

# 核酸檢測系統及其使用方法

## Nucleic Acid Detection System and Method of Use Thereof

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### 摘要 Abstract

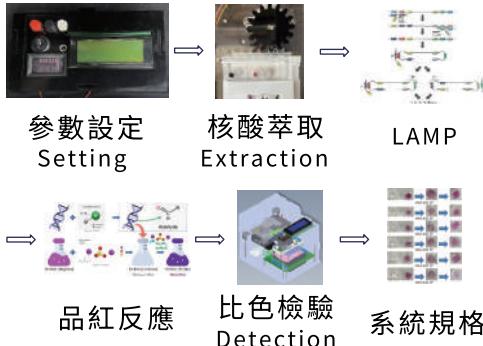
本作品結合濾紙與相變化物質，提升DNA樣本處理的穩定性與便捷性。透過自動化系統減少人為誤差，提高核酸複製和檢測效率與準確性，適用於食品安全檢測應用，實現快速、穩定且高效的基因檢測流程。

This product integrates filter paper and phase change materials for stable DNA processing. Automation minimizes human error, enabling efficient, accurate, and rapid genetic testing for food safety.

### 前言 Introduction

本作品旨在解決傳統食品安全檢測的耗時與低效問題。檢測平台透過簡化樣本處理、自動核酸複製與直接比色檢測，能快速識別食品中的病原體或污染物，提高監測效率與準確性，確保食品安全和健康永續。

This project streamlines food safety testing by automating sample processing, nucleic acid replication, and direct colorimetric detection, enabling faster and more accurate pathogen identification.



### 實驗方法 Experimental methods

本作品開發全自動化核酸檢測系統，整合樣本前處理、核酸複製與比色檢測。僅需手動添加樣本與試劑，濾紙吸收廢液後完成前處理。系統透過機構移動濾紙至不同反應區域，並利用相變化物質精確控制試劑混合，確保穩定的核酸比色檢測流程。

An automated system integrates nucleic acid pretreatment, amplification, and colorimetric detection, using movable filter paper and phase change materials for precise, stable operation.

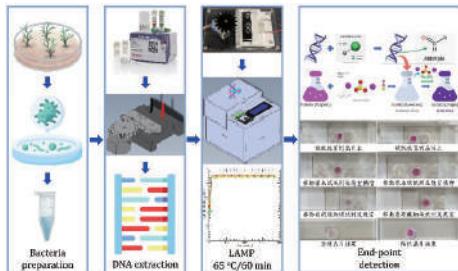


圖1 裝置操作流程圖 (Device operation flow chart)

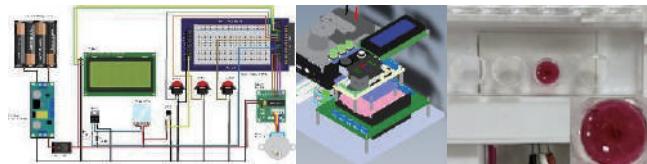


圖2 自動控制、機構移動和比色檢測技術整合  
(Integration of automatic control, mechanical movement, and colorimetric detection technology)

### 結果與討論 Results and discussion

本作品採用模組化設計，為生物科技產業帶來創新與發展機遇。提高靈活性與效率，促進技術進步，開啟更多應用可能，推動產業升級。

This modular design boosts flexibility and efficiency, expands applications, and drives biotechnology advancement.



圖3 系統模組架構圖  
(System module architecture diagram)

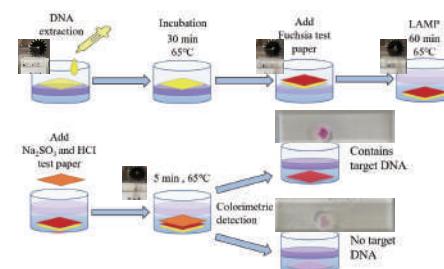


圖4 基因檢測 Sample-in-Answer-out 流程圖

### 結論 Conclusion

本作品開發基於NI myRIO-1900的可攜式病原菌紙基比色檢測裝置，整合Wi-Fi無線傳輸、致冷晶片與自動樣本轉移技術。採用鹼性品紅比色法與纖維素試紙儲存試劑，實現快速、高靈敏度檢測。裝置以18650電池供電，最短10分鐘內顯色，適用於現場食品安全之病原菌檢測，具便攜性與低成本優勢。

A portable, paper-based colorimetric device rapidly detects food pathogens on-site in 10 minutes using automated, low-cost technology.