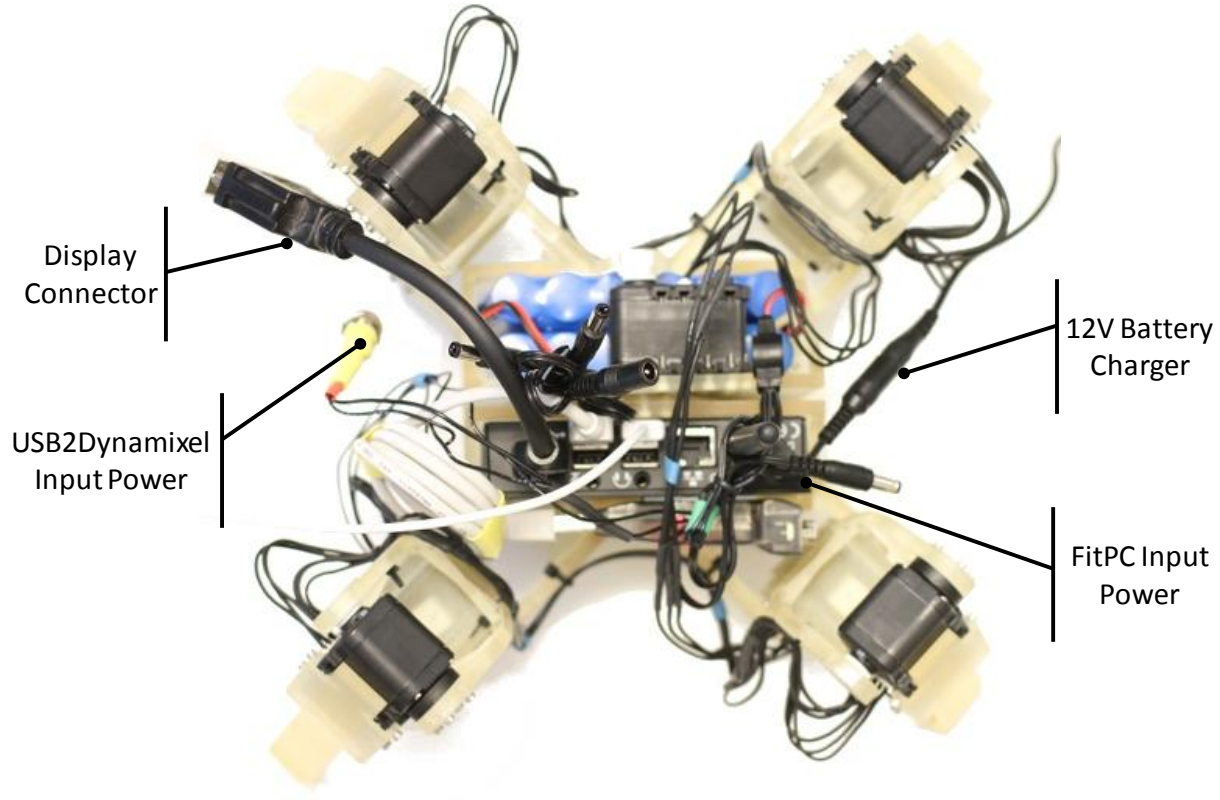
Please pay ATTENTION to the following topics while reading this manual:

- **Operational voltages**.
- **Limit operational angles** for each servo motor.
- **Smooth operation of servo motors** (avoid discontinuous angular reference changes).
- **Operational torques**.

4. Quick Start Guide

A basic operation of the robot can be achieved with the following steps:

1. Connect the 12V battery charger terminal to the female input power entry that is attached to the computer power input.
2. Connect the display using the HDMI to DVI adapter if needed.
3. Connect your USB keyboard and mouse.
4. Turn on the computer.
5. Place the robot over a soft flat surface.
6. Position the robot in the standard resting configuration.
7. Connect the USB2Dynamixel input power to a battery.
8. Open a Windows Command Prompt.
9. CD to C:\Documents and Settings\user\Desktop\Trepen\Debug\
10. Execute Trepen.exe [enter]
11. You should see the robot standing up and walking. After moving about one meter the robot returns to its standard resting position.
12. A safe way to stop the robot is by disconnecting the power of the USB2Dynamixel.
13. You can also stop the program just by CTRL-C.
14. Make sure to return the robot to its standard resting position after operation.



You can use either the battery or the electric connection. Configure the wireless network of your computer.

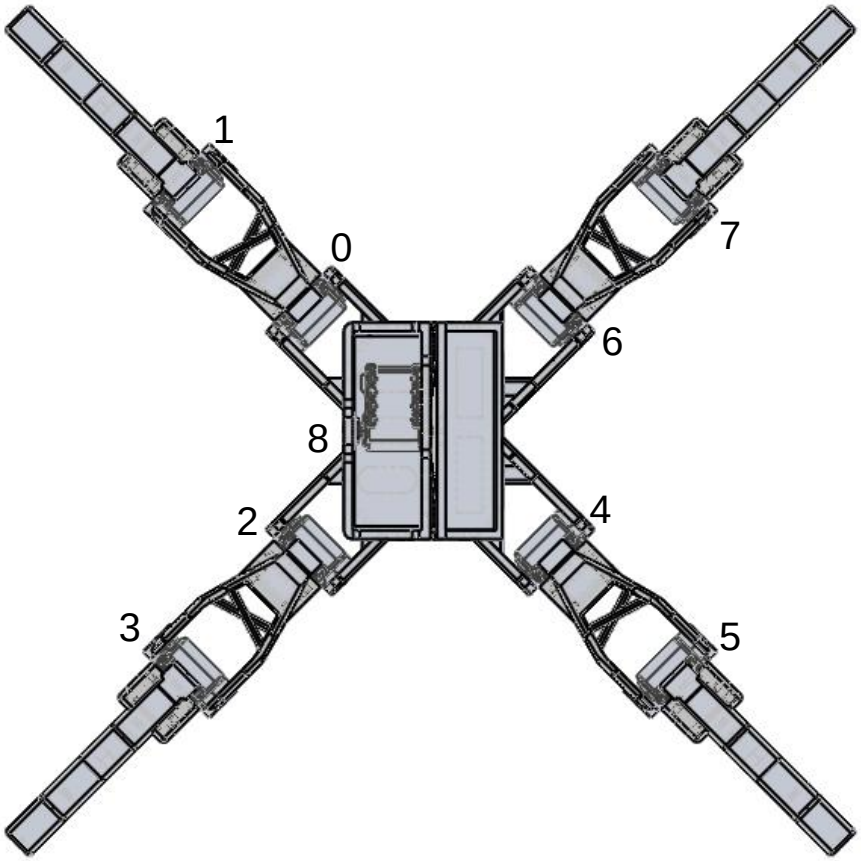
1. Checking Servo Motors

Execute Dinamixel Manager to check connection of the servo motors [Start-> programs -> ROBOTIS -> USB2Dynamixel -> Dynamixel Manager]. Do [Search]. You should see that all the nine motors are visible [0,…,8]. Then press OK.

If the motors are not accessible check the connections along the servo daisy chain. If one motor is disconnected, you will be unable to access the motors downstream the chain.

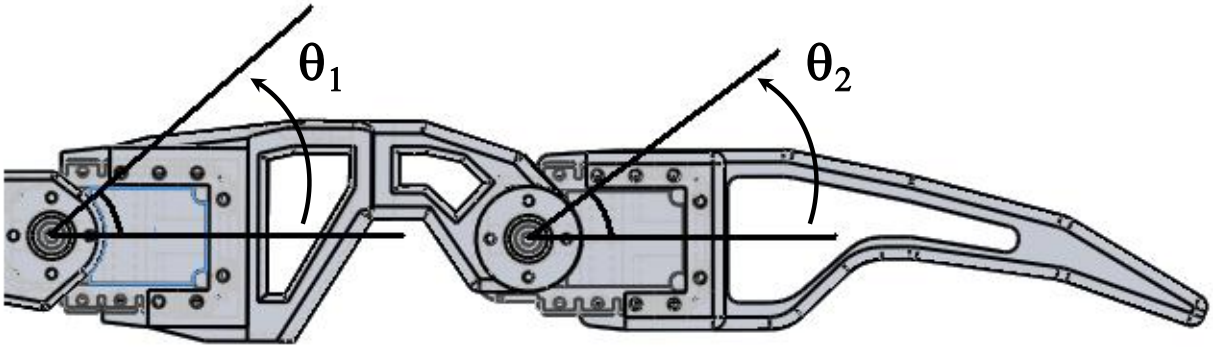
15. Configuration of Servo Motors

- The motors are driven with the pc-based Dynamixel control mode described in [1]. This control mode requires of the USB2Dynamixel adapter to be connected to one of the USB ports. COM port number 3 is already configured using 9600 bits per second, 8 data bits, parity none, 1 stop bit and no flow control.
- As recommended in [1] the COM latency timer was set to 16msec.
- USB2Dynamixel communication system is selected to be in TTL communication mode.
- Dynamixel Manager was used to assign the following IDs to the servo motors.



- Servo motors are configured with Return Level number 2 (all return), Return Delay Time of 250*u*sec, and default Baud Rate (choice 1: 1000000bps).
- The following angular range is suggested for the operation of servo motors:

ID	Minimum Angle	Max Angle	
0			
1			
2			
3			
4			
5			
6			
7			
8			



16. Important Recommendations

- Dynamixel AX-12+ servos are capable of sustaining a 16

17. Example Software

The following software is installed:

- Microsoft Visual C++ 2008 Express
- Robotis USB2Dynamixel API.
- Robotis USB2Dynamixel Manager.

A simple motion software is provided with the robot. It allows re robot to move over a flat surface. The Visual C++ project is available under C:\Documents and Settings\user\Desktop\Trepen\

18. Assembling the Robot

19. Possible Improvements

SSD HD drive. LI-PO batteries, Other servos, (Other servo means other controller)

20. Reference Documents

1. Dynamixel SDK for PC. Document version 1.00