

Visual Servoing Parking System

視覺伺服的自動倒車入庫系統

義守大學電機系

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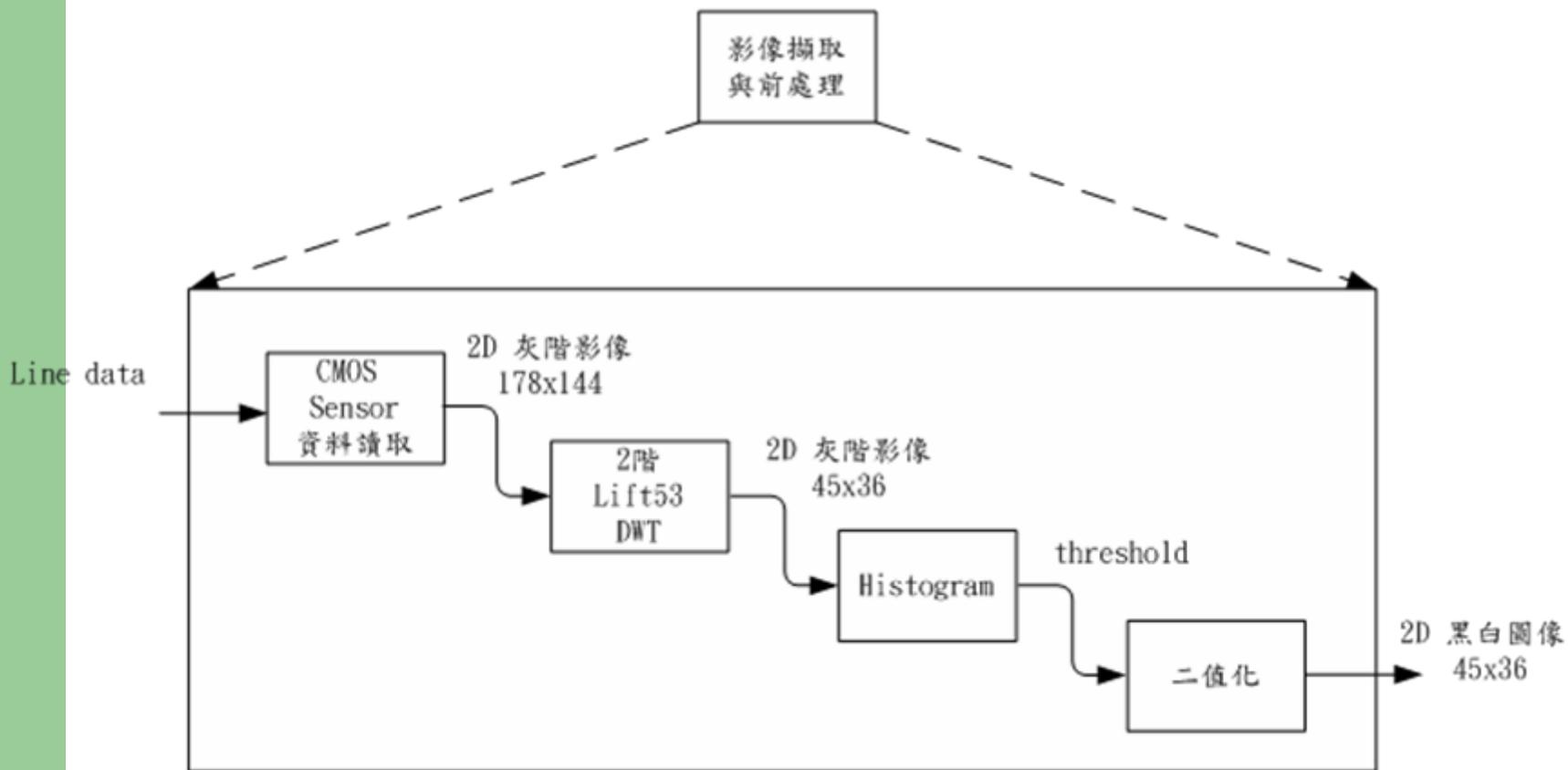
目的

- 仿效日本豐田（TOYOTA）公司所發表的新款概念車中提出的視覺化自動停車系統
- **不使用**紅外線或是超音波感知元件做為距離量測工具
- 完全使用機器視覺達到自動搜尋停車格達到自動停車的目的

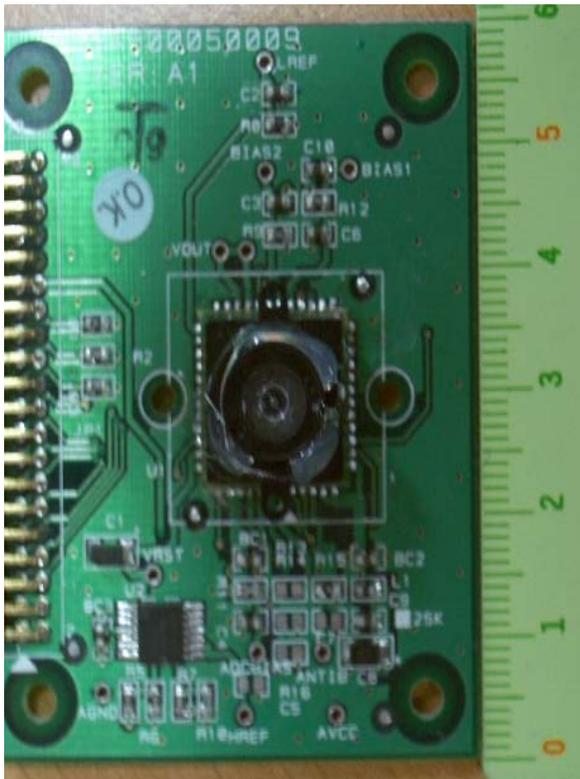
本系統五大功能模組

- 影像擷取與前處理。
- 停車位追蹤。
- 資料傳輸介面。
- 模糊控制系統。
- 伺服馬達動作控制。

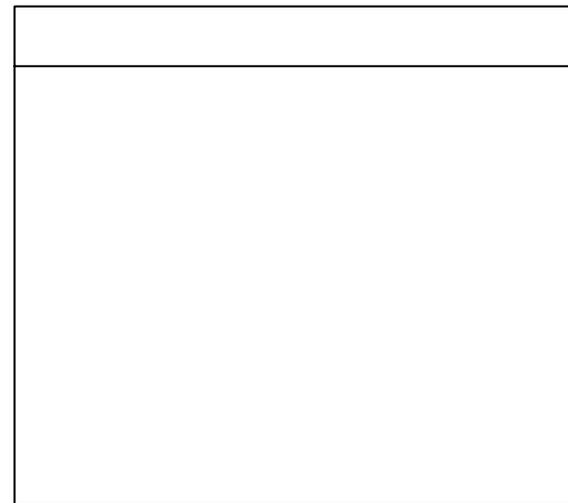
影像擷取與前處理



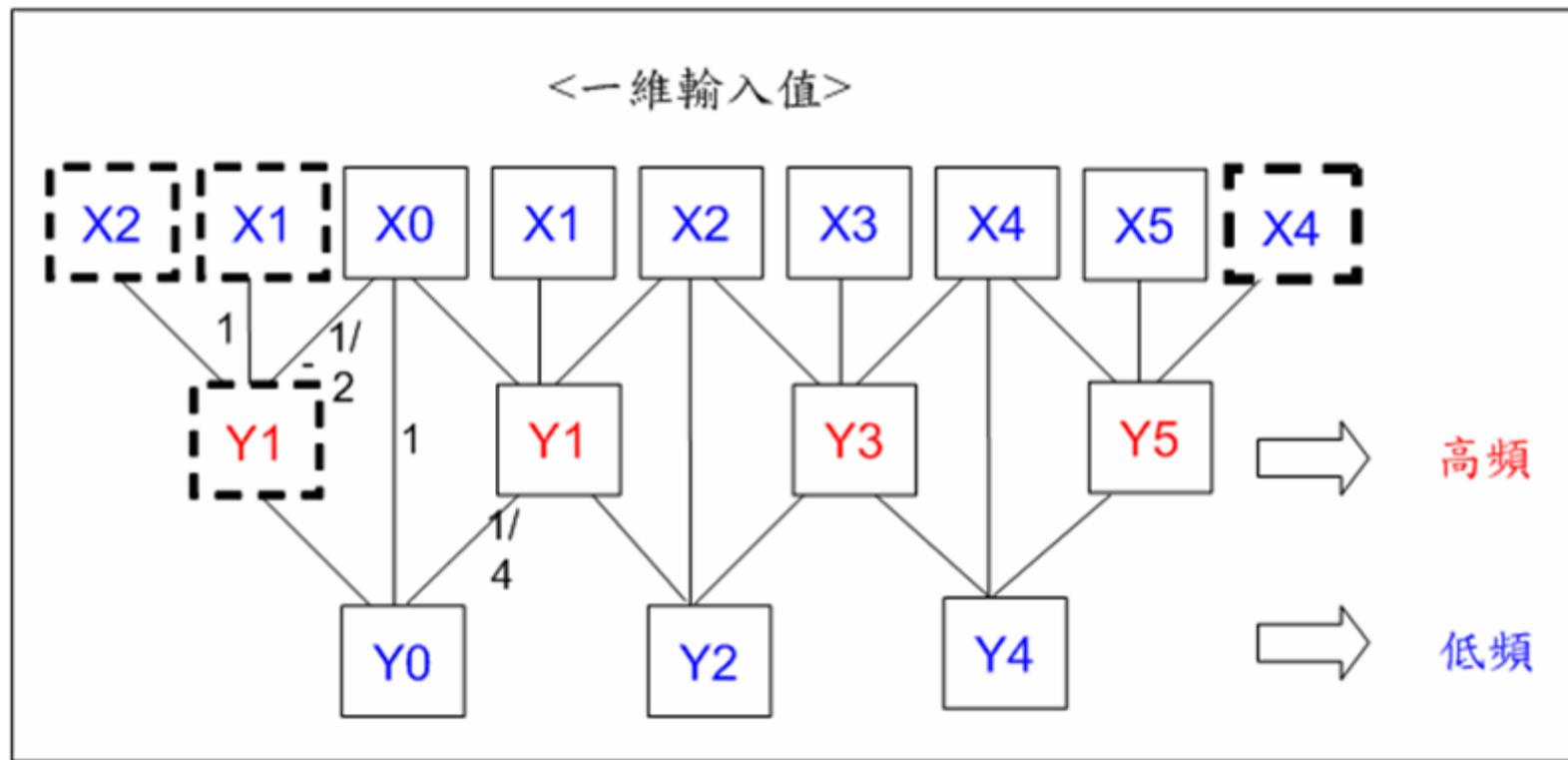
CMOS Image Sensor 取像模組



178x144 Pixels



Lifting53 離散小波轉換



Lifting53 離散小波轉換



原始影像178x144

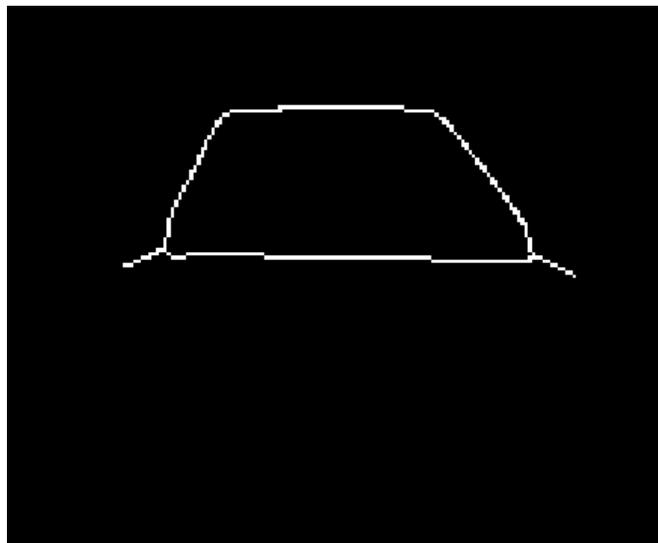


Lift53二階小波轉換影像

影像處理



Histogram 二侢化影像 45x36



細線化影像 45x36

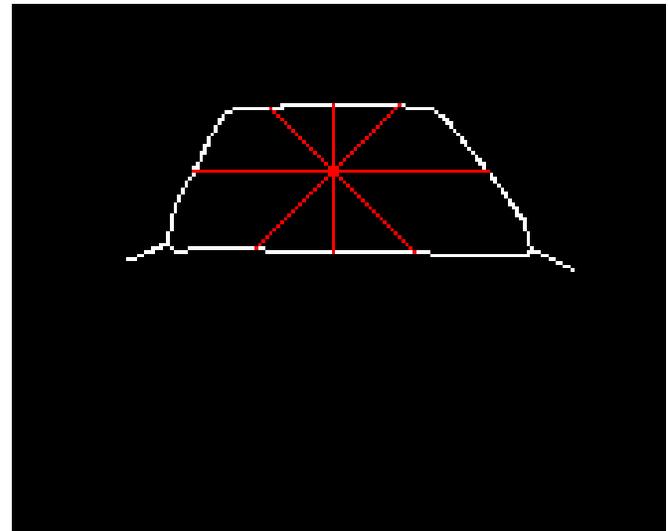
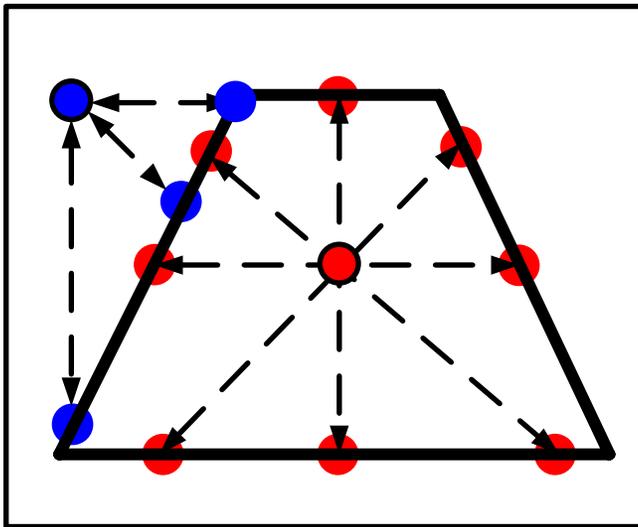
Particle Swarm Optimization (PSO)

粒子群最佳化

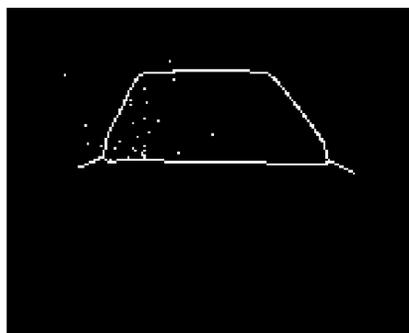
$$V_{id} = V_{id} + c_1 * rand() * (P_{id} - X_{id}) \\ + c_2 * rand() * (P_{gd} - X_{id})$$

$$X_{id} = X_{id} + V_{id}$$

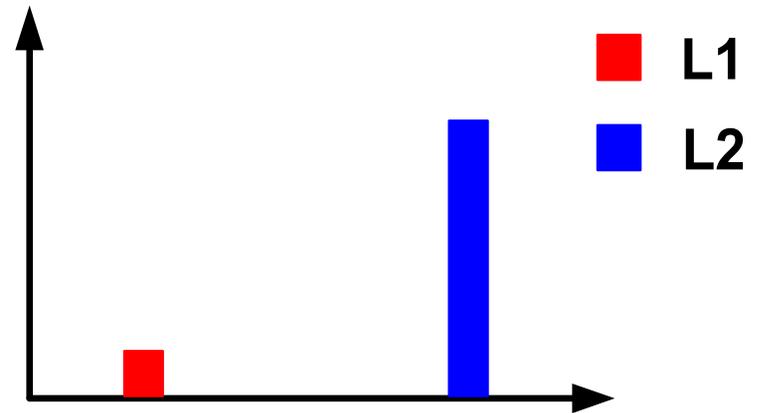
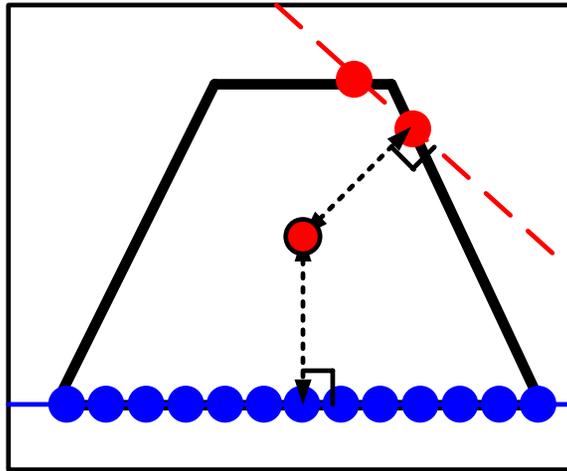
PSO 目標函數



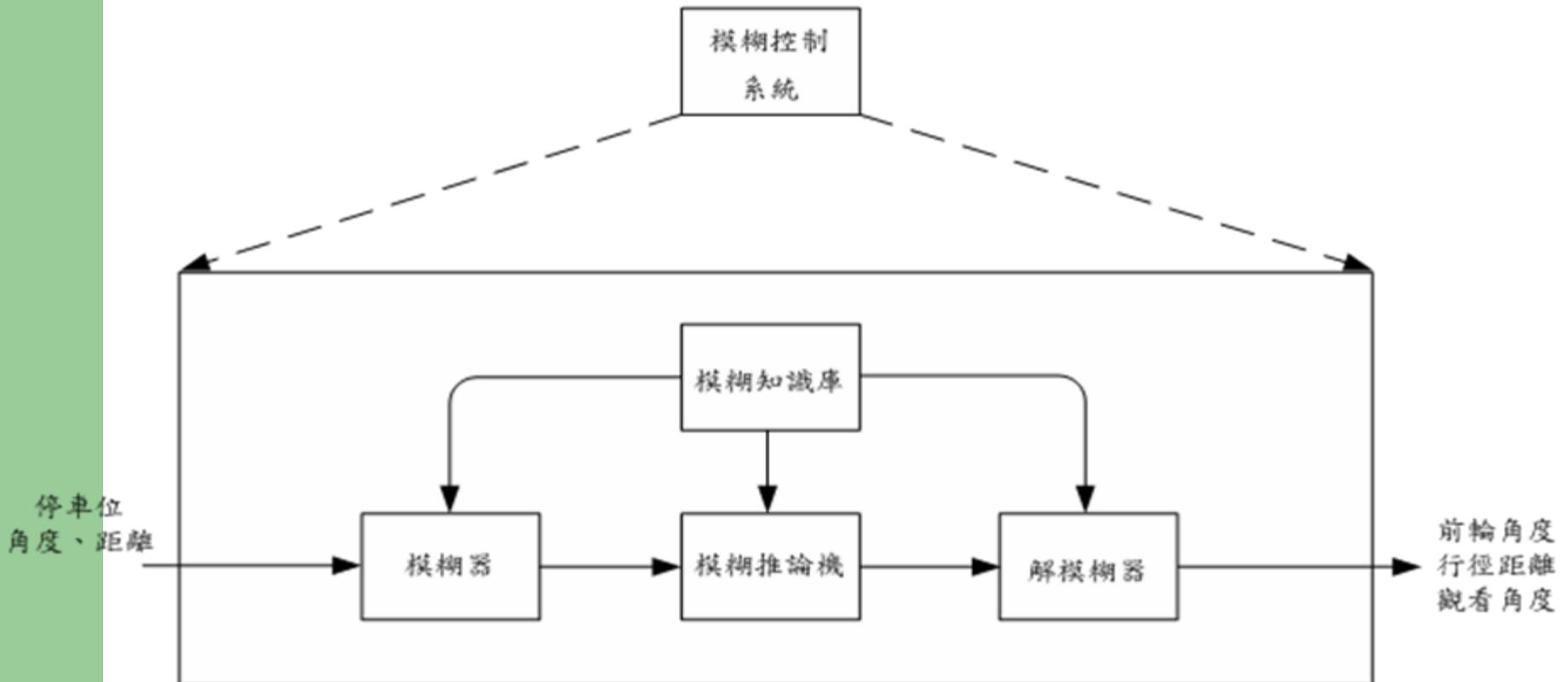
PSO 停車位追蹤



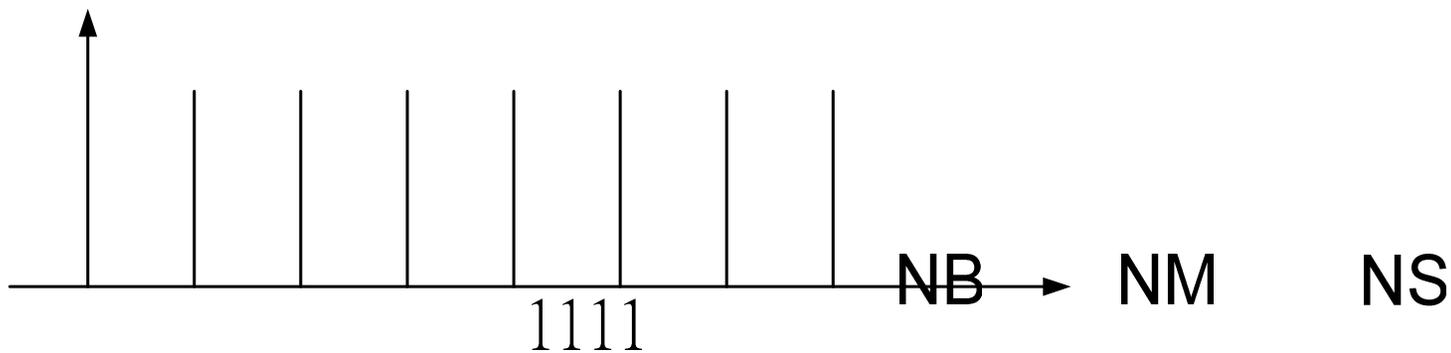
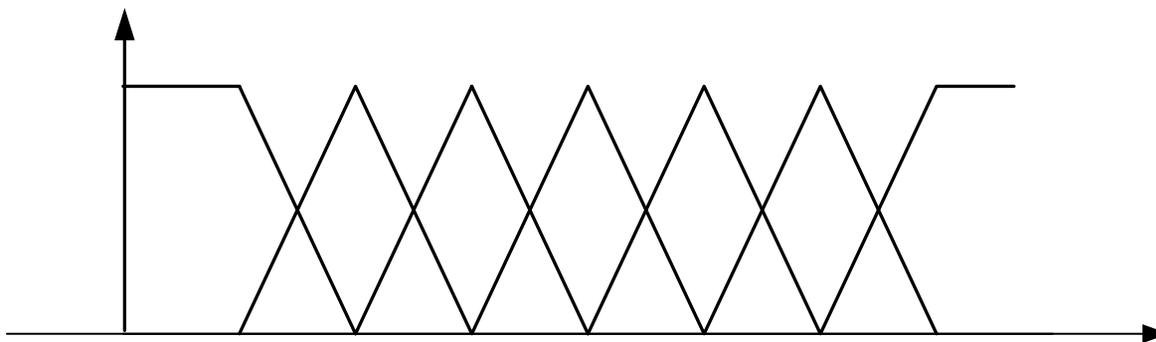
Fast Hough Transform



模糊控制系統



歸屬函數

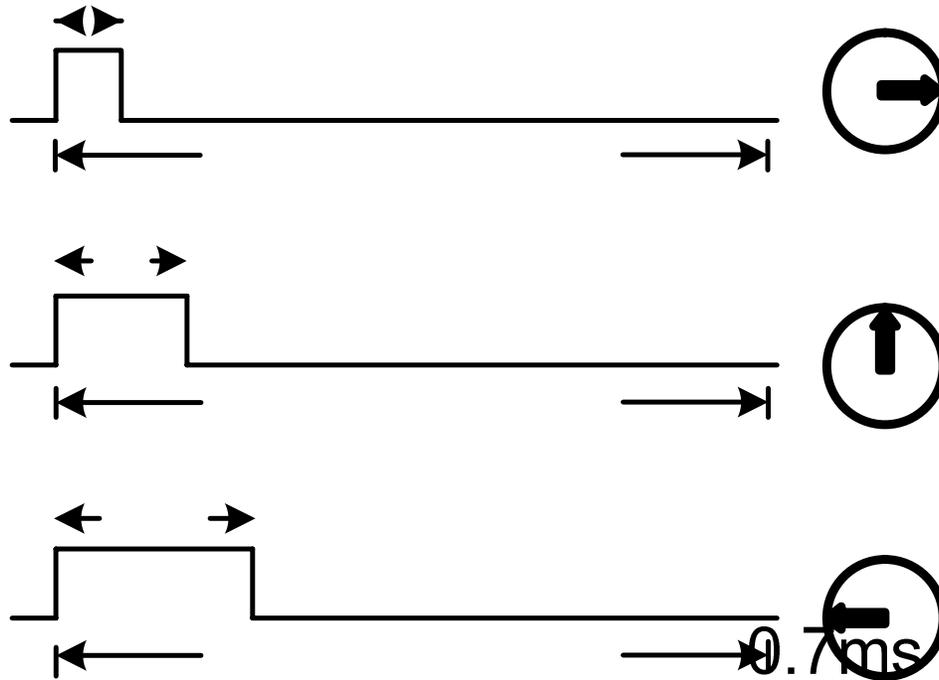


解模糊化FPGA硬體設計

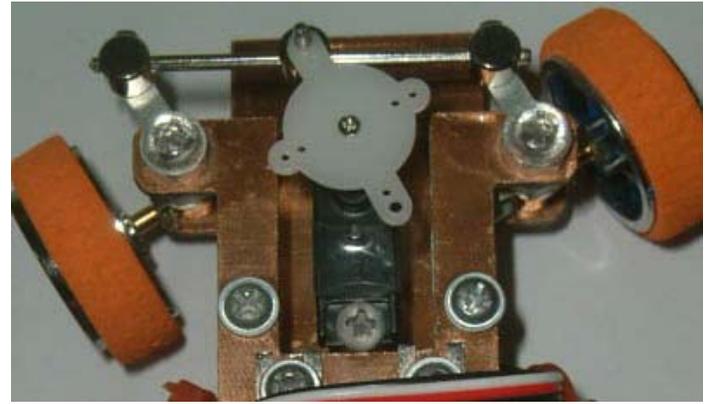
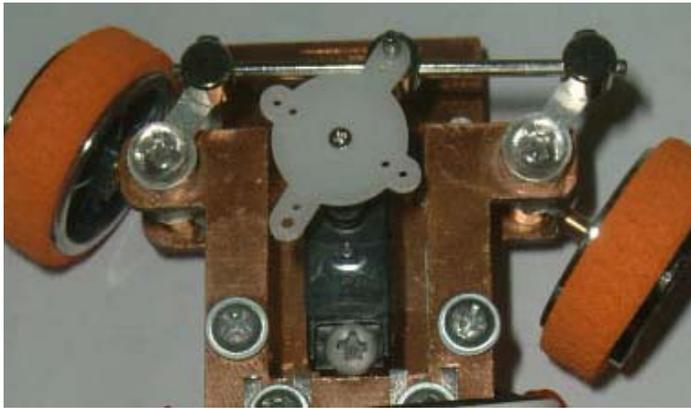
高度法(Height Method)：

$$Q = \frac{\sum_{n=1}^N W_n * Z_n}{\sum_{n=1}^N W_n}$$

伺服馬達控制器 (PWM)

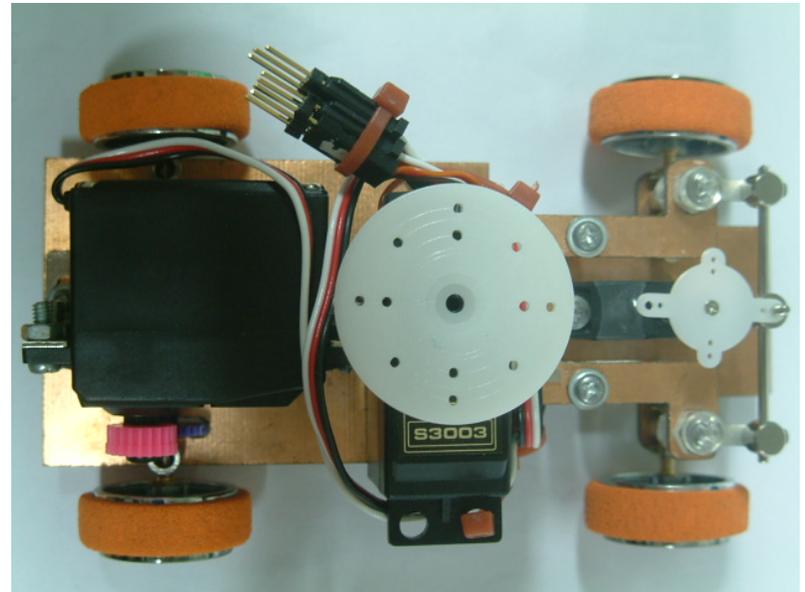
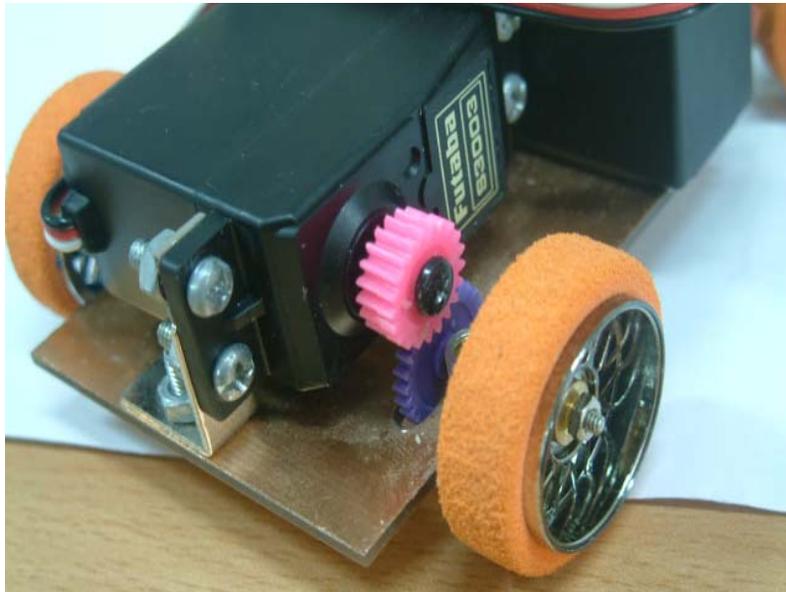


轉向機構

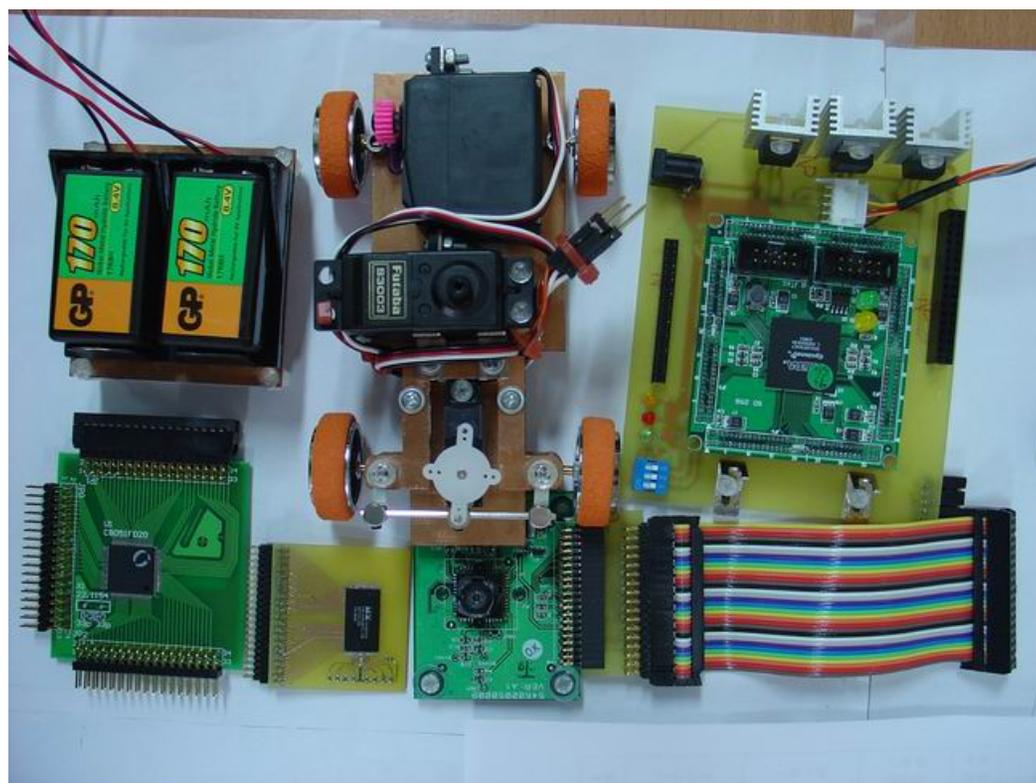


轉向機構上方俯視圖

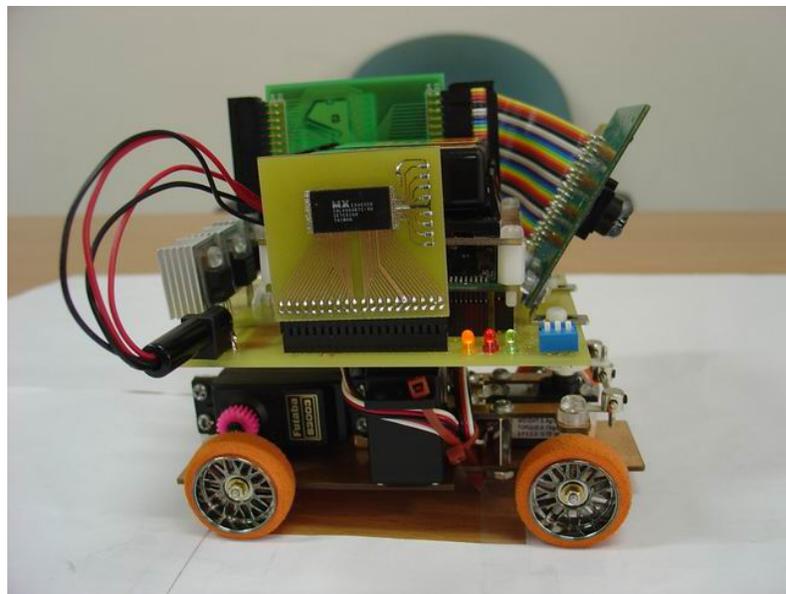
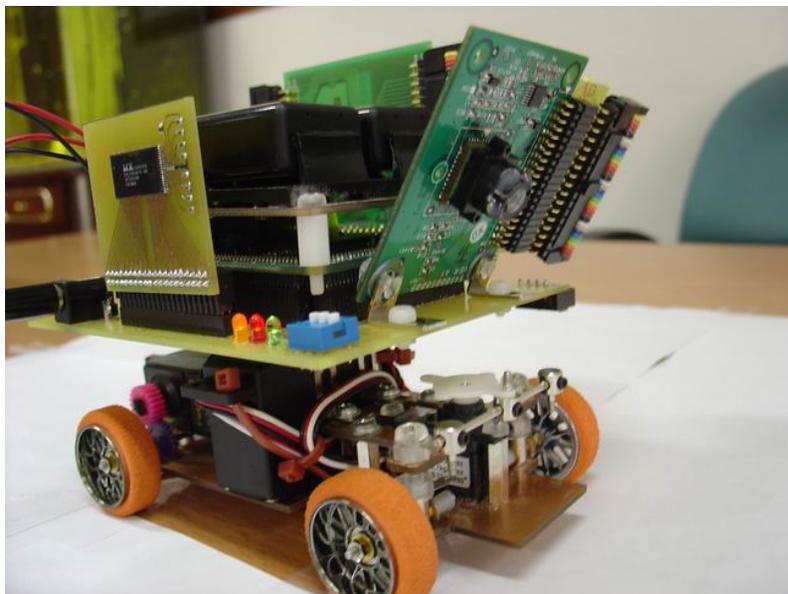
驅動機構



系統各部分硬體模組



完成圖



影片展示

