Future Technology Devices International Ltd.

Application Note

AN_202

VNC2 Android Robotic ARM Demo Guide

Document Reference No.:FT_000586

Version 1.0

Issue Date: 2012-02-09

This document describes how the Vinculum device, VNC2 may be used with the VINCO Touch Key shield to control the servo motors of a Robotic Arm controlled from an Android platform in Android Open Accessory mode.

Table of Contents

1 Introduction

This document describes how the Vinculum device, VNC2, may be used with the VINCO Touch Key shield to control the servo motors of a Robotic Arm controlled from an Android platform.

In this demonstration the Android platform is operating in Open Accessory Mode ie the peripheral, and the VNC2 chip is the USB host that bridges data from the Android USB port to the PWM interface of the servo motors on the robotic arm.

Please contact FTDIChip for source code for Android and VNC2 firmware.

1.1 Overview

Android Open Accessory mode is a new (Android OS 3.1+) feature that allows Android devices that do not have a USB host port to connect to peripheral hardware. This simplifies driver/application development on the Android platform as no additional drivers are required. Additionally this does not adversely affect battery life in portable platforms as the USB port power must be provided by the accessory attached to the Android platform.

The Android Robotic Arm demo uses 4 servo motors connected to the joints of the arm to control the base (left/right), Arm (up/down), wrist (up/down) and Grip (open/close) of the Robotic Arm.

Each of these servo motors is controlled from the PWM interface of the VNC2 IC mounted on a VINCO development PCB. One PWM channel is required for each motor.

Firmware to connect to the Android platform over the Android Open Accessory Mode of the USB peripheral port and drive the PWM outputs was developed using the free VNC2 toolchain.

1.2 Hardware Requirements

- Vinco Development Module, pre-programmed with VNC2 Robotic Arm demo firmware.
- VNC2 Debugger/Programmer Module, optional if VNC2 is pre-programmed with Robotic Demo firmware.
- Vinco Touch Key Shield
- Robotic Arm, assembled.
- Motorola XOOM android tablet, running Android 3.1 or higher.
- 5volts output DC power supply adapter to Robotic Arm and VNC2.
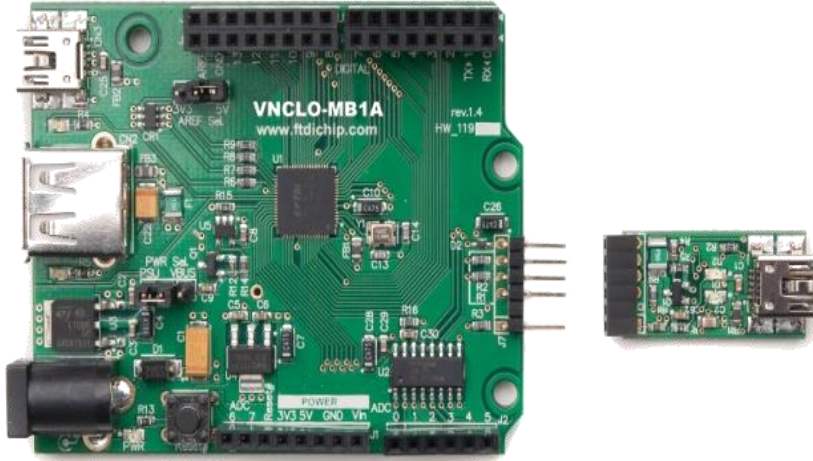- USB cable to power the VNC2 board.

1.3 Software Requirement

1. Pre-programmed VNC2 with Robotic-Arm firmware.

2. Android Robotic Arm source code or apk file.

3. PC with eclipse or some other tool to flash the apk file into Motorola tablet.

2 Hardware
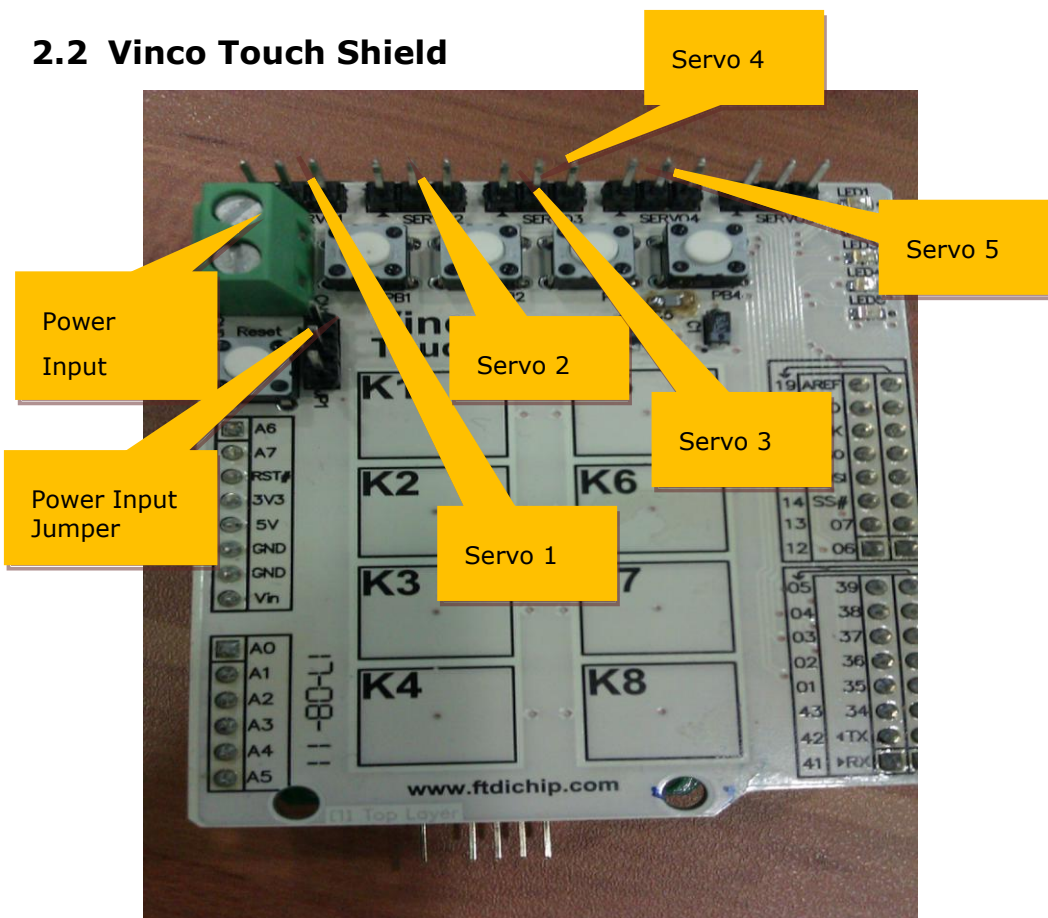
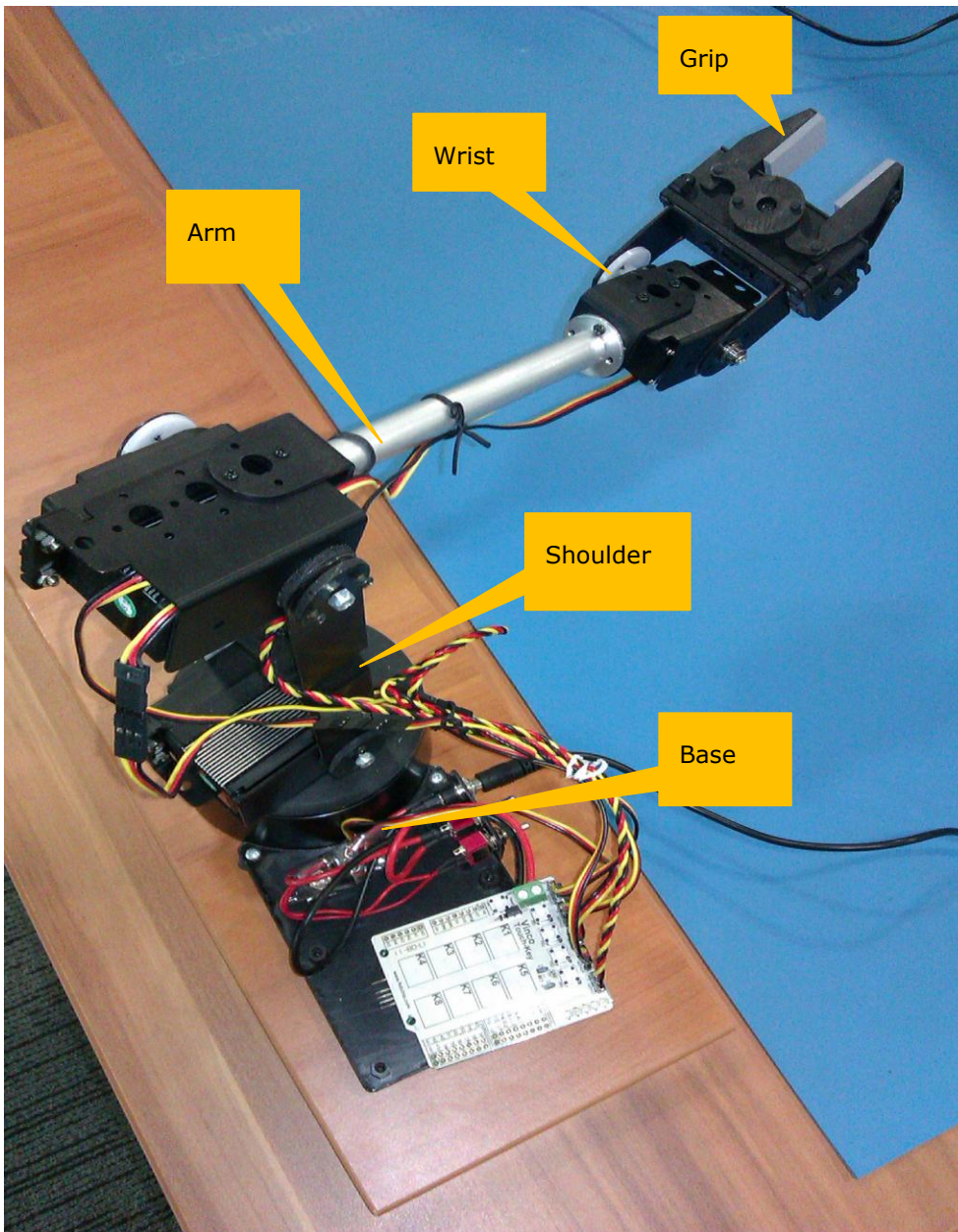This section describes the hardware modules used in this demo.

2.1 VNC2

Figure 2.1 Vinco Development Module with VNC2 Debug Module

2.2 Vinco Touch Shield

Figure 2.2 Vinco Touch-Key Shield

2.3 Robotic Arm

Figure 2.3 Robotic Arm

The Robotic-Arm uses 5 servos for the control of its Base, shoulder , arm, wrist and grip components.

The demo make use of 4 servos, shoulder servo is not being used in the demo, but should be supplied power and must kept in straight vertical position.

The servos are from Hitec, http://www.hitecrcd.com/. All the servos require 3-5V peak-to-peak square wave pulse. The pulse duration is from 0.9 ms to 2.1 ms with 1.5 ms as centre. The pulse refreshe rate is 50 Hz.

Hitec servos used in the robotic-Arm require supply voltages in the range of 4.8V-6V.

3 Setup

This section describes the setup of demo.

3.1 Application software Setup

An Android application was developed in JAVA for a Motorola Xoom tablet running Android 3.1. The Android application uses standard Android widgets, such as seekbar, edittext, textview, buttons, and, imageview.

The compiled output that runs on the Android platform is called RoboticArmDemoActivity.apk. this is the file that must be loaded onto the Motorola Xoom/

To program the Android application, user need to setup the Eclipse environment as described in Android Developers at http://developer.android.com/sdk/installing.html. This web link will provide information on loading applications onto the Android platform over USB.

3.2 Hardware Setup

Note: It is assumed that Robotic Arm is assembled as described by the manufacturer of the Robotic Arm.

1. Remove any power supplied to Vinco and Vinco Touch-Key Shield.
2. Mount the Vinco Touch-Key shield to Vinco; follow the connectors on touch-shield.
3. Connect Robotic Arm's Base to Servo3.
4. Connect Robotic Arm's shoulder to Servo 5.
5. Connect Robotic Arm's Arm to servo 4.
6. Connect Robotic Arm's wrist to Servo 1.
7. Connect Robotic Arm's grip to Servo 2.
8. Put a jumper into 1 and 2 position of "Power Input Jumper".
9. Hold the Robotic Arm's shoulder into straight position, just like in figure 3.1
10. Connect the external power supply into the power input socket on Vinco Touch-Key Shield.

**Figure 3.1 Robotic Arm Assembled**

4   Demo

After completing the configuration and assembly steps as described in section 3, supply power to VNC2. After supplying the power to VNC2, connect the Motorola Xoom tablet to host port of VNC2.

Note: remember to hold the Robotic Arm's shoulder in straight position before supplying power to Vinco touch-key shield and VNC2.

Note: do not move any part of the Robotic Arm's parts by force while power is supplied. For adjusting any part of Robotic Arm, remove the power supply to Vinco Touch-Key shield.

When the USB port 1 (VINCO CN2) is connected to the Android platform the application shown below will automatically start. :
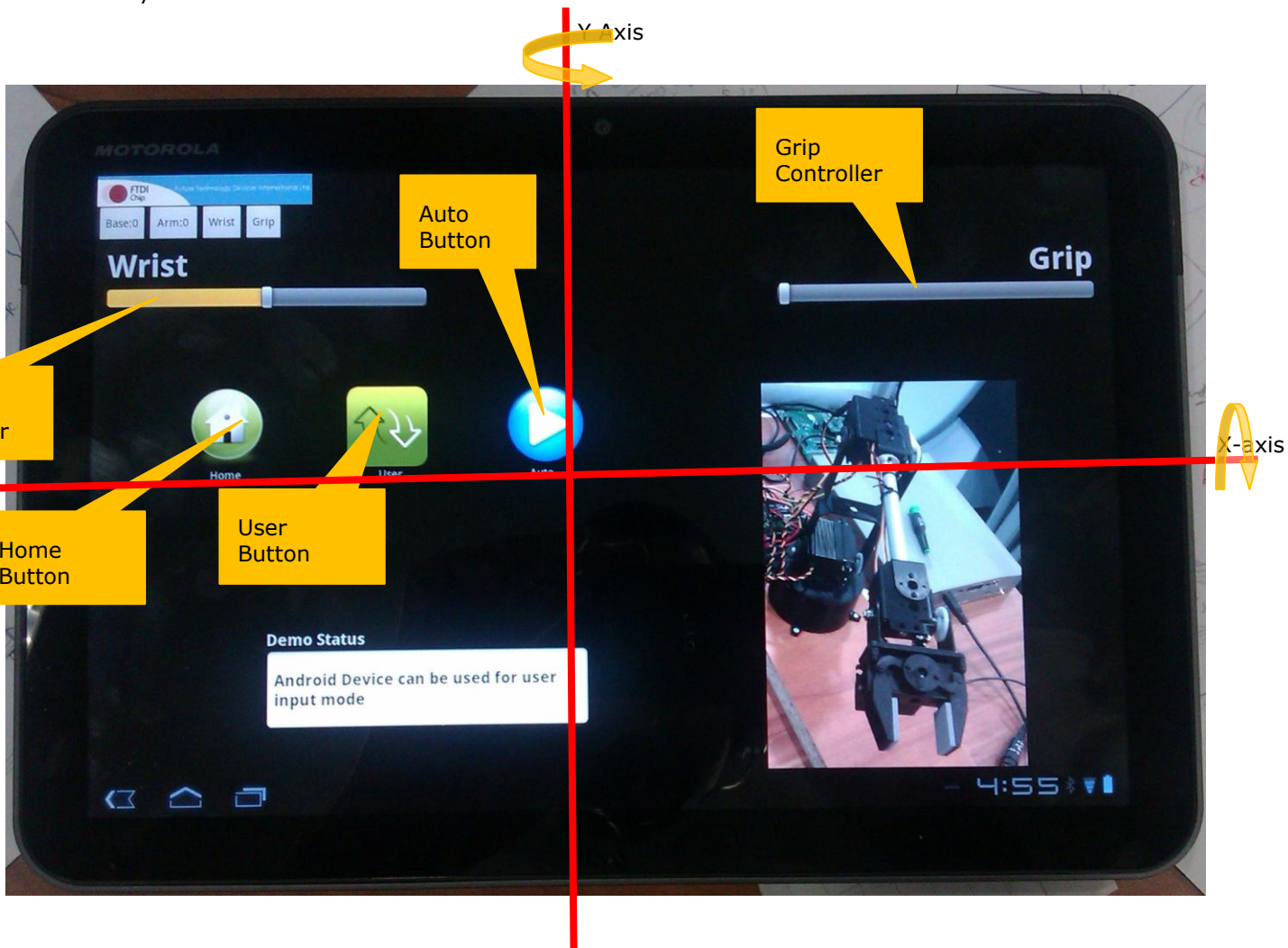
 Figure 4.1 Android Application

4.1 User Button

To control the movement of Robotic Arm, the user has to press User button. At the start, the demo setup is in user mode. In user mode user can control the movement of Robotic Arm.

1. To move the Arm up, rotate the Android tablet slowly along the x-axis in upwards direction.

2. To move the Arm down, rotate the Android tablet slowly along the x-axis in downward direction.

3. To move the Arm to left, rotate the Android tablet slowly along the y-axis in left direction.

4. To move the Arm to right, rotate the Android tablet slowly along the y-axis in right direction.

5. To move the wrist up, slide a finger to the right direction on the wrist controller.

6. To move the wrist down, slide a finger towards the left direction on the wrist controller.

7. To open the grip, slide a finger toward the right direction on the grip controller.

8. To close the grip, slide a finger towards the left direction on the grip controller.

4.2 Home Button

To bring the Robotic Arm into a default state, i.e, straight arm, wrist and open grip, use the Home button.

In Home mode, the user controls are disabled, i.e. user movement, touch wouldn't affect the Robotic Arm's movement.

To control the Robotic Arm again by user, press the User button.

4.3   Auto Button

The auto button puts the Robotic Arm in auto mode. In auto mode, the movements of Robotic Arm's are fixed to pre-defined controls.

In auto mode, the user controls are disabled, i.e. user movement, touch wouldn't affect the Robotic Arm's movement.

To control the Robotic Arm again by user, press the User button.

4.4 Wrist Controller

In User mode, Wrist controller controls the movement of wrist. To move the wrist up, slide a finger on wrist controller towards the right direction. To move the wrist down, slide a finger to the left direction on wrist controller.

4.5 Grip Controller

In User mode, Grip controller controls the movement of grip. To open the grip, slide a finger on grip controller towards the right direction. To close grip, slide a finger to the left direction on grip controller.

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6 Appendix A – References

Document References

[1] FTDI Application Note 142,
http://www.ftdichip.com/Support/Documents/AppNotes/AN_142_Vinculum-II_Tool_Chain_Getting_Started_Guide.pdf

[2] FTDI Application Note 151,
http://www.ftdichip.com/Support/Documents/AppNotes/AN_151%20Vinculum%20II%20User%20Guide.pdf

VNC2 Datasheet : http://www.ftdichip.com/Support/Documents/DataSheets/ICs/DS_Vinculum-II.pdf

VINCO Datasheet : http://www.ftdichip.com/Support/Documents/DataSheets/Modules/DS_Vinco.pdf

TouchKey Shield datasheet :
http://www.ftdichip.com/Support/Documents/DataSheets/Modules/DS_Vinco_Touchkey_Shield.pdf

http://www.ftdichip.com/Support/Documents/AppNotes/AN_159%20Vinculum-II%20Firmware%20Flash%20Programming.pdf

Acronyms and Abbreviations

USB	Universal Serial Bus

Appendix B – List of Tables & Figures

List of Tables

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7 Appendix C – Revision History

Document Title: AN_202 VNC2_Android_Robotic_Arm_Demo

Document Reference No.:   FT_000586

Clearance No.:   FTDI# 278

Product Page: http://www.ftdichip.com/Products/ICs/VNC2.htm

Document Feedback: Send Feedback

Revision	Changes	Date
1.0	Initial Release	2012-02-09