



Connect your device to application

# Be “Android”

## Robocat: robot control system

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# Agenda

Motivation

Robocat

Architecture

HW

HAL

JNI

Case Study

Demo



程式就像貓

偶爾玩玩就很快樂

？

工程師的一門公修課  
每天加班也能寫自由軟體

逗  
猫  
子

我宅  
我色  
我舒服



## 科技界的文藝青年，工程界的哲學家

- 數十位工程師含淚推薦
- 本世紀最深情的程式告白法
- 電子書單日超過十萬次下載

- 延伸閱讀必色夫：
- 深入研究 X window
  - Hello World 跟貓一樣對怪
  - 我是軟體，那些硬體看我的事





# 每個宅男的夢想



# Robocat



# Robocat

- Google Android / GNU Linux 下的機器人控制系統
- 整合於 Oxdroid
- 可同時控制多組伺服馬達
- 無痛開發反饋機器人系統
- 可支援多種伺服馬達



# Architecture

Apps

Robocat

librobocat-jni

librobocat

libcatcan

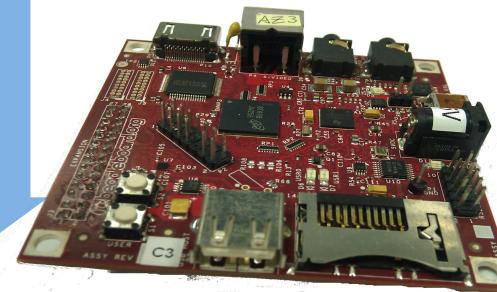
BB Mouse



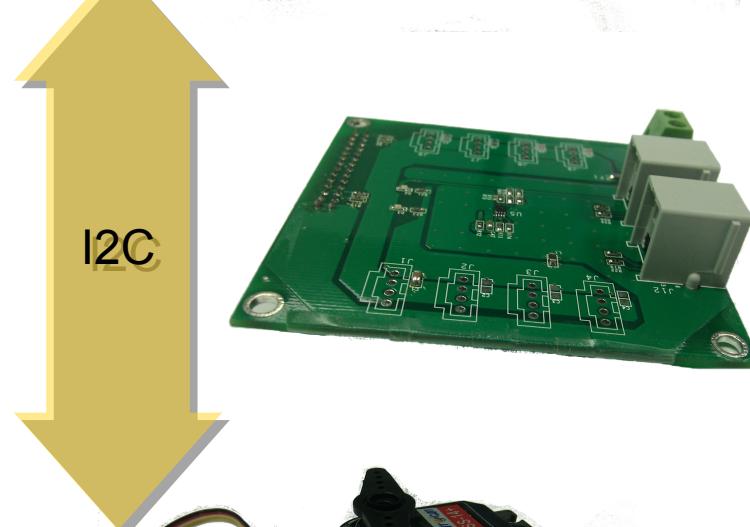
# Hardware Platform



Bluetooth dongle



OMAP3530 Beagleboard



BB Mouse -I2C Level Translator  
1V8 ↔ 5V

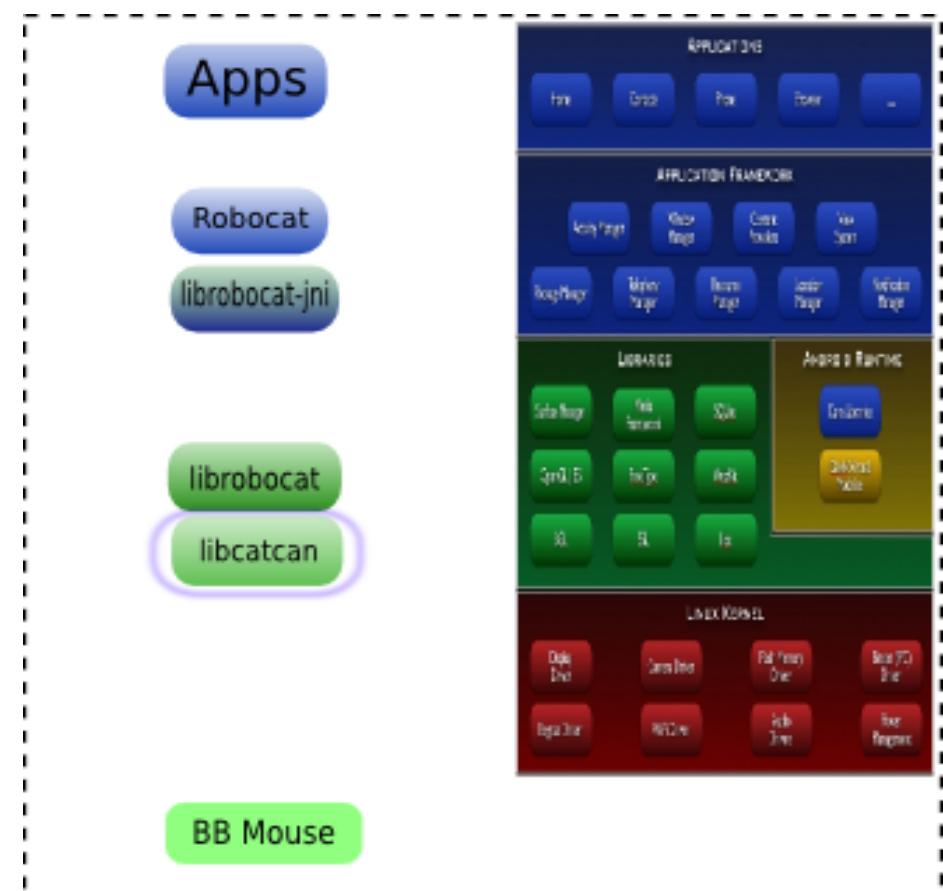


SS-14+ Servo

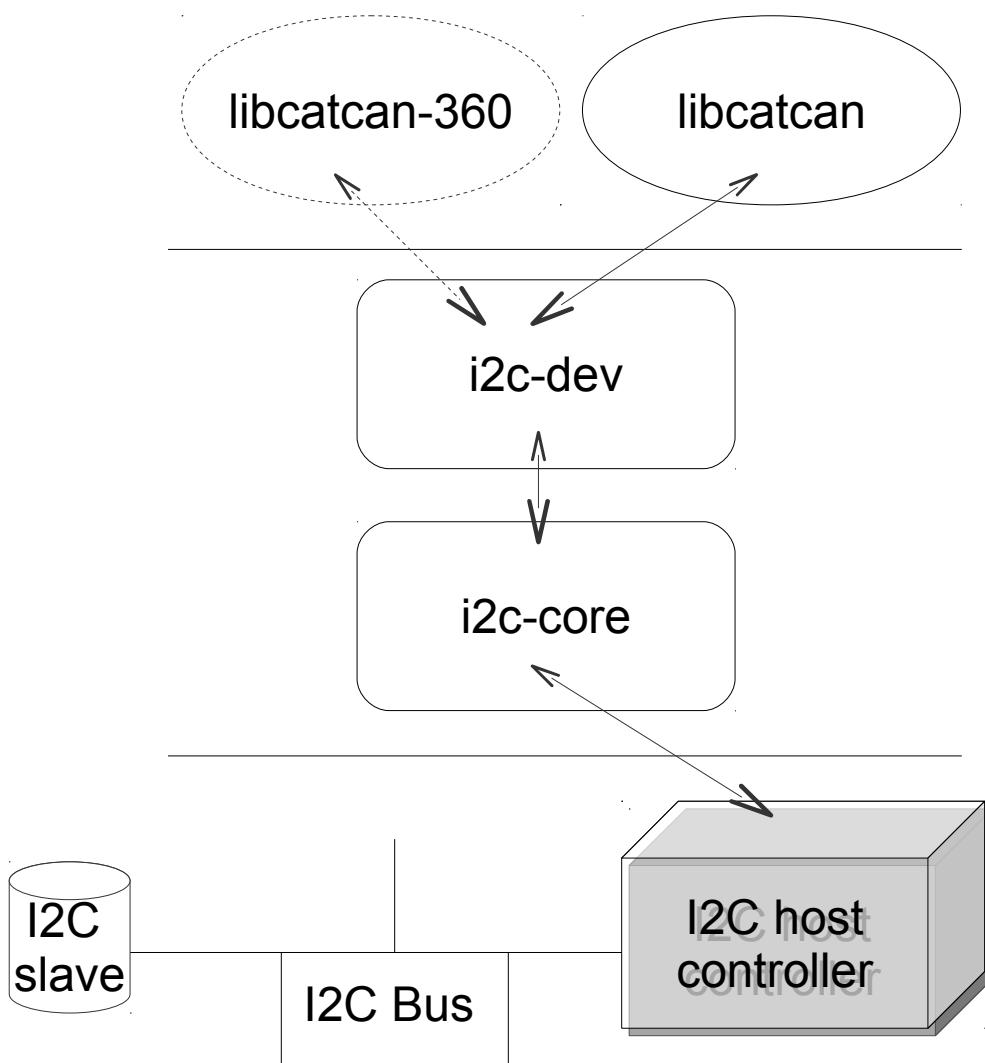


# Libcatcan, User mode I2C driver

- Libcatcan is an user space driver for device catcan ss14+
- Catcan SS14+
  - I2C interface
  - Power: 6v2~7v5
  - Dynamic PID setting
  - Plug and play
  - Group call
    - Asynchronous
    - Synchronous



# Libcatcan (cont)

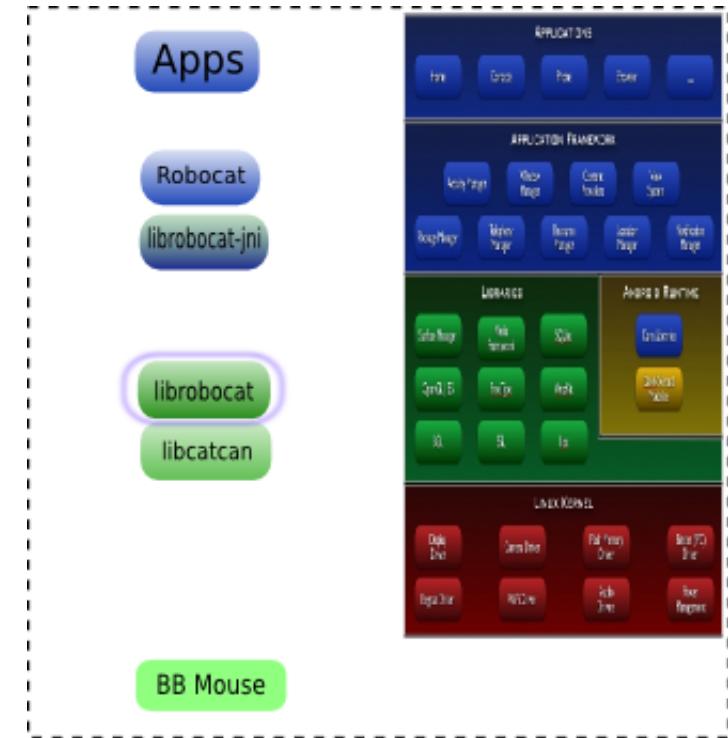


- No kernel driver needed, but enabling I2C bus 2 is requisite
- Easy and convenient to integrate with application
- Features:
  - Seek/get position
  - Group action
  - Change I2C address

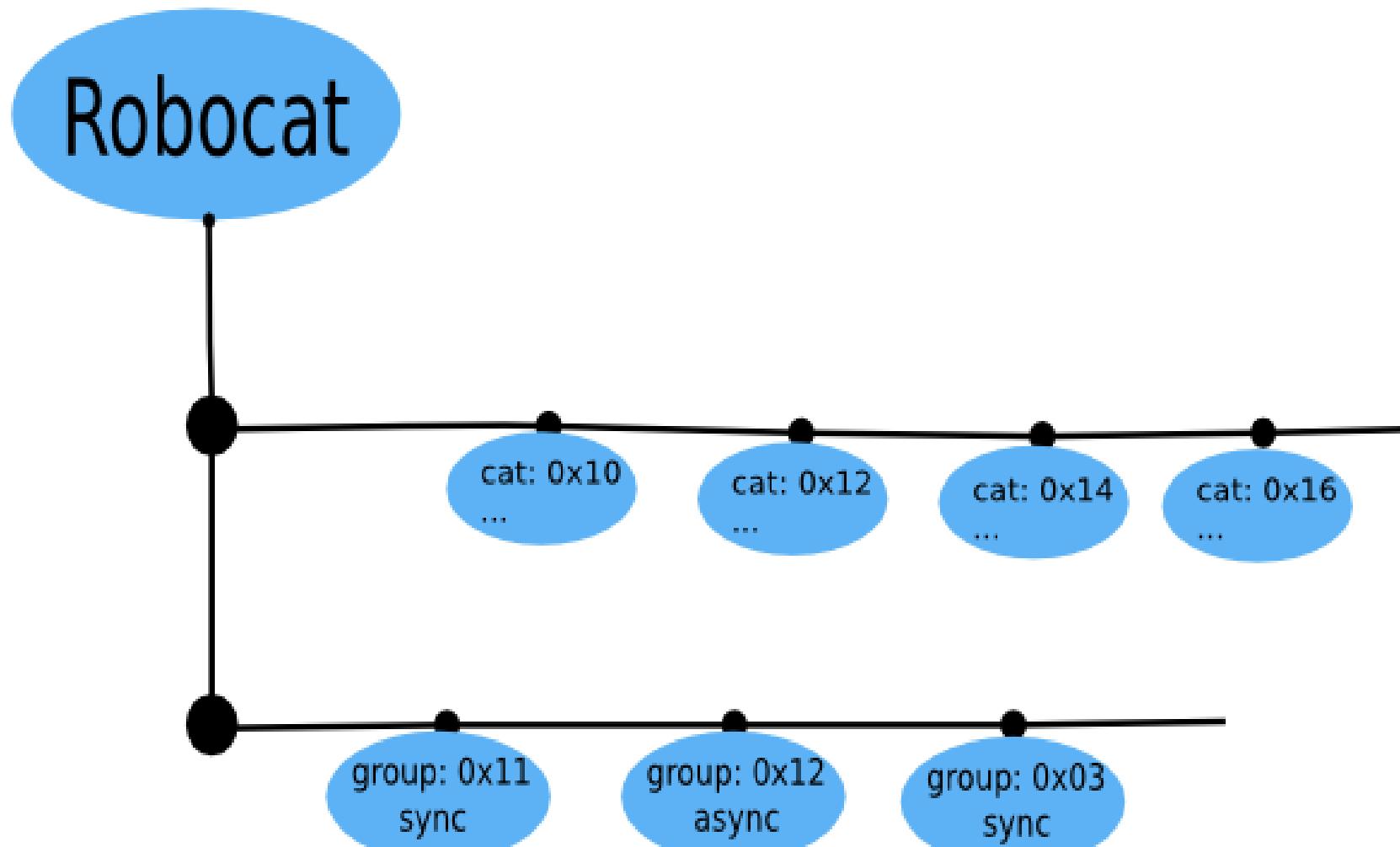


# Librobocat

- Abstract robot control system
- Position aware
- Sync and Async control
- Grouping cats

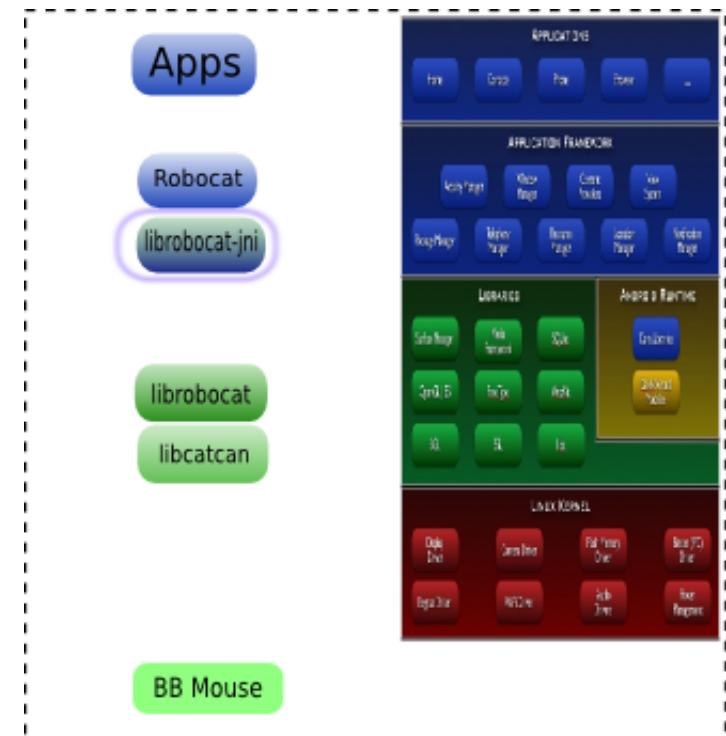


# Robocat (cont)



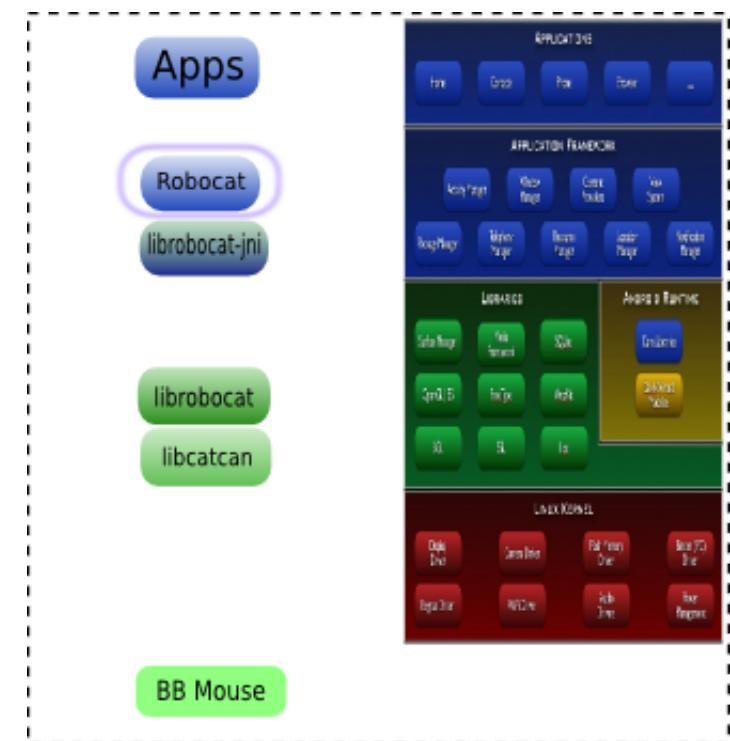
# librobocat-jni

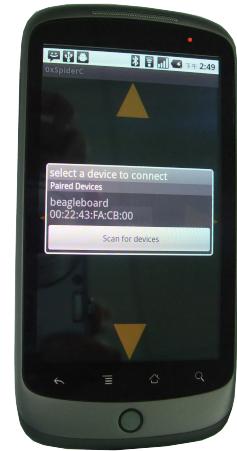
- Very thin layer glues librobocat and Robocat Java API



# Robocat Java API

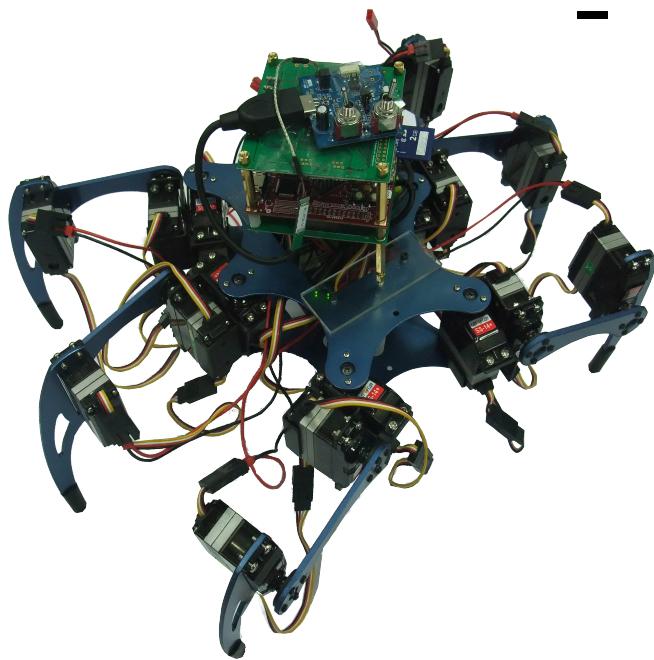
- Java library controls the librobocat
- Work flawlessly with Android API





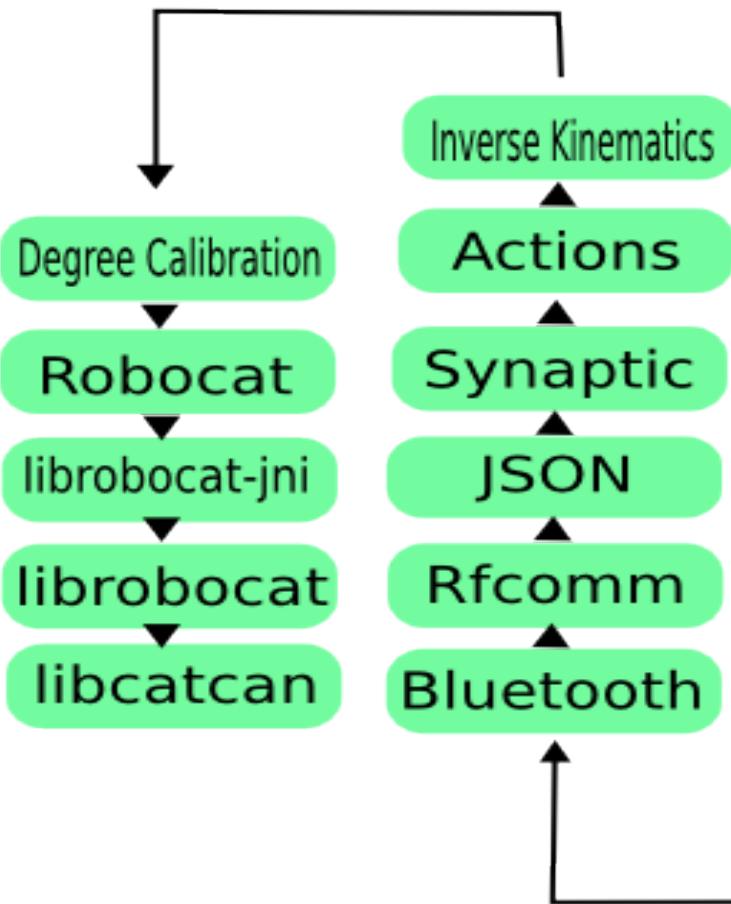
# Case Study

## - OxBot -

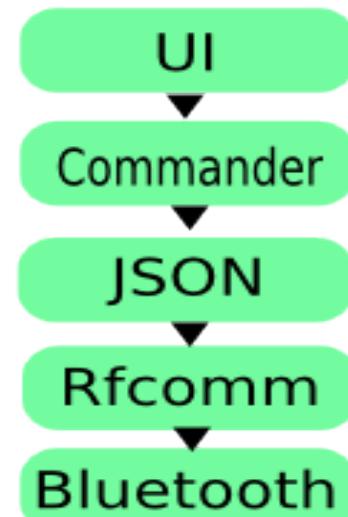


# Spider Architecture

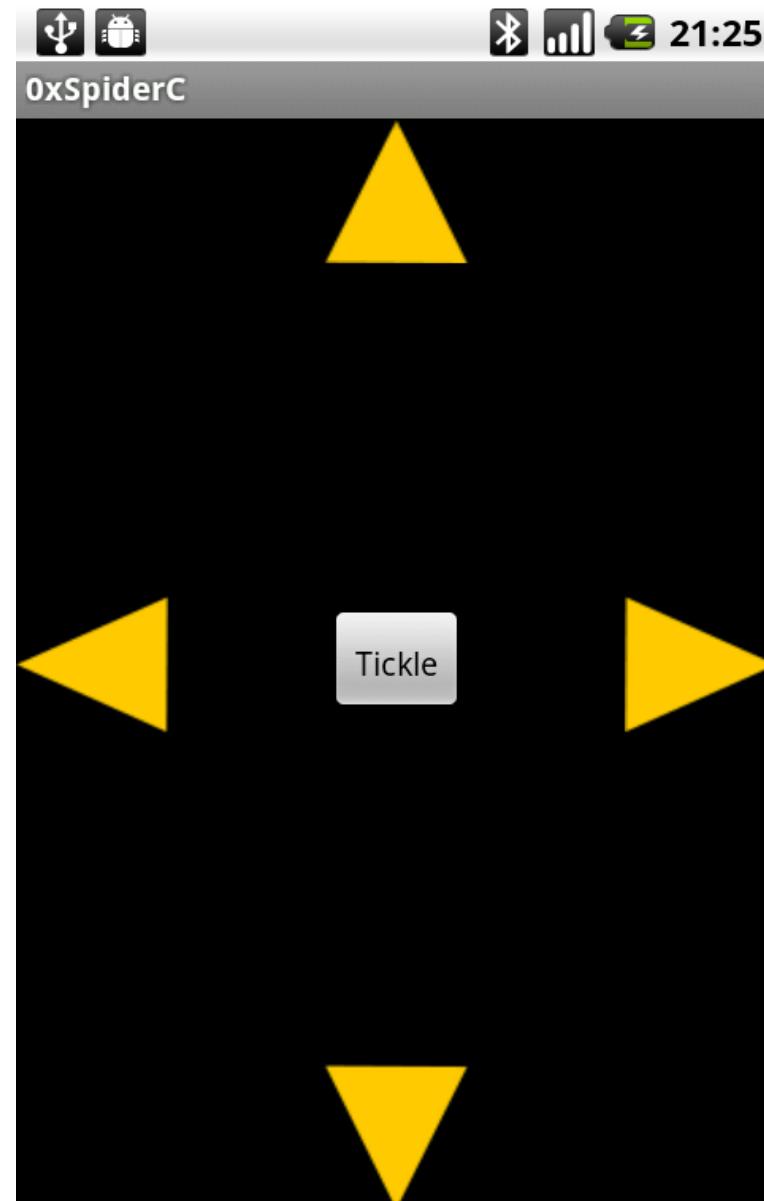
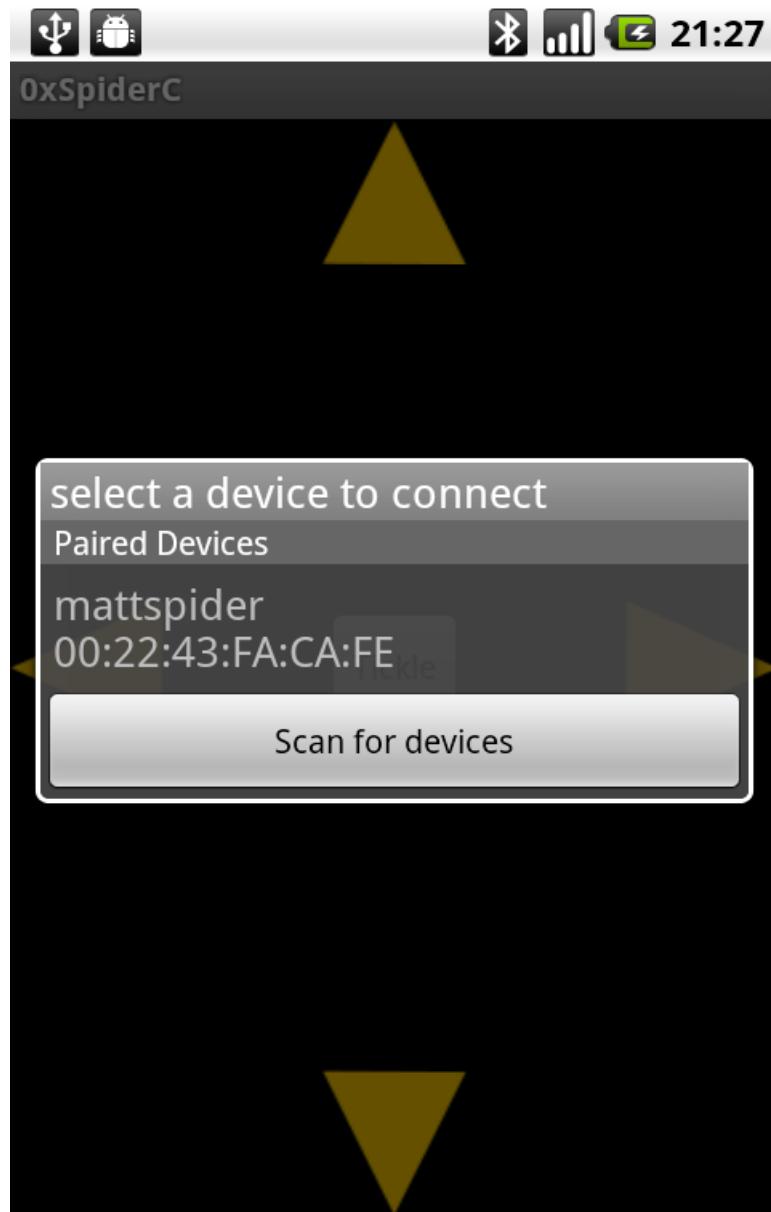
## Server (Spider)



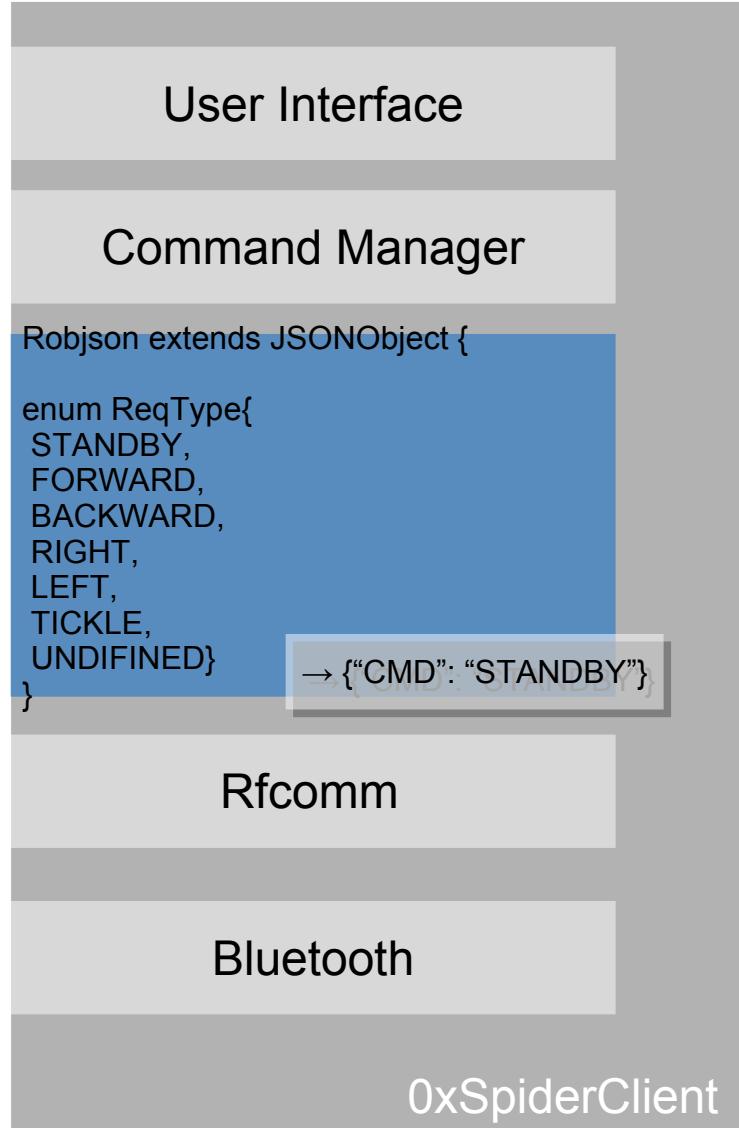
## Client (Phone)



# 0xspiderClient: UI



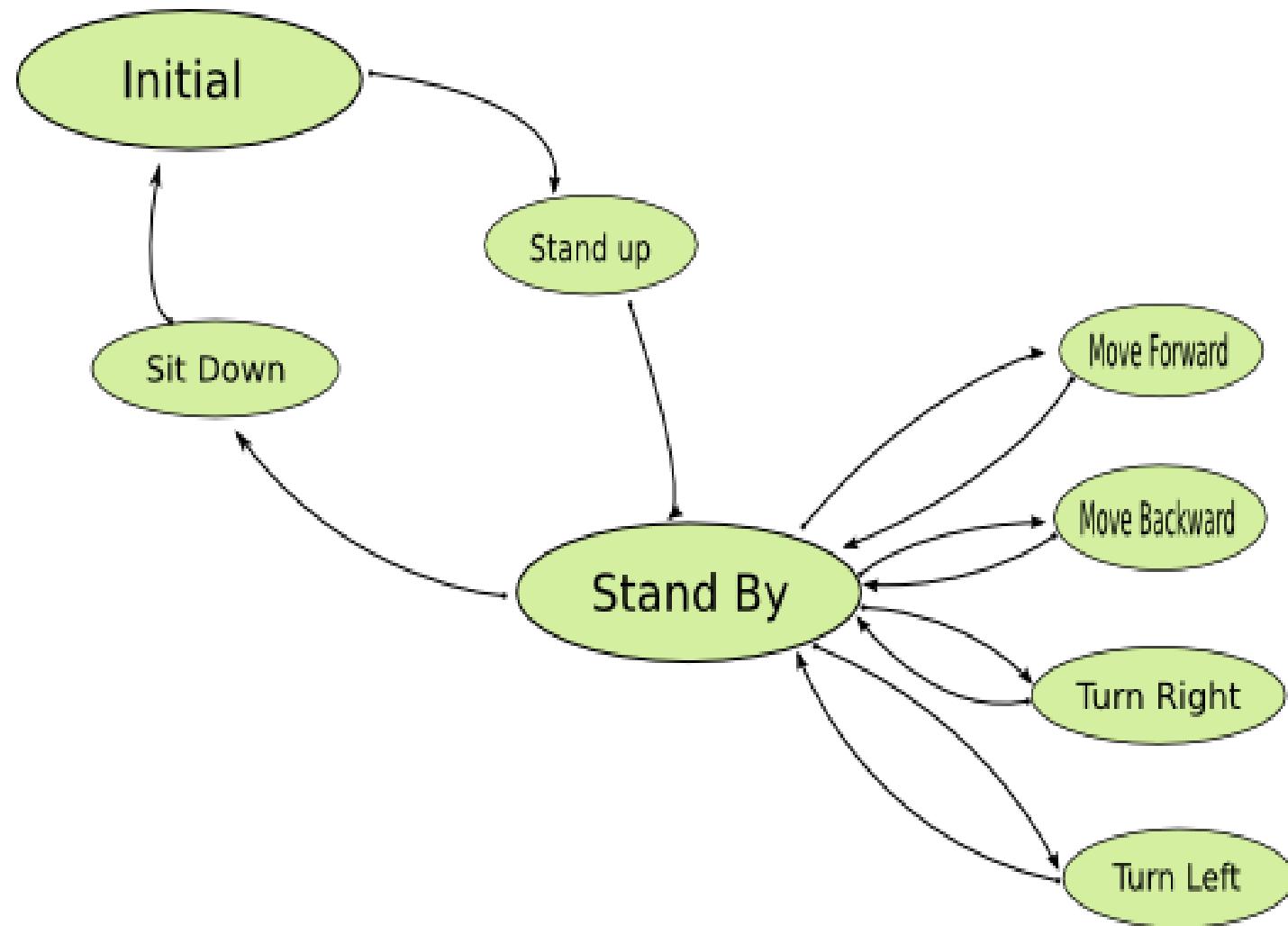
# JSON (JavaScript Object Notation)



- We need a simple protocol for remote controlling
- Lightweight data interahcnage: serialize/de-serialize
- Natively support in Android
- Easy to have extension

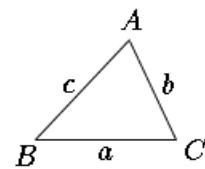


# Synaptic

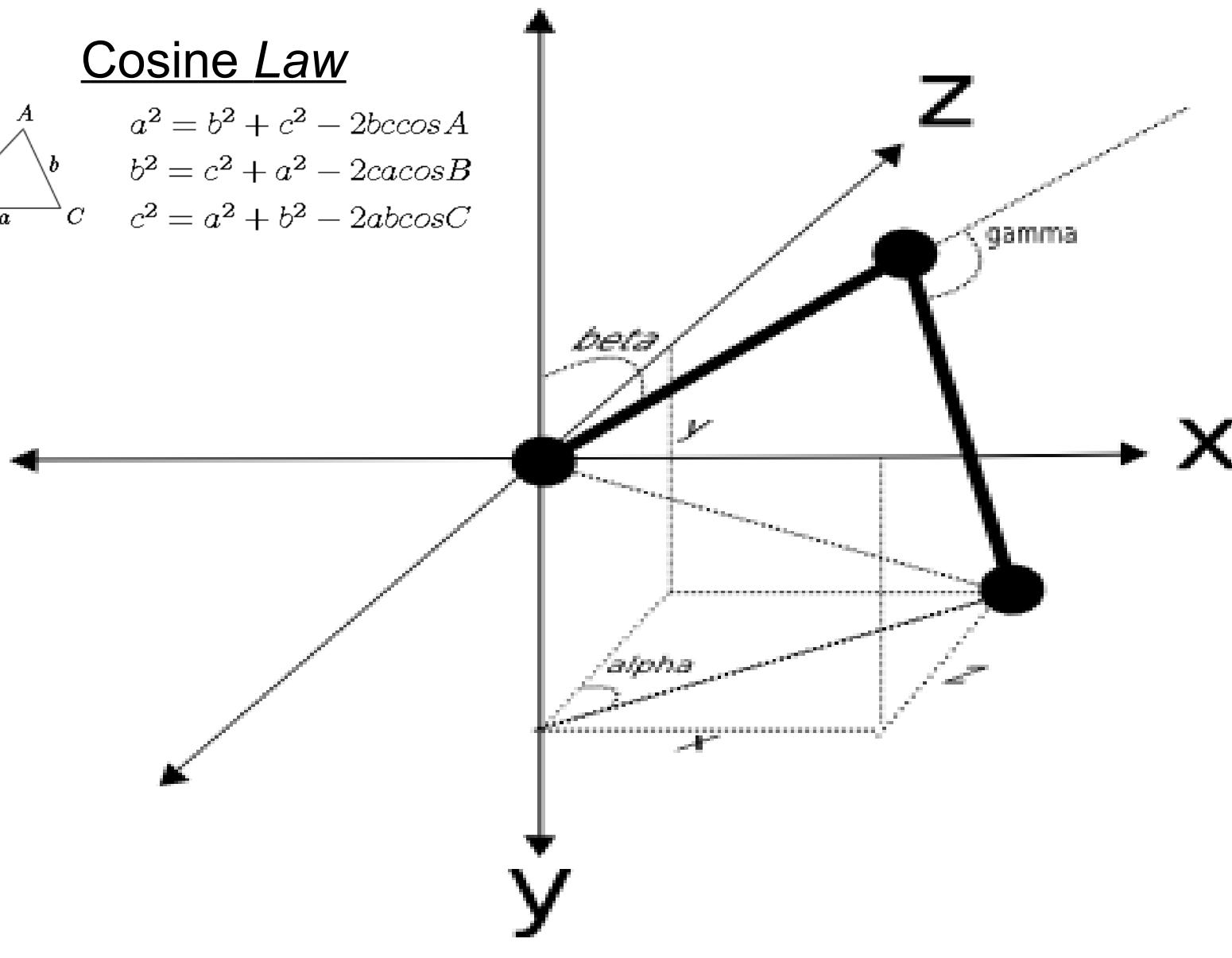


# Inverse Kinematics

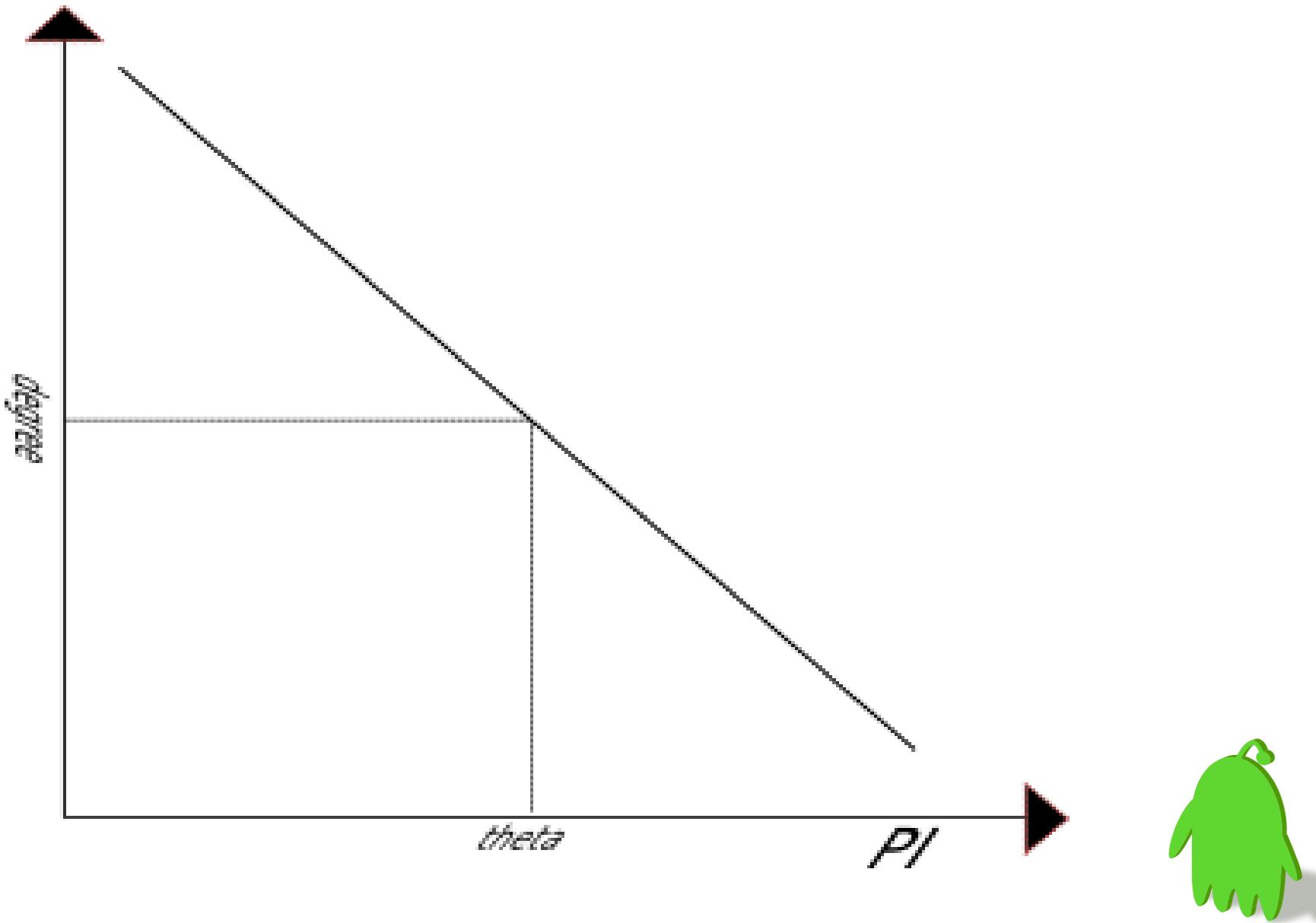
## Cosine Law



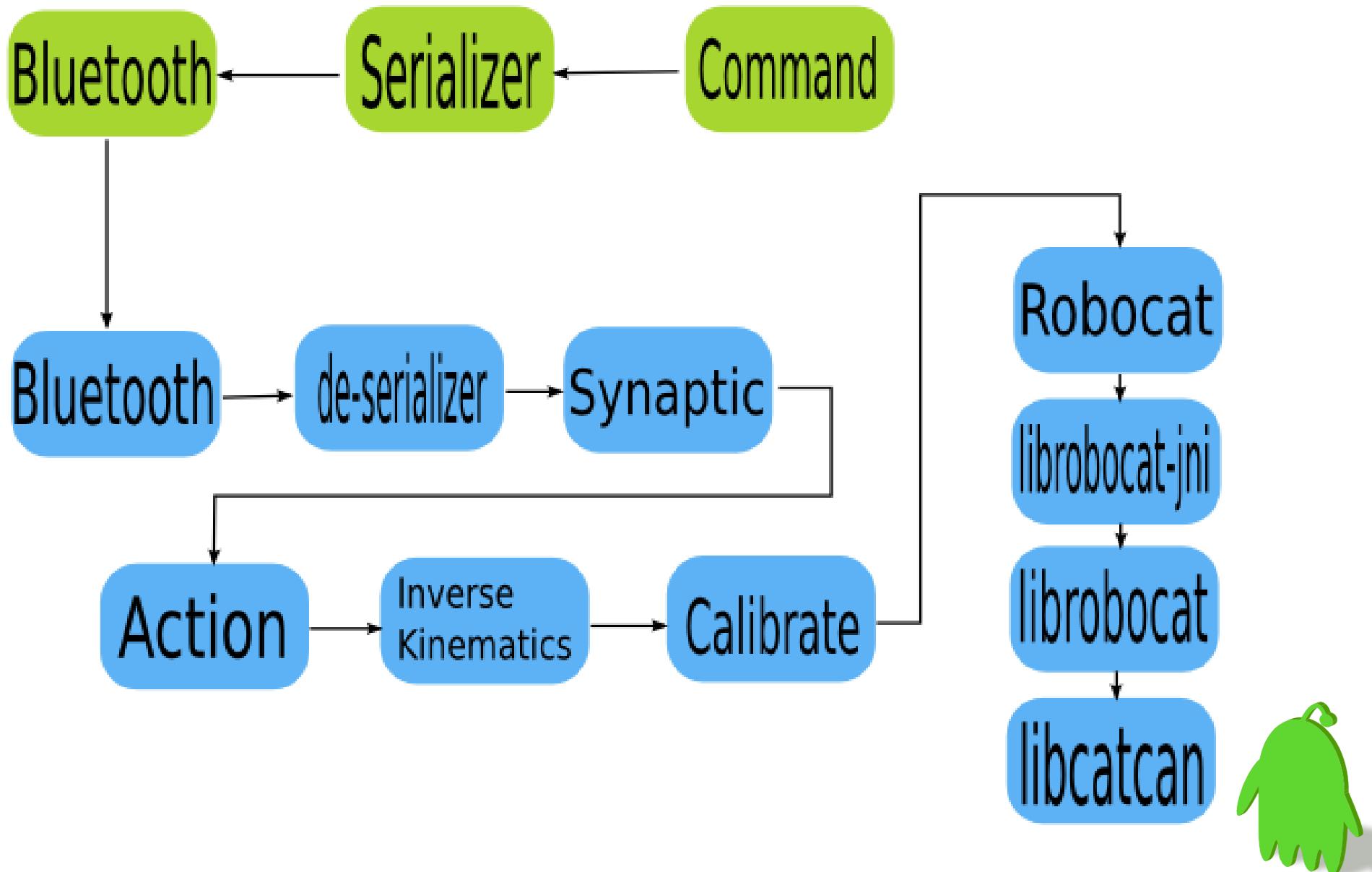
$$a^2 = b^2 + c^2 - 2bccosA$$
$$b^2 = c^2 + a^2 - 2cacosB$$
$$c^2 = a^2 + b^2 - 2abcosC$$



# Degree Calibration



# Command Flow



# DEMO



# Reference

- Robocat Project: <http://code.google.com/p/0xrobocat/>
- Robocat Source: <http://gitorious.org/robocat/robocat>
- Oxdroid: <http://code.google.com/p/0xdroid/>
- Board: <http://beagleboard.org/>
- Servo BBMouse: <http://www.catcan.com.tw/>
- Inverse Kinematics:  
[http://freespace.virgin.net/hugo.elias/models/m\\_ik.htm](http://freespace.virgin.net/hugo.elias/models/m_ik.htm)
- Bluetooth Module: <http://www.azurewave.com/>
- Camera Module: <http://www.azurewave.com/>



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# 15 Aug 2010 Conference