教案難波萬

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Motivation

来不及解释了！快上车！
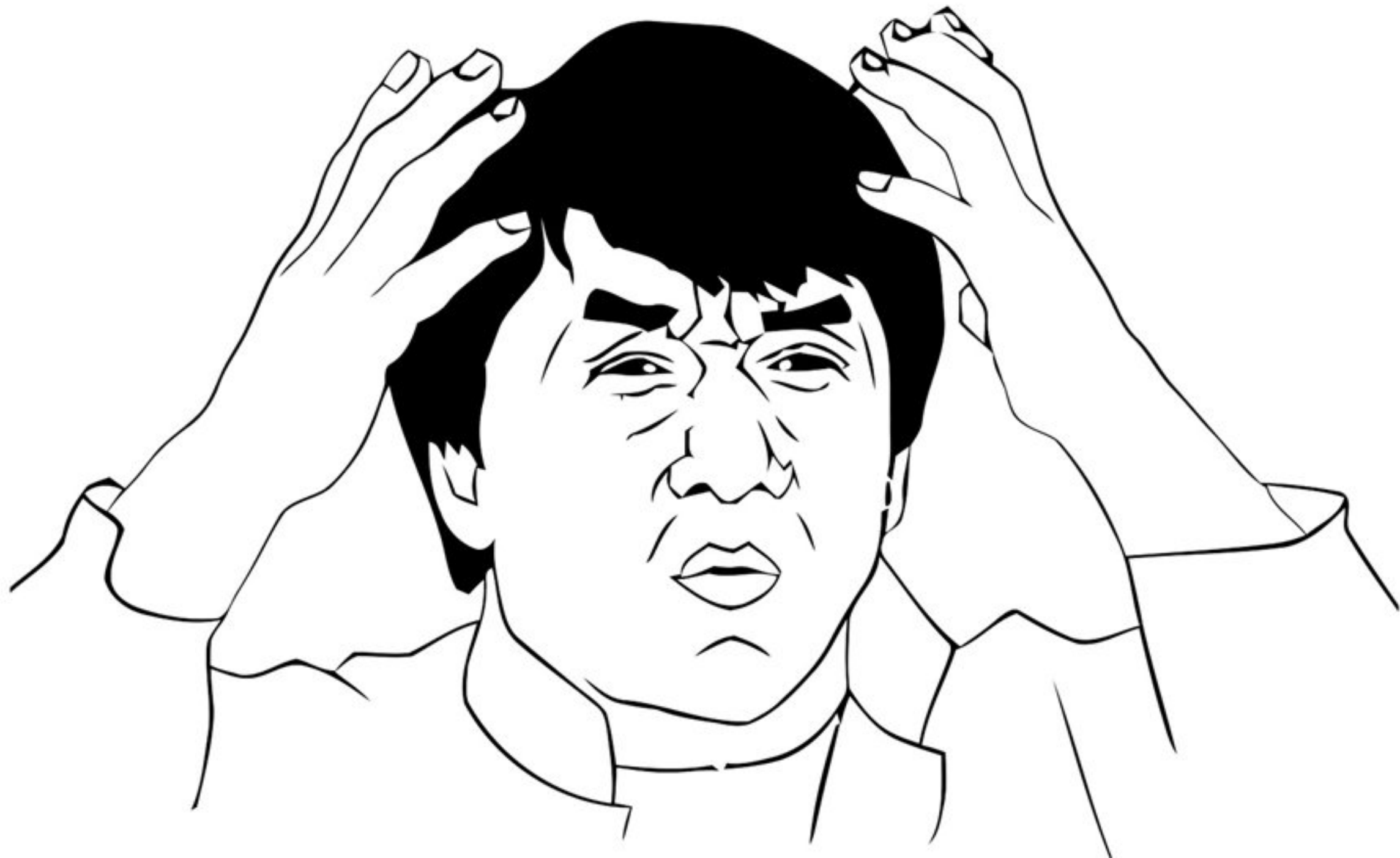
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Outline

- Motivation
- Overview
- Hardware
- Tracking System
  - Simple Tracking
  - PID Tracking
- Control System
  - Remote Control
  - Parameter Setting
- Project and Eight Week Units

Overview

- We developed a stuff that features:
  - Compact, but powerful;
  - Ordered by mobile phones, so we can
  - Play everywhere; and it
  - Goes everywhere by itself, of course;
  - Robust, in any path.
- Remote-controlled toy cars of EE version.

Demo

What Will the First-Year Learn

- Control System
  - Modularized Programming: Moving, Calculating, and Ordering
  - Feedback Handling
  - Iteration Experiment
- App Programming
- Embedded System
  - Arduino Board as a Solution
  - Data Sheet Reading
- Hardware Know-how

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Hardware

- We have a lot of bugs during development, like
  - Weight Balancing
  - Sensor/Board Positioning
  - Unstable/Improper Voltage
  - Circuit Shorting
- We know how to prevent such problems, hence.
- Reference to: https://goo.gl/erkTuj.

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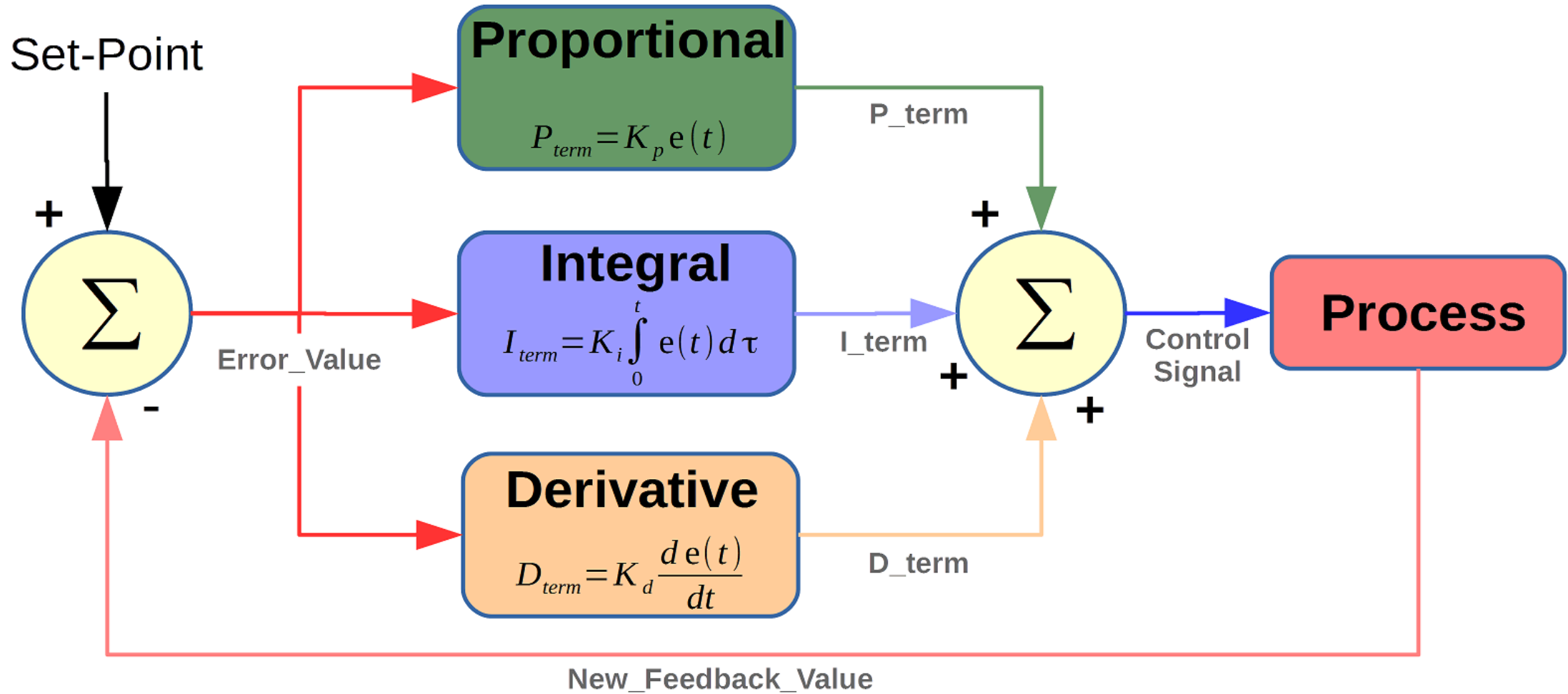
- Recap and Eight Week Units

Tracking System

- Simple Tracking System
  - Two/Three Stage Control
  - Simple but Edged
  - Without Feedback Handling
- PID Tracking System
  - Go with Proportional, Integral, and Differential Parameters
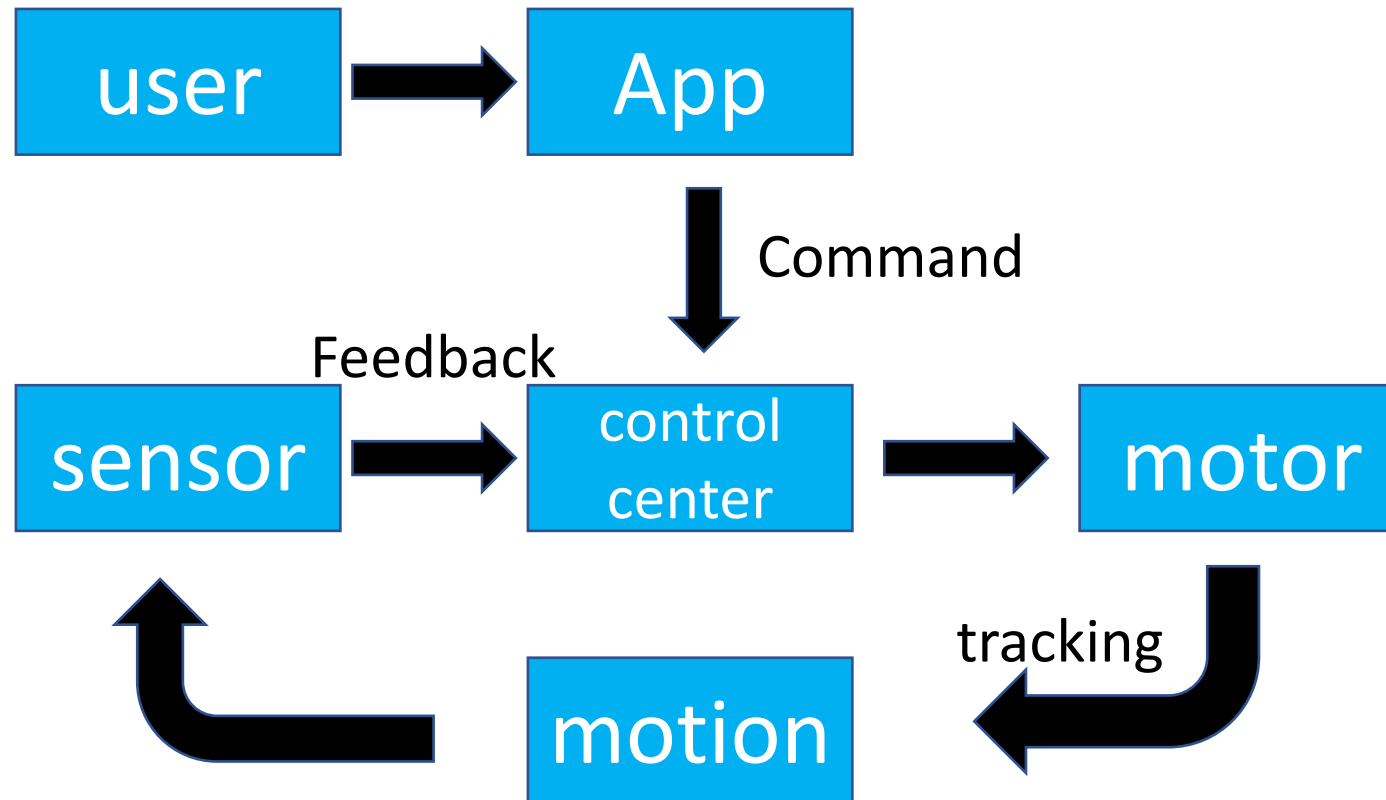 - Stable, Smooth and Robust

Simple Tracking System

- A intuitive solution that the car:
  - Turns right when it goes to the left,
  - And vise versa.
- When it comes to three stage control, the car:
  - Turns less if diverges less;
  - Turns more if diverges more.

PID Tracking System

Proportional

$$P_{term} = K_p \, \mathrm{e}(t)$$

Integral

$$I_{term} = K_i \int_0^t \mathrm{e}(t) \, d\tau$$

Derivative

$$D_{term} = K_d \frac{d\,\mathrm{e}(t)}{dt}$$

Process

Set-Point

Error_Value

P_term

I_term

D_term

Control Signal

New_Feedback_Value

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System Block Diagram

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Control System: via App

- Set PID Parameter and Velocity

- Manual Remote Control

- Bluetooth Communication

App UI

Control Panel

Parameter Setting

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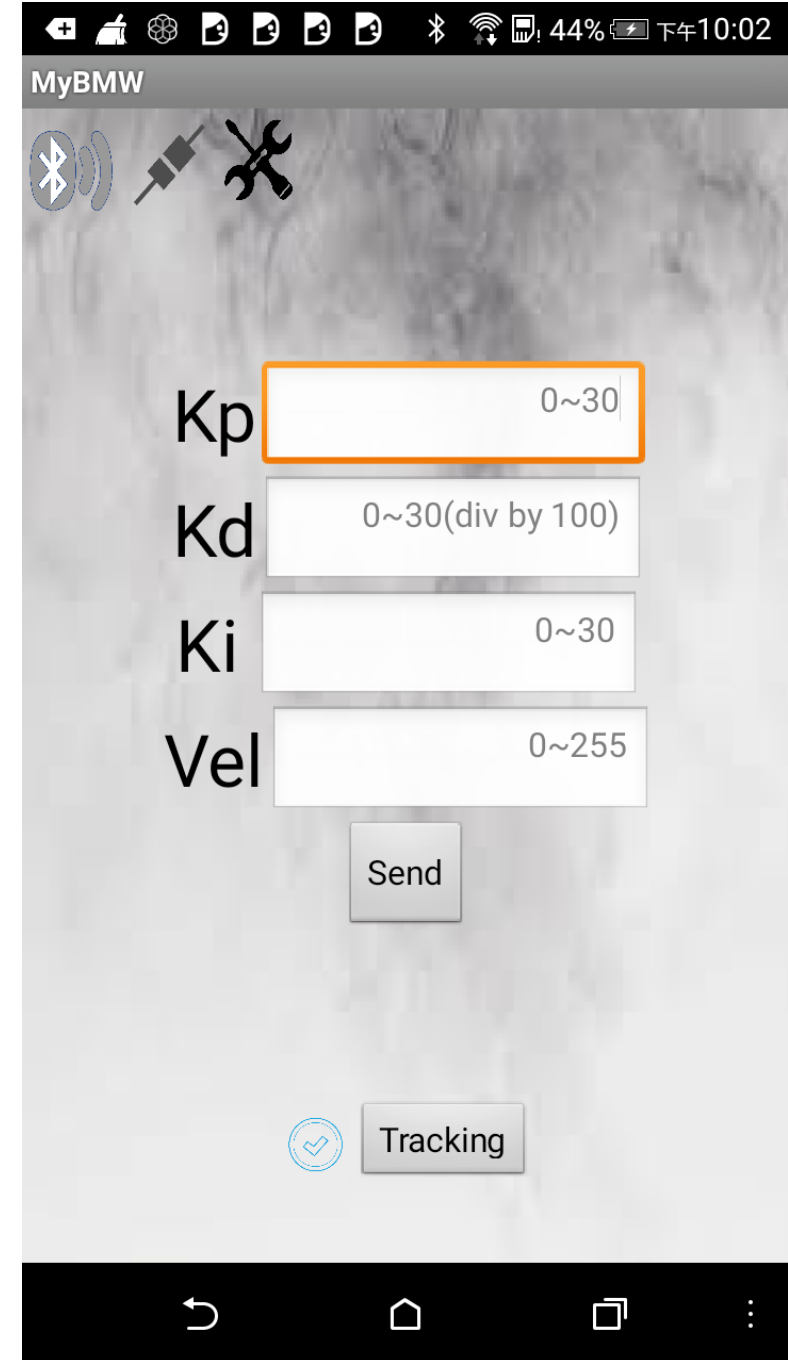
- Project and Eight Week Units

Project

- Have the first-year improve the car to play:
  - Obstacle Contest
  - Race in difficulties of three different level
- In addition, we will set some limit such as but not limited to:
  - Weight
  - Physical Size
  - Number of Sensors

Eight Weeks Units

- **Intro to Arduino**
  - Intro to pins, working voltage
  - "Hello World!"
- **Intro to Bluetooth**
  - Communication with Bluetooth
- **Bluetooth-Controlled Car**
  - Simple app
  - Controlled by mobile phone
  - Manual tracking
- **Simple Tracking System**
  - Track with infrared module
  - Two/Three stages control system

- **PID System with Photo Resistor**
  - Intro to PID control system
  - Realize PID with photo resistor
- **PID System with Infrared Array**
  - Realized PID with infrared module
  - Set PID parameters

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- **Intro to Internet of Thing**
  - Intro to embedded system
  - Intro to cloud
- **Intro to Algorithm**

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Conclusion

- Project Advantages
  - Combination with Others' Projects
  - Rookie Friendly
  - Interesting among Real Life
  - Application Oriented
- Strengthened Skills
  - Programming
  - Iteration Experiment
  - Engineering Sense, e.g. feedback
  - Hardware Sense, e.g. working voltage