組別 **Team ID**：**202321**
專題屬性 **Catlegory**：多功能網站系統（**Website System Design**）
專題名稱 **Project**：**AI 食品微生物影像菌落判讀及自動比對法規系統**
（**AI food microbial image colony counting interpretation and automatic comparison system**）

一、指導老師 **Advistor**：柯秀佳老師（**Prof. Ko, Hsiu-Chia**）

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三、 系統環境 **System environment**：
（一）軟體 Software：
作業系統 Operating System: Windows10
語言 Programing language: Python、PHP、JavaScript、CSS、Dart、HTML
開發工具 Toolkits: Visual Studio Code、Flutter
開發環境 Development environment: Laravel
（二）硬體 Hardware：
CPU:Intel(R) Core(TM)i5-10210U CPU @ 1.6GHz 或更高規格；硬碟:475G；記憶體:8G RAM；樹莓派

四、 簡介：
（一）系統簡述
食品實驗室為了檢測食品在加工過程的衛生度及食物的新鮮度，會透過食品檢體檢驗不同微生物的菌落數，以判讀檢體是否符合衛生標準。然而，食品實驗室仍仰賴人工判讀菌落數，亦缺乏自動化驗證結果是否符合衛生標準的機制，造成人力成本的上升及管理的不易。本專題為產學合作專題，主要的目的在於利用 AI 影像辨識技術自動判讀食品微生物的菌落數及檢驗結果是否符合衛生法規管理標準。系統模組包含了樹莓派影像擷取、AI 菌落數自動判讀及驗證、網頁端系統與微生物檢驗管理、及手機端即時數據查詢。透過本專題，實驗室可以管理共用的食品衛生標準法規，實驗人員只要彈性設定檢體製作標準、欲監控的時間區間、及欲檢測的微生物法規後，樹莓派即會自動擷取檢體不同時間點的菌落數變化，並即時透過 AI 自動辨識菌落數及判讀是否符合衛生標準。當檢體發生超標或檢驗完成後，亦會主動推播檢驗結果至檢驗人員的 APP。檢驗人員可以即時監控及檢視檢驗結果，進一步確認菌落辨識的正確性並修正。本系統讓管理者可以透過數據分析結果，持續制定改善檢驗管理流程的方法，提升檢驗管理的效率與效能。

（二）特色
■ 即時化的樹莓派菌落數影像擷取
■ 智能化的 AI 菌落數自動辨識
■ 自動化的食品微生物檢驗流程管理
■ 行動化的 APP 檢驗過程及結果監控
■ 易維護的 MVC 系統開發架構
■ 簡易的多層次數據分析探索

■ 友善的使用者介面

五、 Introduction：

(I) System Overview

In order to assess the hygiene and freshness of food during the processing stage, food laboratories test various microbial colony counts in food specimens to determine whether they meet sanitary standards. However, the laboratories still depend on manual interpretation of the colony counts and lack an automated system to verify if the results comply with sanitary standards, leading to increased labor costs and difficulties in management. This project, a collaborative effort between industry and academia, aims primarily to use AI image recognition technology to automatically interpret the microbial colony counts in food and verify whether the test results comply with sanitary regulations and standards. The system modules include Raspberry Pi for image capture, automatic interpretation and verification of colony counts through AI, a web-based system for microbial inspection management, and a mobile app for real-time data queries. Through this project, laboratories can manage shared food hygiene standards and regulations. Laboratory personnel only need to flexibly set the sample production standards, the desired monitoring time intervals, and the microbial regulations to be tested. The Raspberry Pi will then automatically capture the changes in colony counts at different time points of the specimen and instantly interpret the colony counts and determine compliance with sanitary standards through AI. When a specimen exceeds the standard or the inspection is completed, the results will also be actively pushed to the inspectors' APP. Inspectors can monitor and review the test results in real-time, further confirming the accuracy of the colony identification and making necessary corrections. This system allows administrators to continuously develop methods for improving inspection and management processes through data analysis results, thereby enhancing the efficiency and effectiveness of inspection management.

(II) Features
■ Real-time Raspberry Pi microbial colony count image capture
■ Intelligent AI automatic recognition of microbial colony counts
■ Automated management of the food microbiology inspection process
■ Mobile APP for monitoring the inspection process and results
■ Maintainable MVC system development architecture
■ Simple multi-level exploratory data analysis
■ User-friendly interface