

智慧型作物害蟲影像監測系統

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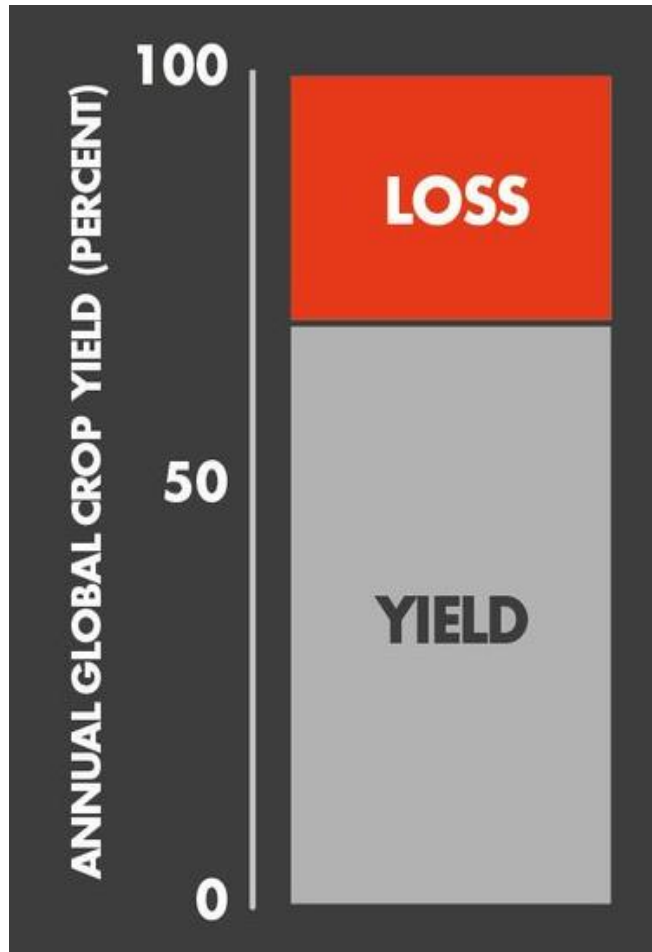
Department of Biomechatronics Engineering

大綱

- 前言
- 害蟲智慧偵測與辨識系統
- 病蟲害預警與管理
- 智慧型病蟲害整合管理之未來願景



前言

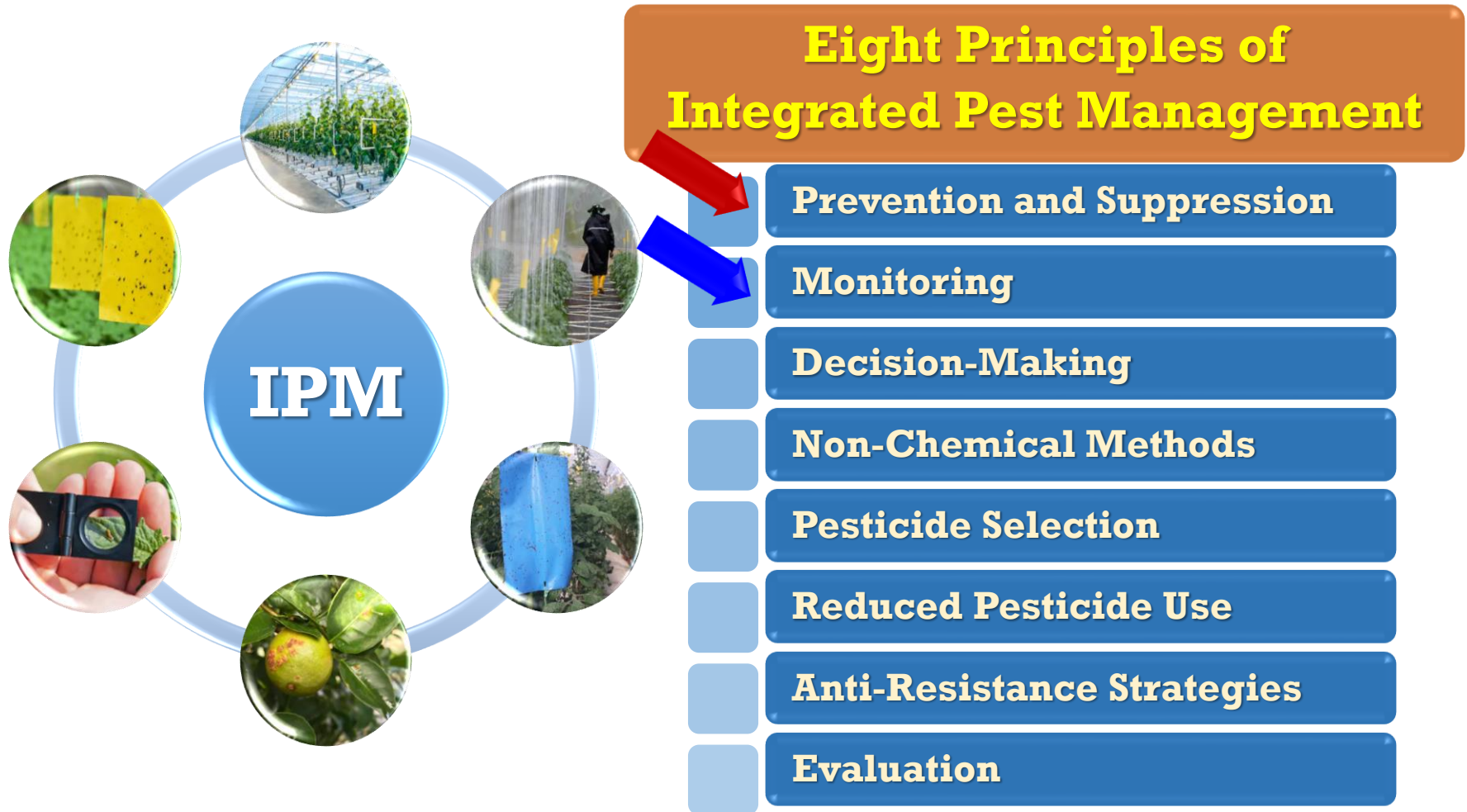


BETWEEN 20 AND 40% OF GLOBAL CROP YIELDS ARE REDUCED EACH YEAR DUE TO DAMAGE BY PLANT PESTS AND DISEASES

Sources: FAO Statistics; Oerke, (2006)



前言



Source: ANNEX III of Framework Directive 2009/128/EC



前言



Technical Aspect of IPM

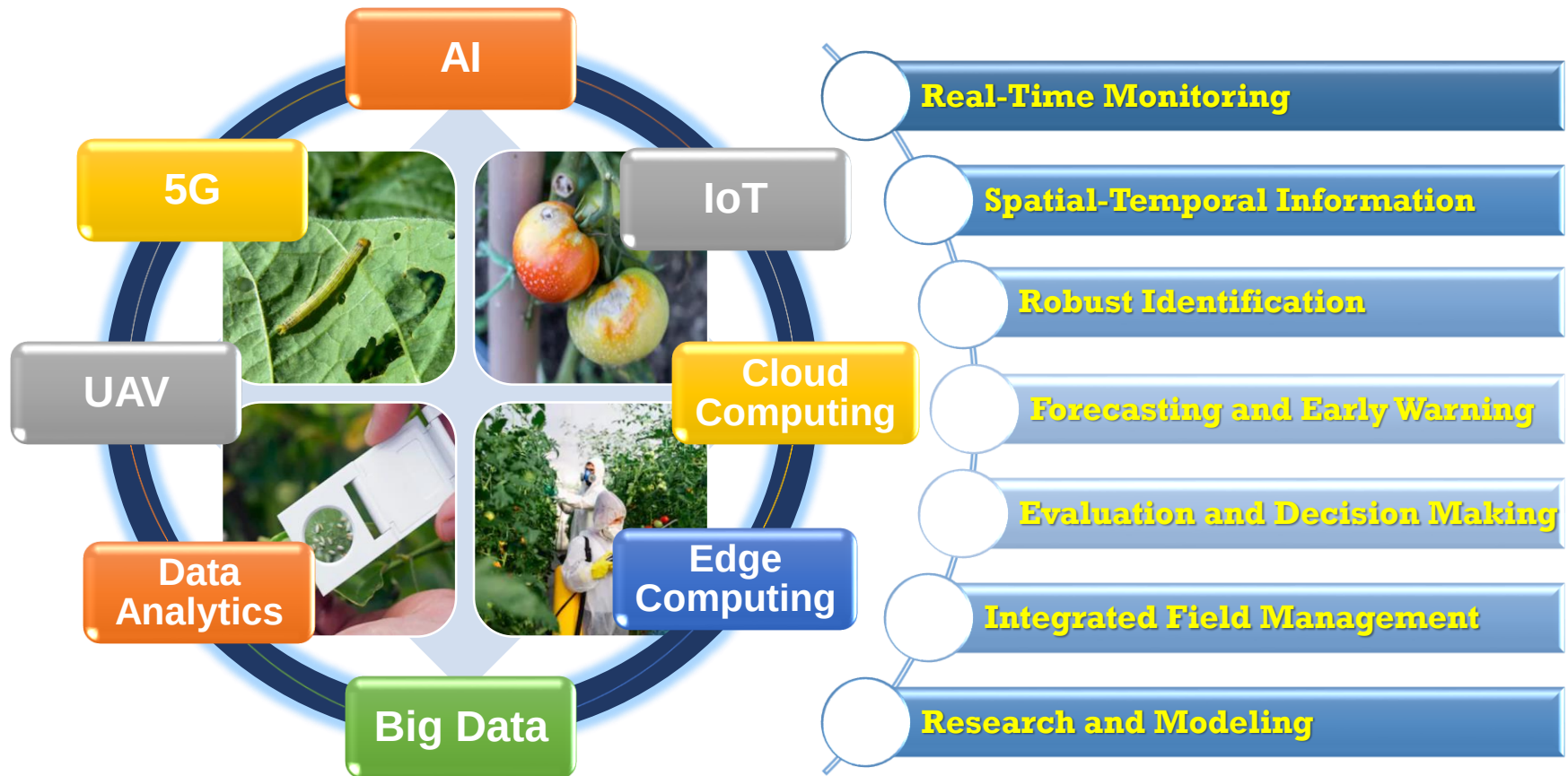


Source: <https://www.arbico-organics.com/category/integrated-pest-management-DIY>



前言

Key Technologies for Next Generation Pest and Disease Research and Management



害蟲智慧偵測與辨識系統

黏蟲紙 Sticky Paper Traps



- ◆ 非農藥防治重要資材
- ◆ 栽培環境蟲害監測



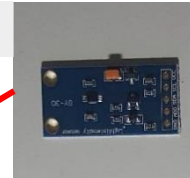
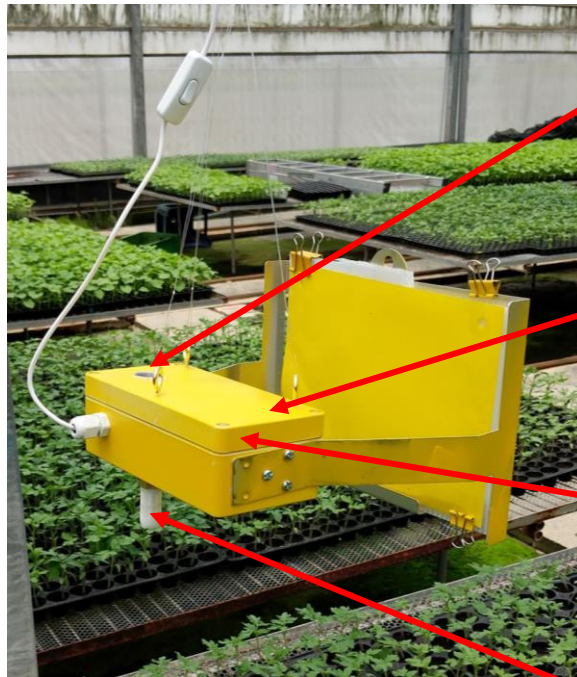
黃色黏蟲紙: 一般防治與監測 (粉蟲, 薊馬, 蠅類等)
藍色黏蟲紙: 其他特定害蟲 (薊馬, 蚜蟲等)

害蟲智慧偵測與辨識系統

整合AI影像辨識與環境監測之智慧感測模組

Integrated Sensor Module

Ver. 6 (April 2019)



BH1750 Light intensity sensor
(ROHM Semiconductor)



Raspberry Pi Camera Module v2.1
(Raspberry Pi Foundation, Inc.)



Raspberry Pi 3
(Raspberry Pi Foundation, Inc.)



SHT20
(Sensirion)

Improvements:

- Waterproof design
- Even more simplified assembly

害蟲智慧偵測與辨識系統

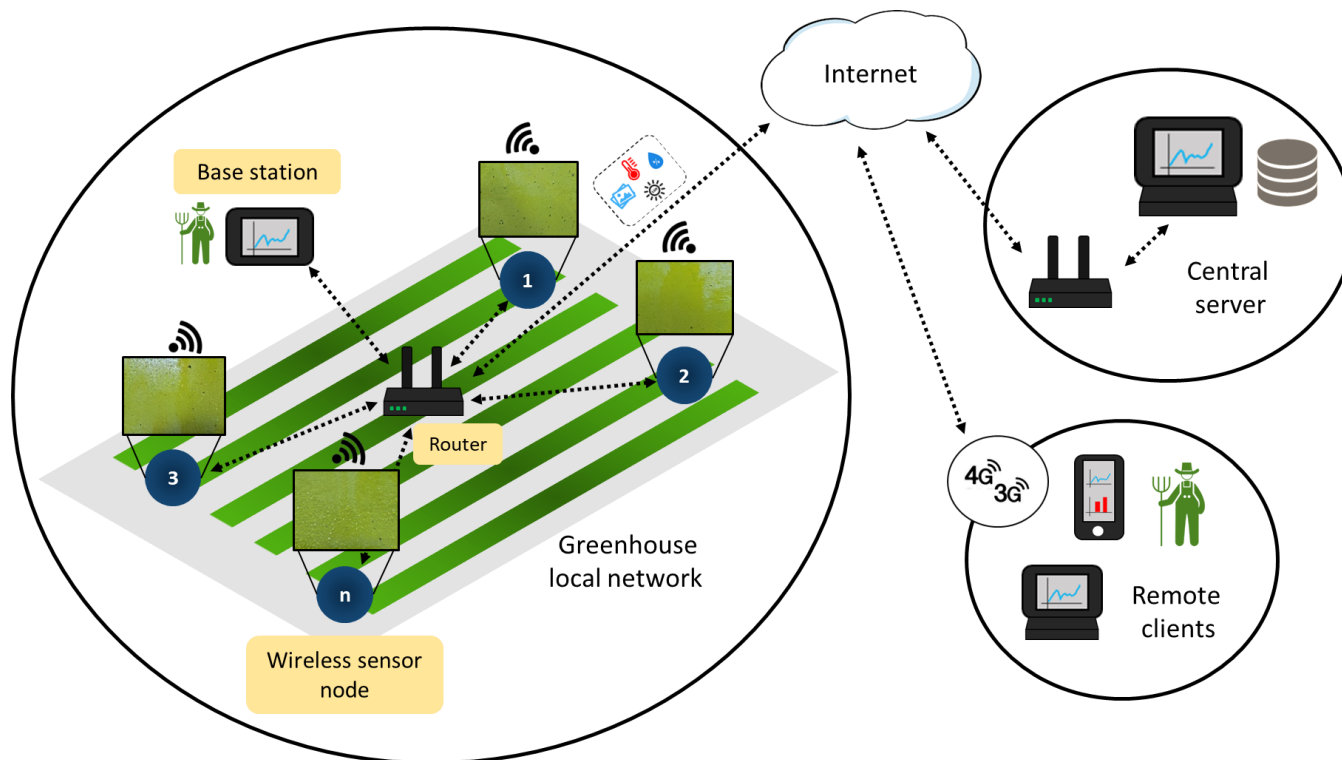
運用深度學習AI影像辨識技術進行害蟲偵測與辨識

Pest detection and recognition using deep learning



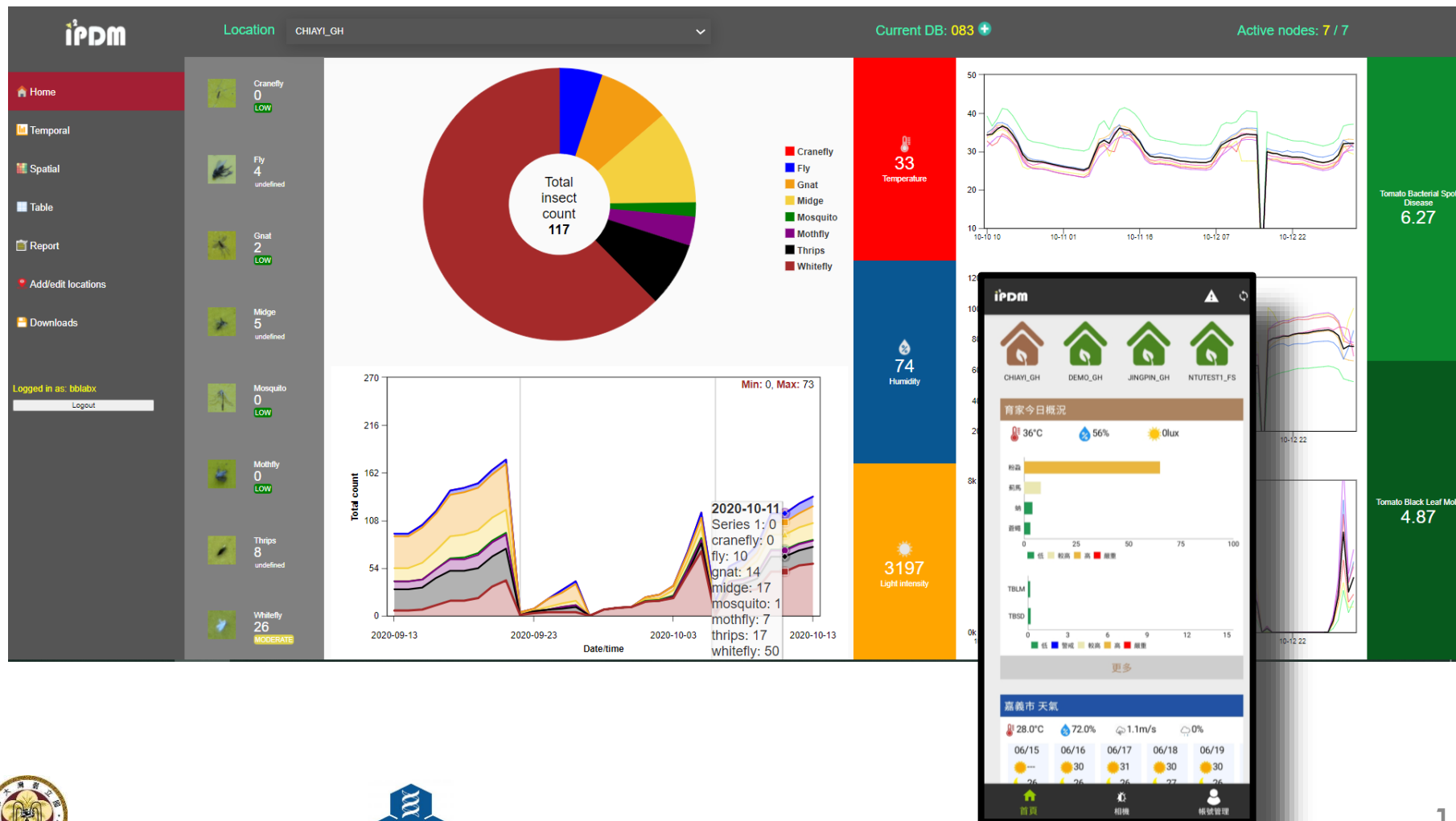
害蟲智慧偵測與辨識系統

系統架構



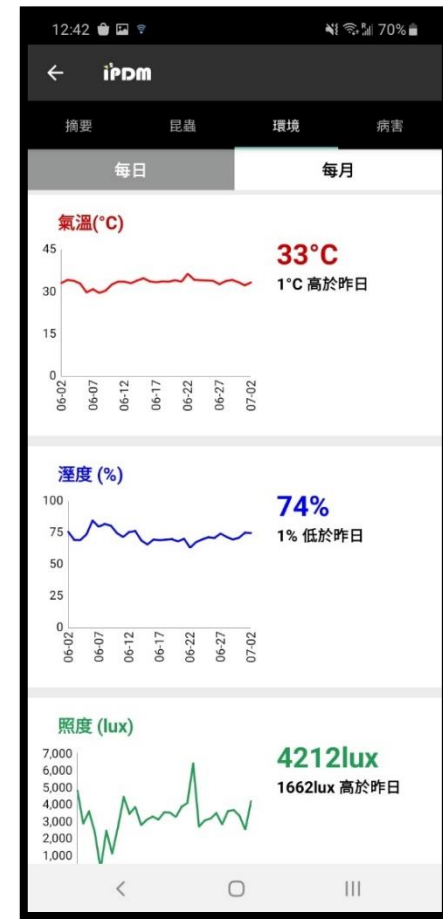
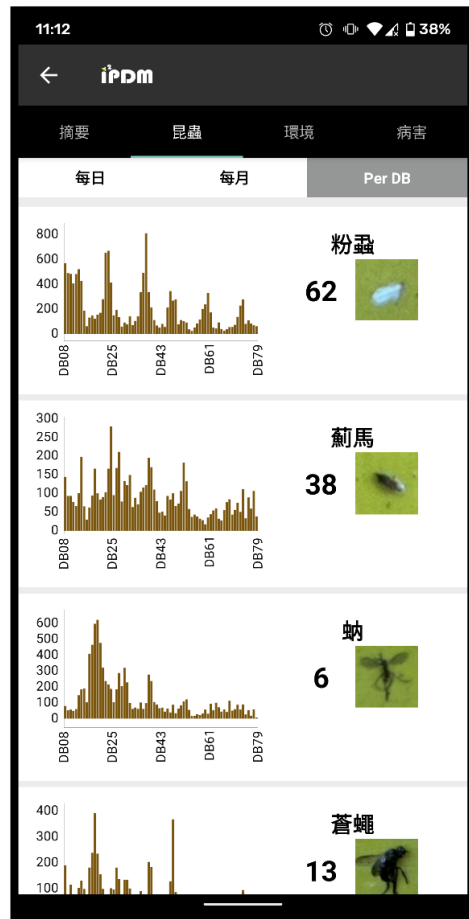
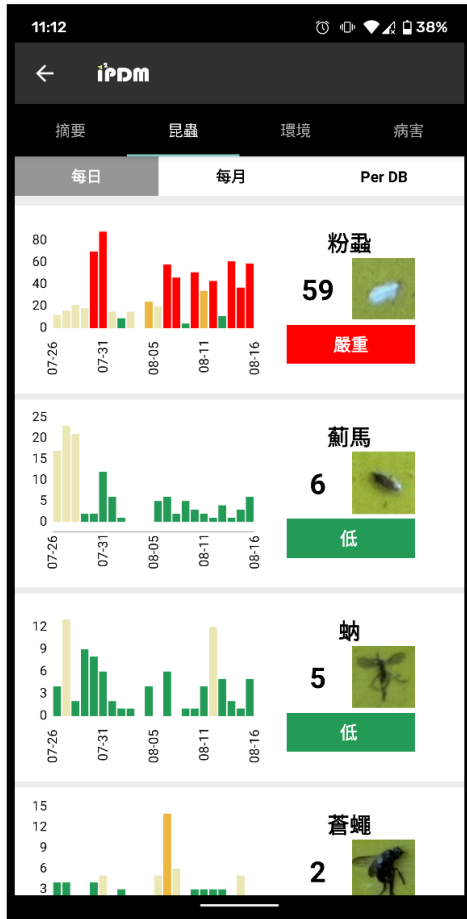
害蟲智慧偵測與辨識系統

網頁與行動裝置即時顯示場域內環境及蟲害資訊



害蟲智慧偵測與辨識系統

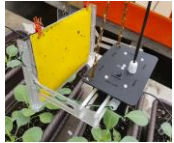
網頁與行動裝置即時顯示場域內環境及蟲害資訊



害蟲智慧偵測與辨識系統

場域驗證

水果與蔬菜溫室場域



NTU Experimental Farm

Crops: Cabbage
Nodes: 4



Farm A

Crops: Strawberry
Nodes: 8



Farm B

Crops: Vegetable seedling
Nodes: 10



Farm C

Crops: Vegetable seedling
Nodes: 7



Farm D

Crops: Vegetable seedling
Nodes: 6



TNDAIS Mango Orchard

Crops: Mango
Nodes: 3

果園與花卉實驗場域

Farm E

Crops: Eustoma
Nodes: 8



Farm F

Crops: Orchid
Nodes: 6



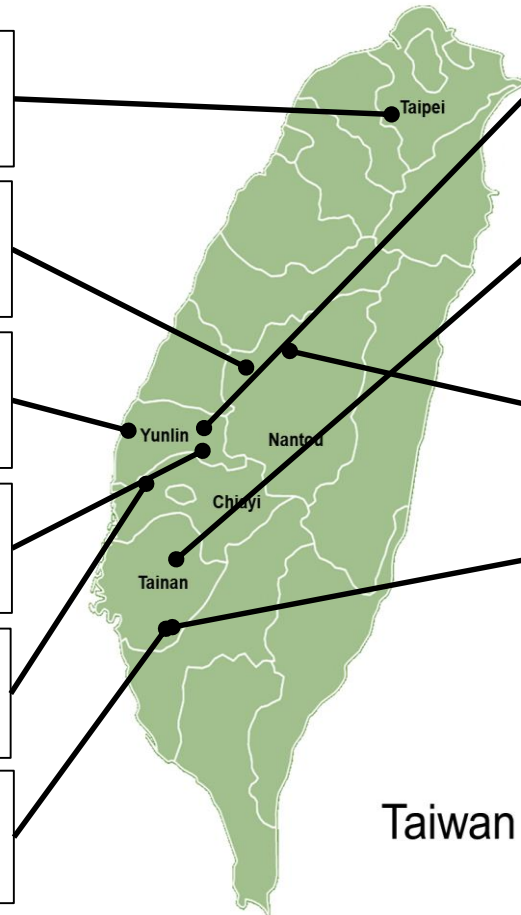
Farm G

Crops: Tomato
Nodes: 8 x 2



TNDAIS Experimental Farm

Crops: Eustoma
Nodes: 6



Taiwan

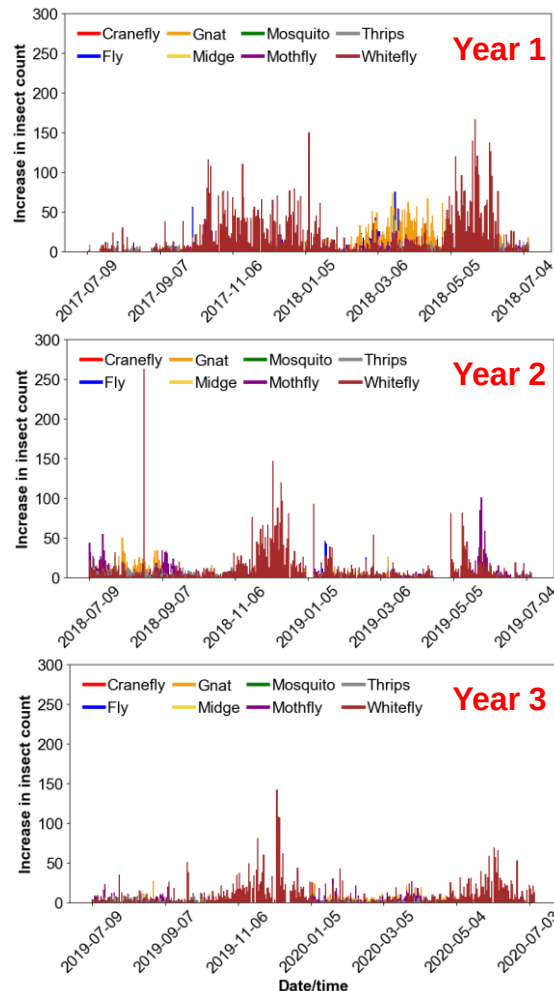
Planning: 6 sites



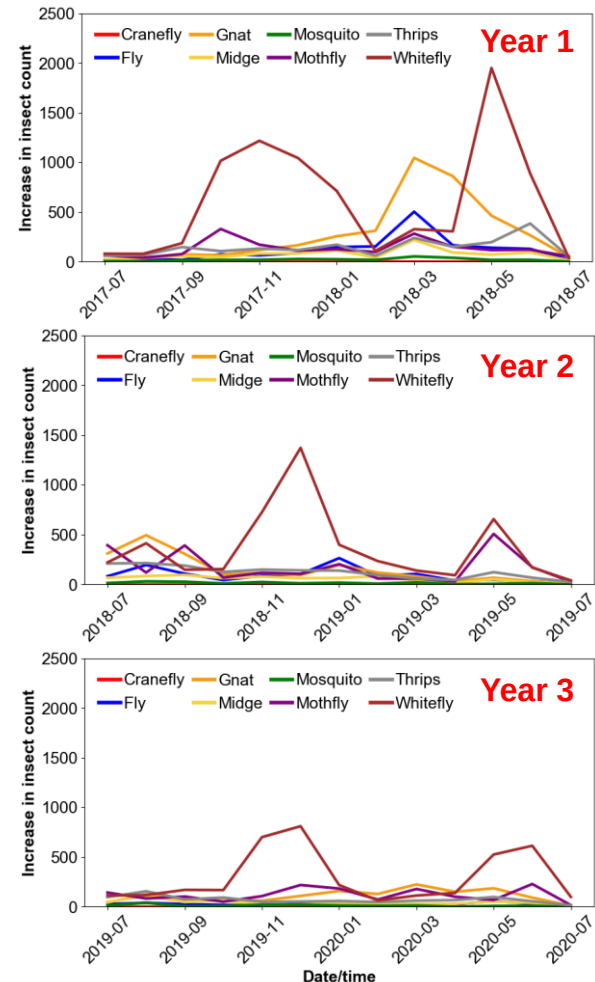
害蟲智慧偵測與辨識系統

應用實例

Daily increase in insect count



Monthly total insect count



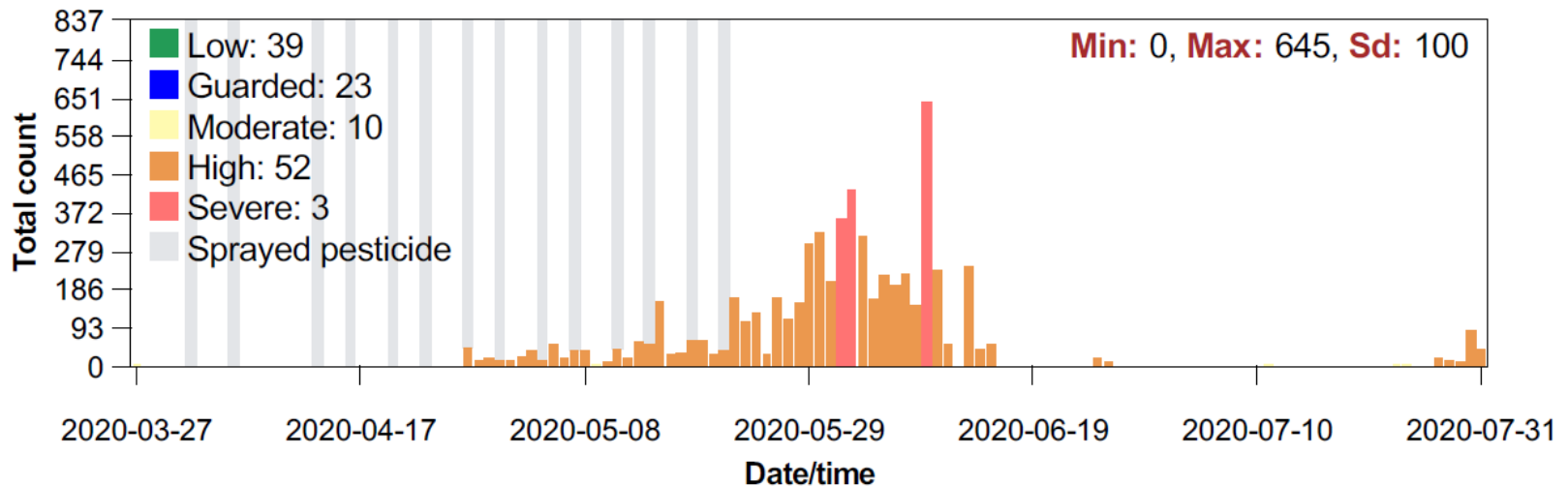
害蟲智慧偵測與辨識系統

應用實例

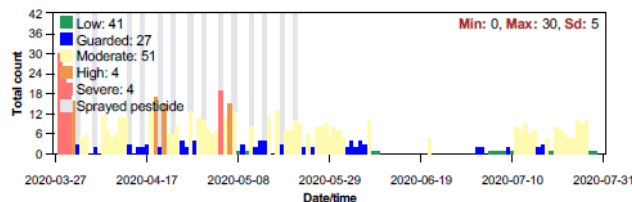
Daily differential insect count (cranefly)

Daily differential insect count (mosquito)

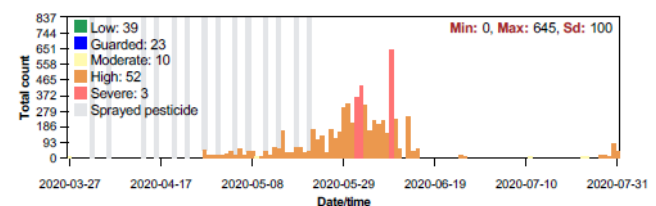
Daily differential insect count (whitefly)



Daily differential insect count (midge)



Daily differential insect count (whitefly)



病蟲害預警與管理

蟲害預警系統的建置

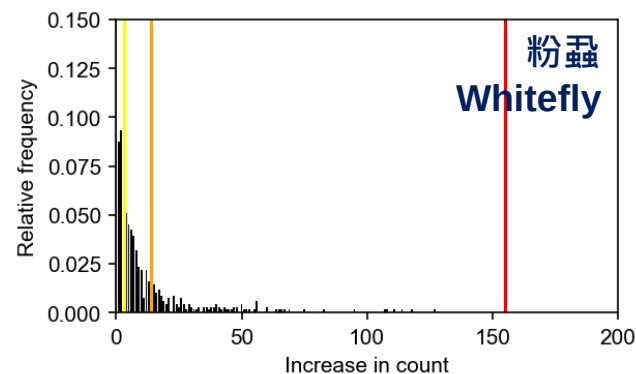
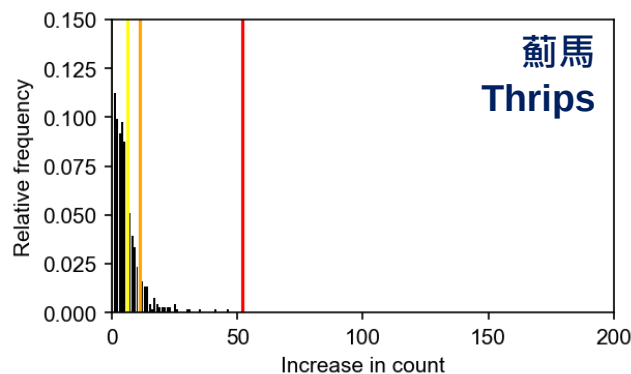
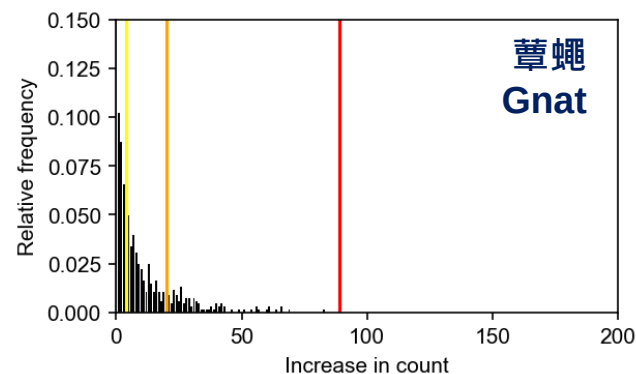
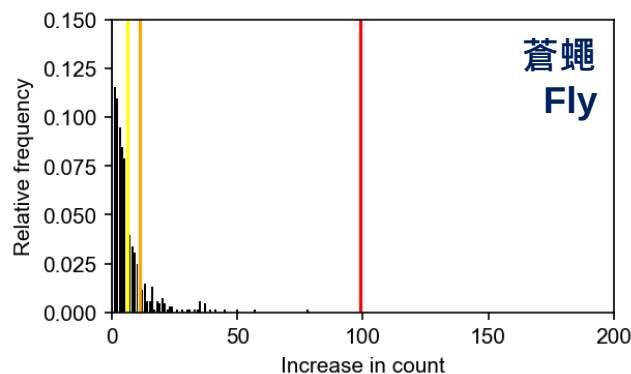
每日偵測害蟲數量異常與預警

嚴重 Severe

高 High

較高 Elevated

正常範圍 Normal



病蟲害預警與管理

番茄種苗細菌性斑點病預警系統

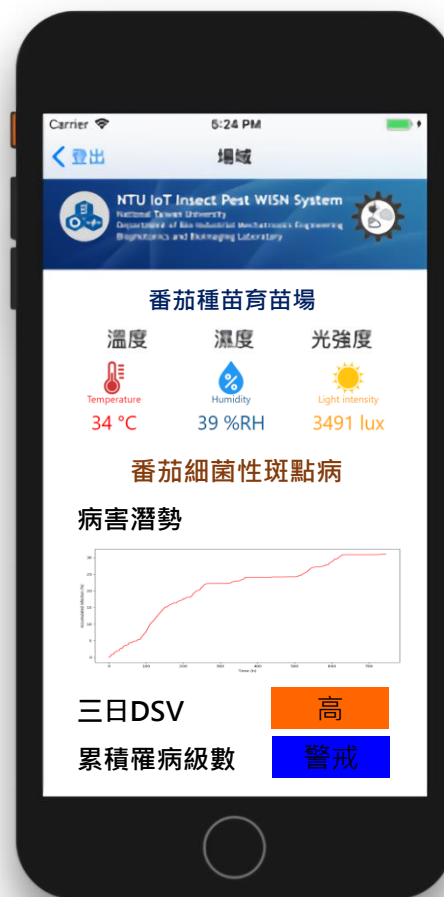
嚴重 Severe

高 High

較高 Elevated

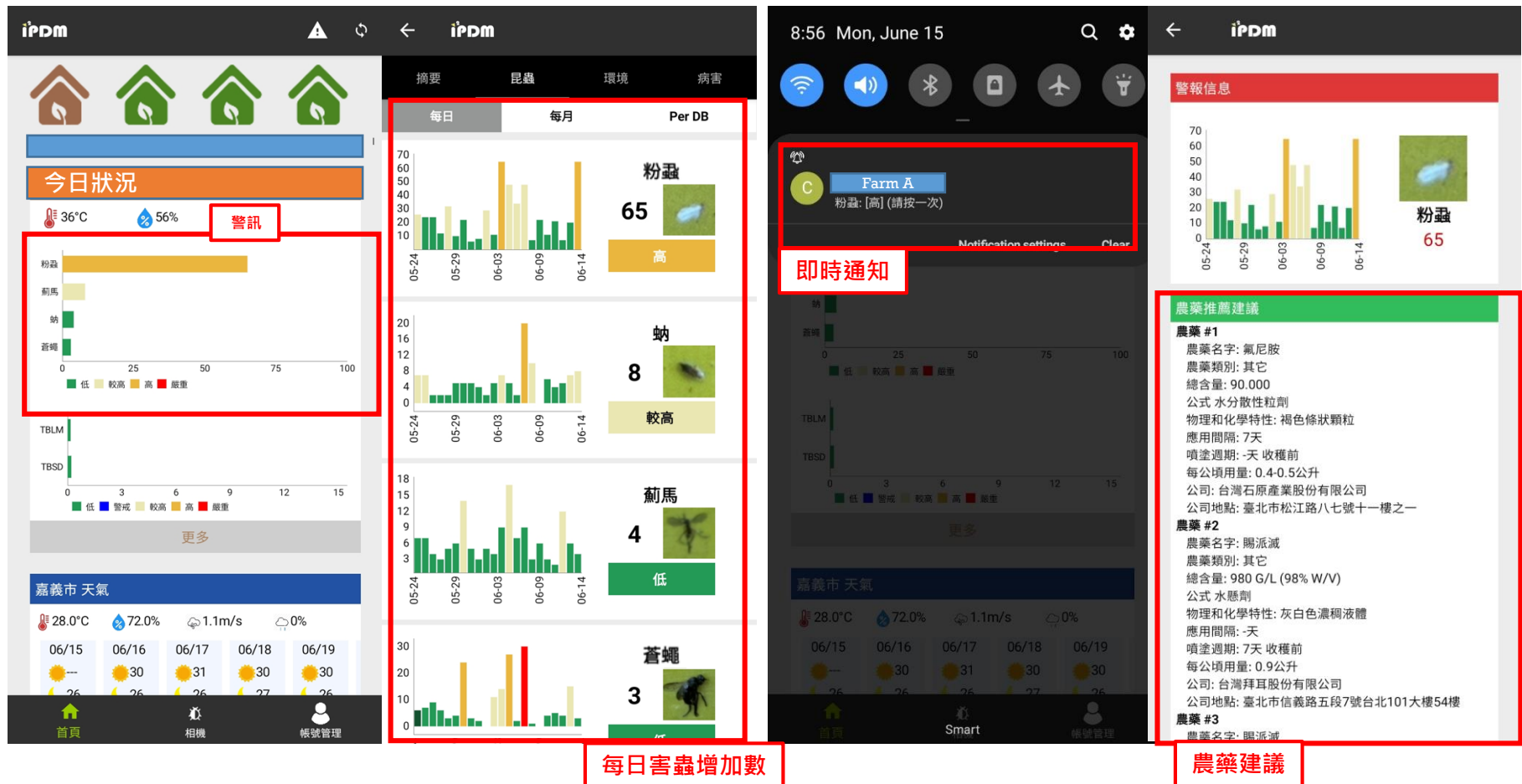
警戒 Guarded

低 Low



病蟲害預警與管理

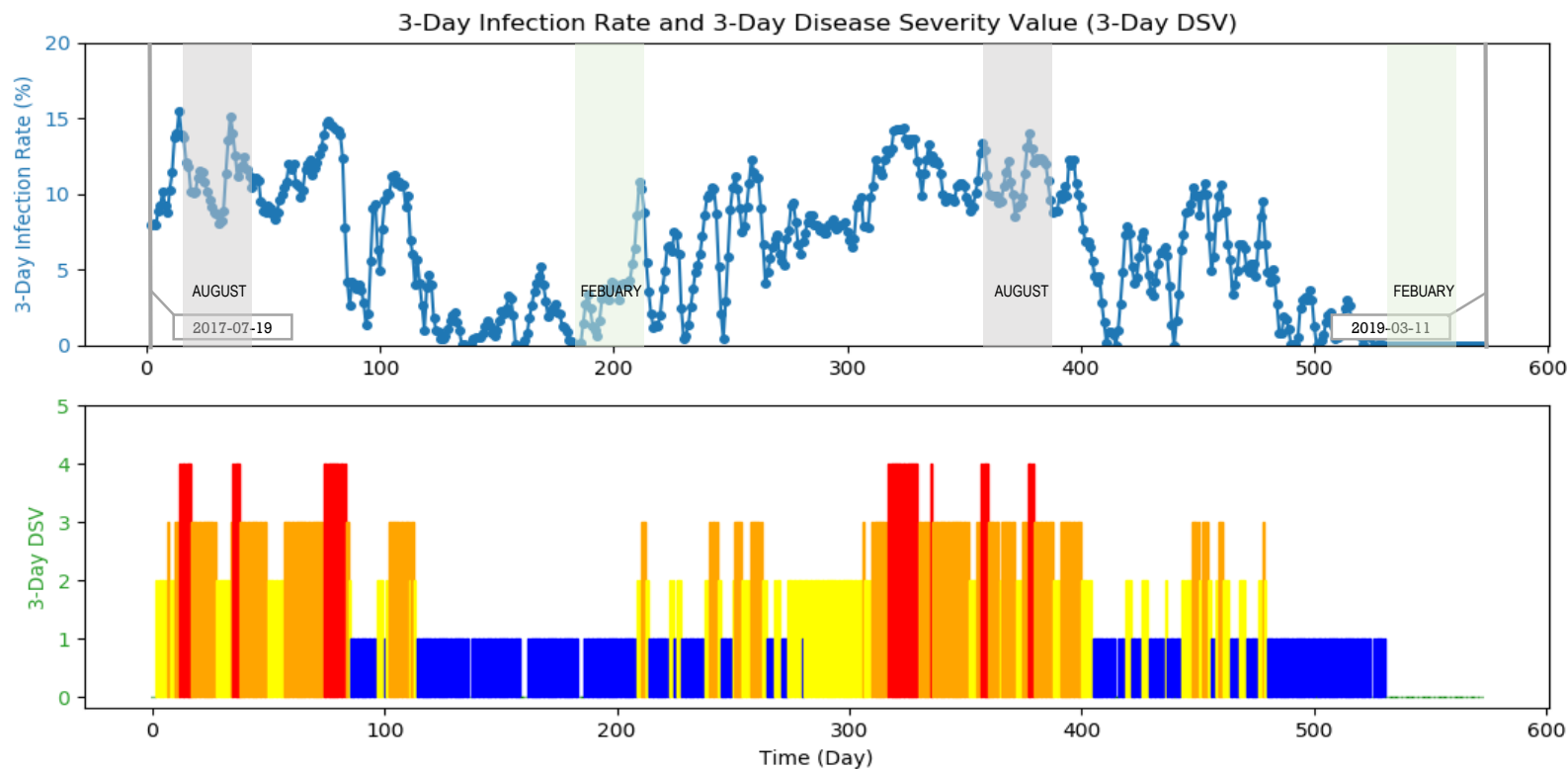
APP中檢視蟲害資料及警訊



病蟲害預警與管理

應用實例

■ 番茄種苗細菌性斑點病預警系統



育苗場長期監測與病害指數DSV分析 (3-D_DSV)

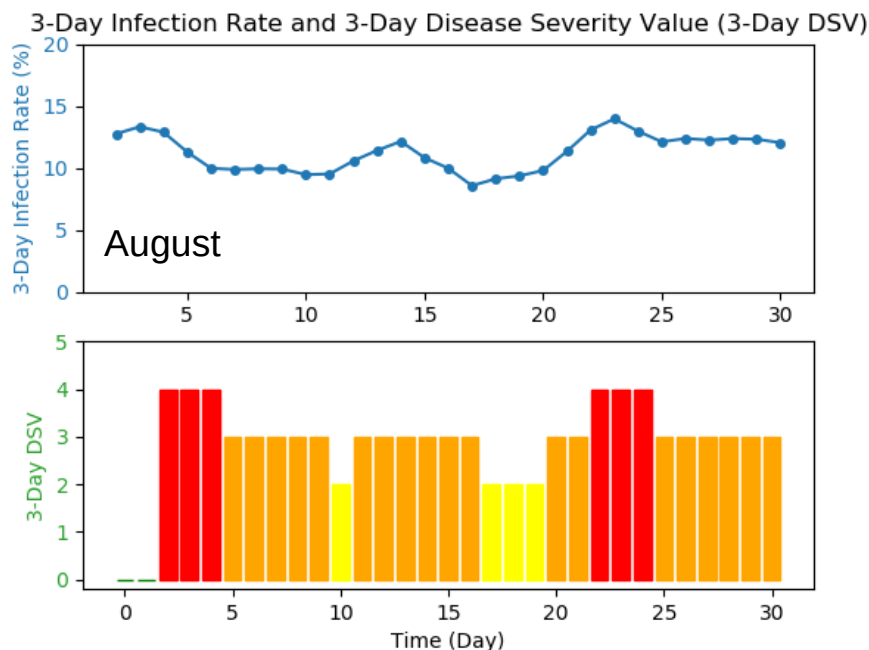


病蟲害預警與管理

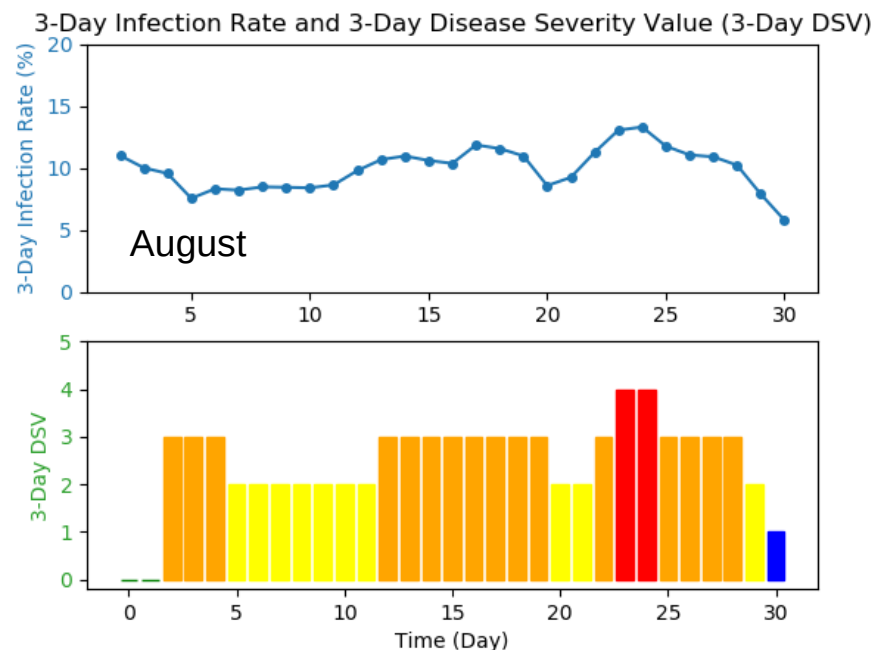
應用實例

番茄種苗細菌性斑點病預警系統

育苗場A



育苗場B

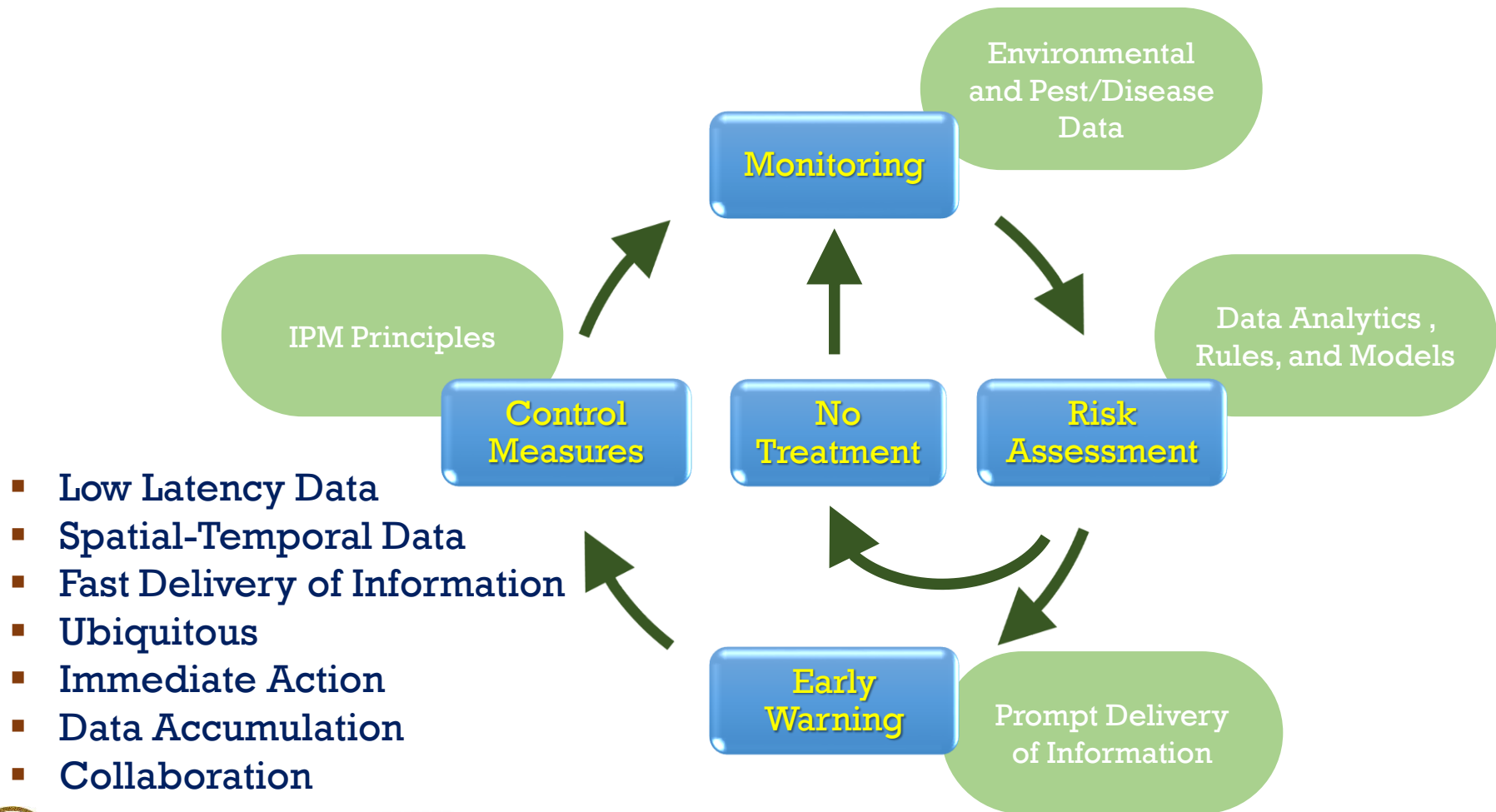


溫室栽培環境管理對於作物病害之影響



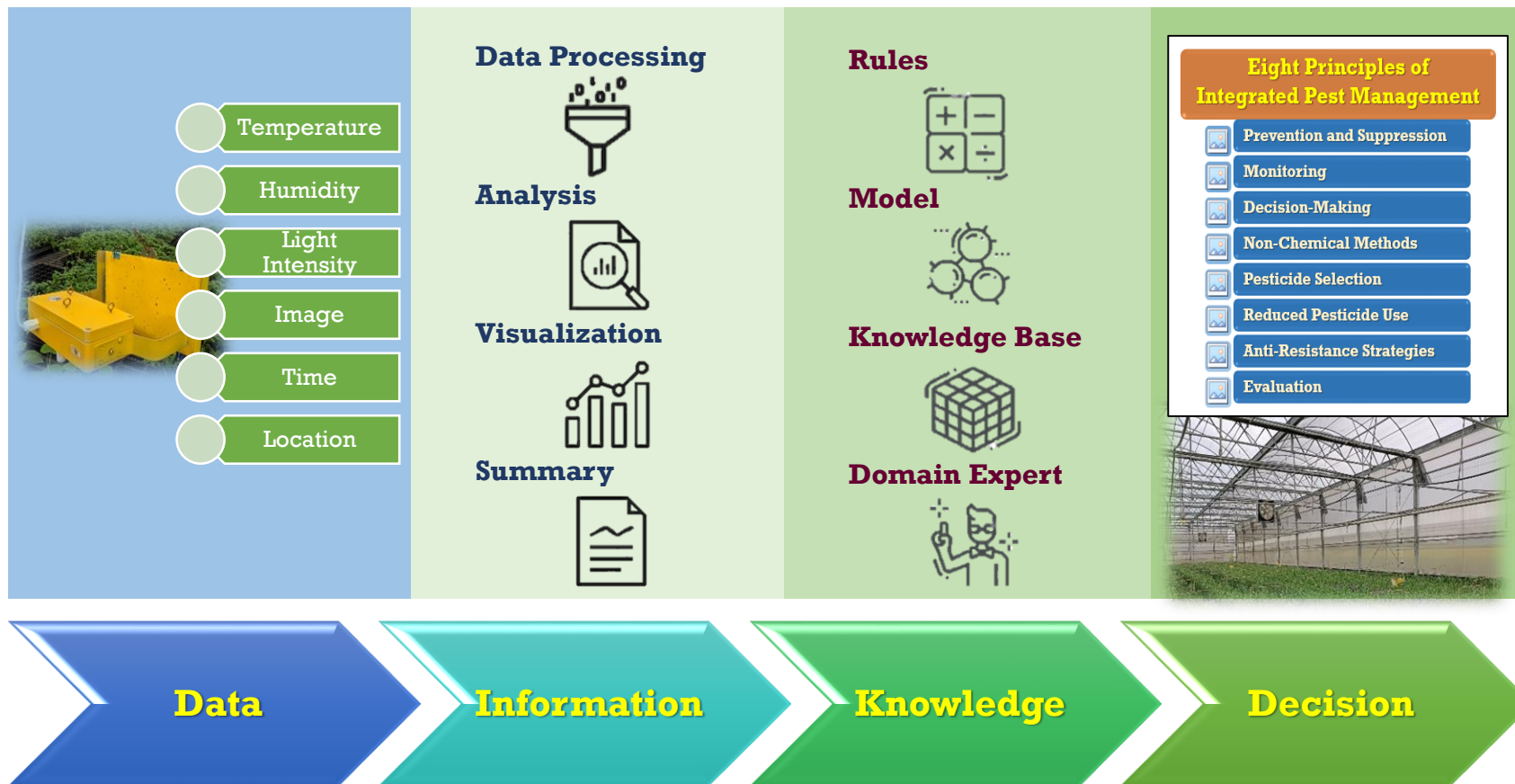
病蟲害預警與管理

即時與精準之病蟲害預警系統



病蟲害預警與管理

資料-資訊-知識-決策



智慧型病蟲害整合管理之未來願景

病蟲害預警系統的管理目標



進行早期蟲害防治

降低栽培作物損害

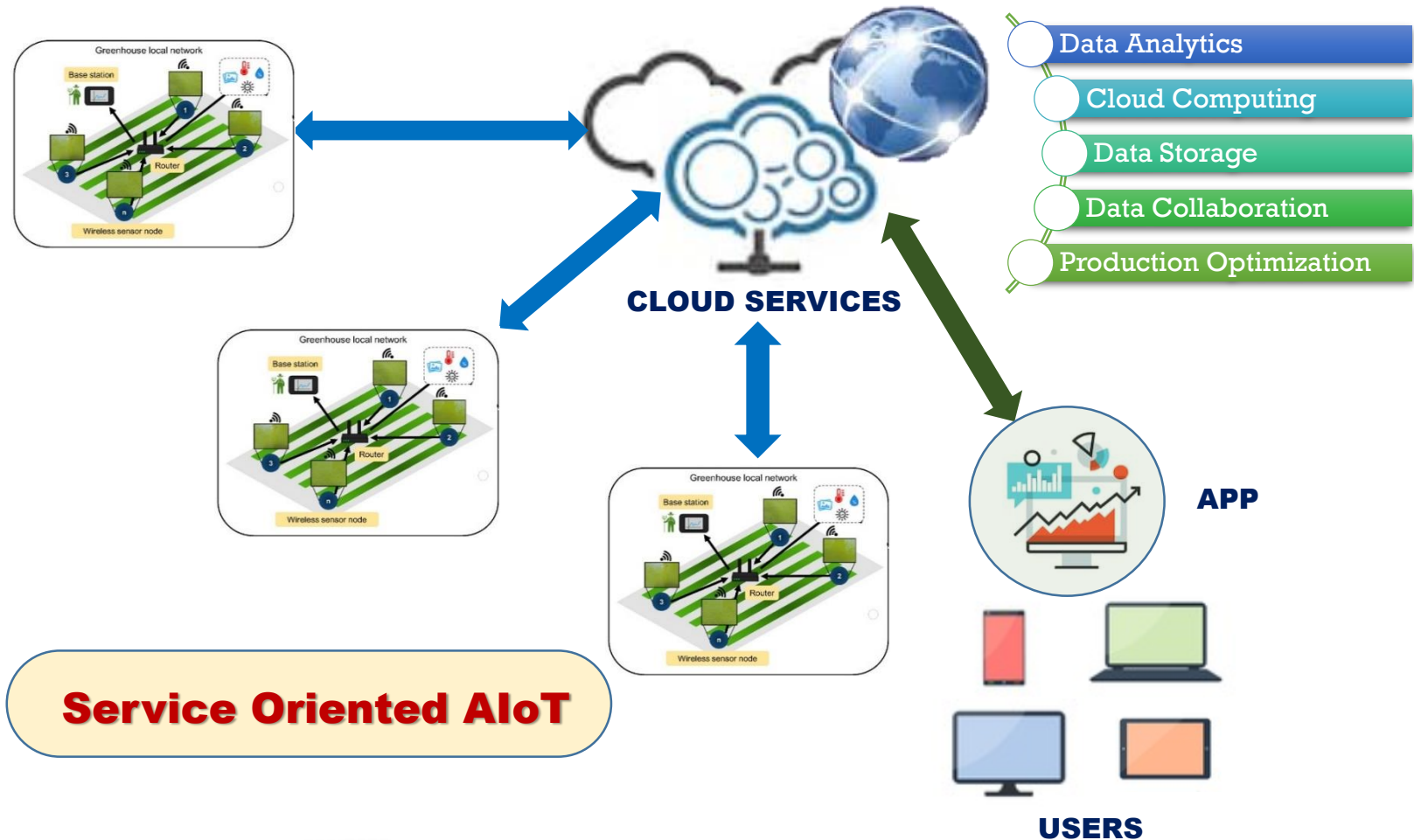
改善溫室栽培管理環境

減少農藥與資材使用

提升栽培作物品質

智慧型病蟲害整合管理之未來願景

智慧物聯網監測系統之應用已成趨勢



智慧型病蟲害整合管理之未來願景

智慧物聯網監測系統之產業應用與推廣

系統商品化與研發



多重感測

病蟲害預警預測模型

多元化數位服務

傳輸與節能

人工智慧

雲端平台數位服務



產業應用與推廣



智慧型病蟲害整合管理之未來願景

智慧型病蟲害整合管理的新紀元



即時性

精準性

廣域性

行動裝置

巨量資料

數據分析

集合智慧

智慧型病蟲害整合管理

致 謝

密切合作夥伴

臺南區農業改良場

- 協助建置驗證場域地：嘉義、雲林、臺南、彰化
- 實驗進行間協助更換黏蟲紙及硬體維護
- 農民回饋意見諮詢
- 育苗場害蟲數量與管理紀錄
- 共同建立番茄種苗病害預警模型
- 系統示範推廣



謝謝聆聽