Key Innovations

A number of technological innovations are required for scalability

Drone-based autonomous deployment for high-throughput

It takes too long to place traps. Ideal places to deploy traps are difficult for humans to reach. It make take several hours to place and collect a trap.

Key Innovations

A number of technological innovations are required for scalability

Cloud-scale metagenomic analytics to automatically identify threats

Today humans must sift through lots of biological data to pick out candidate threats. This would not scale for high volumes of field collections.

PREMONITION

High-throughput and low-cost monitoring known and unknown pathogens in the environment via autonomous collection of mosquitoes.

Animals maintain pathogens in environment

Mosquitoes collect blood, sampling many pathogens

Drones deploy autonomous mosquito traps

From environment to global pathogen data

Global pathogen data in space x time x genes

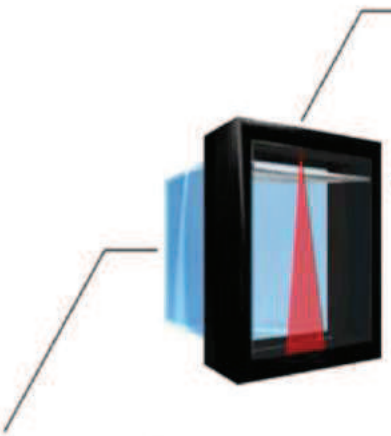
Collected mosquitoes are gene sequenced and pathogens detected computationally

Long-range aerial or ground systems deploy short-range drones

A Smarter Trap

Real-time speciation and selective trapping of insects; in-situ stabilization of nucleic acids; low-cost and low-power sensor and actuators.

Honeycomb design simplifies automated processing



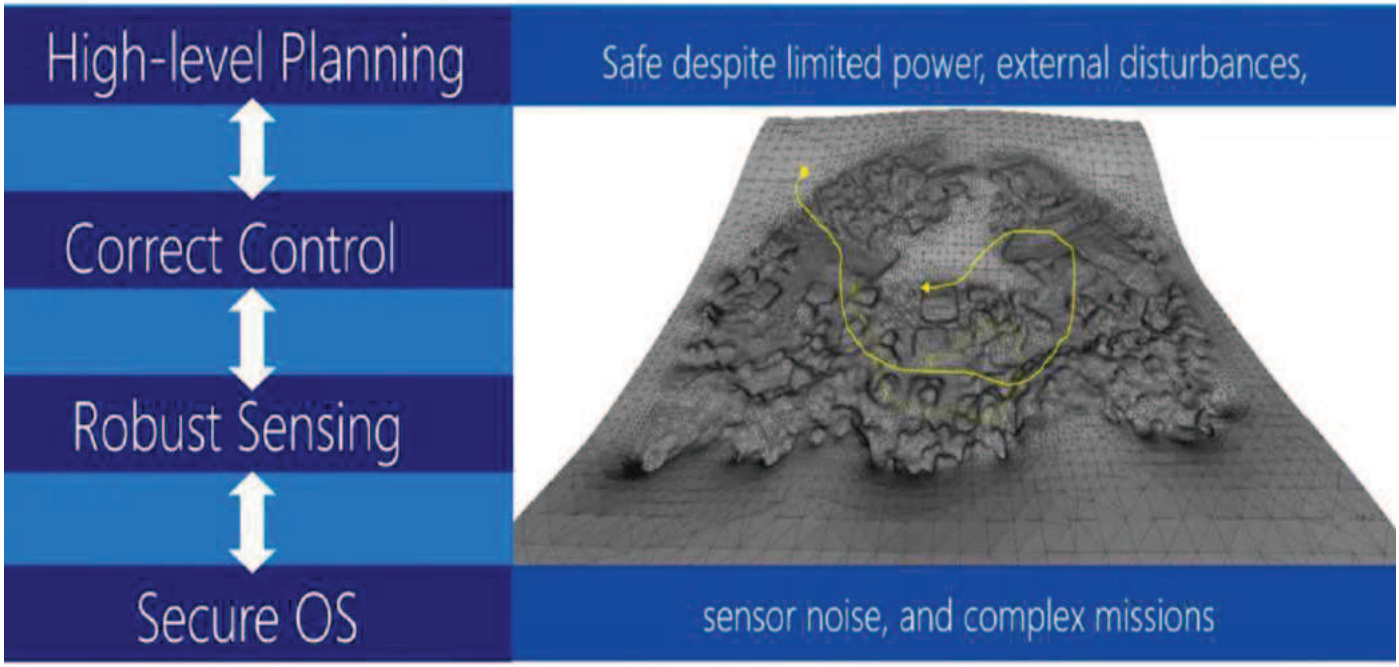
Low-cost laser / photo diodes listen to insect wings; light outside of mosquito visible spectrum (>650nm)

In-situ chemical stabilization of insect preserves sample for up to one week

Door closes when species of interest enters cell. Signal processing delay ~100ms

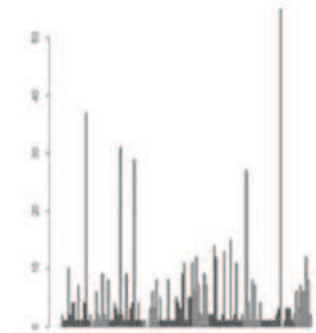
Autonomous Deployment

Developing a drone control stack using advanced operating systems, program verification technologies, vision, and machine learning

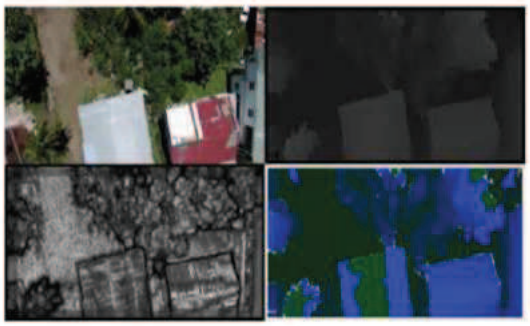


Learning Mosquito Hotspots

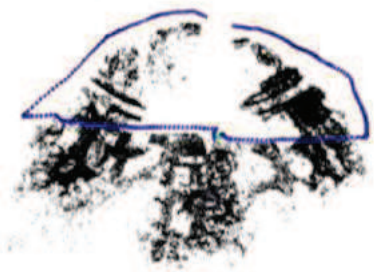
So drones can make deployment decisions that normally require field biologists



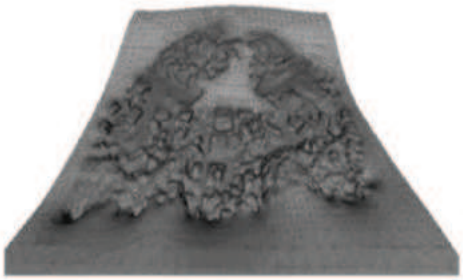
Mosquito counts by site



Mosquito hotspot



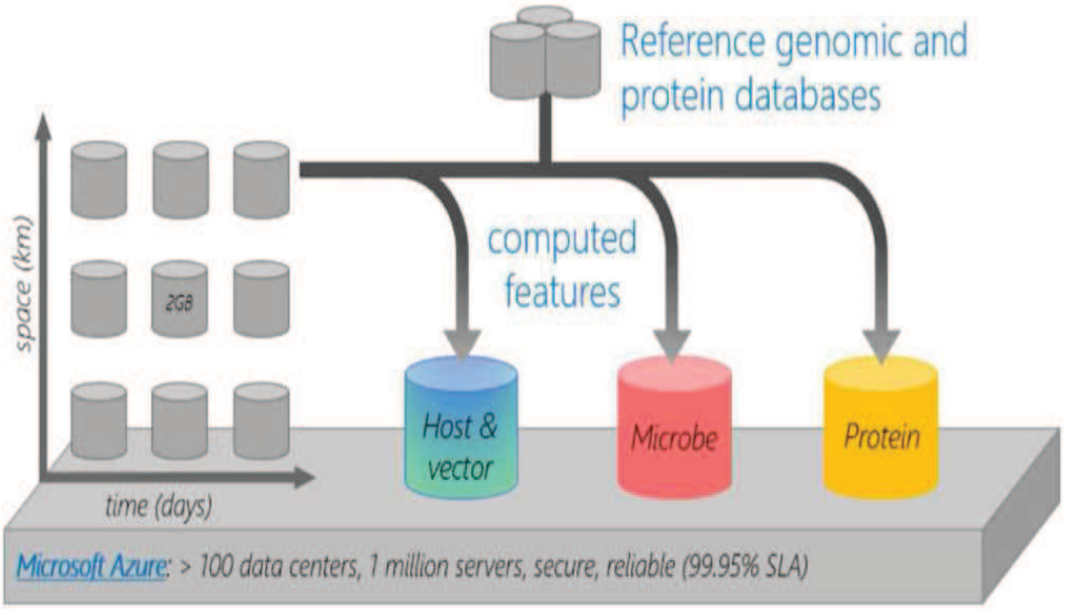
Reconstruction of camera pose and drone path



Reconstruction of fined-grained 3D environment

Better genomic data analytics

Feature extraction and indexing from spatial/temporal genetic data.



Data cleansing and similarity to reference genes

De novo assembly to reconstruct genes of unknown organisms

Recognize potential threat sequences by expressed proteins

Microsoft

THANK YOU

智慧系統與晶片產業發展策略會議

《智慧科技於防疫之應用》

引言人

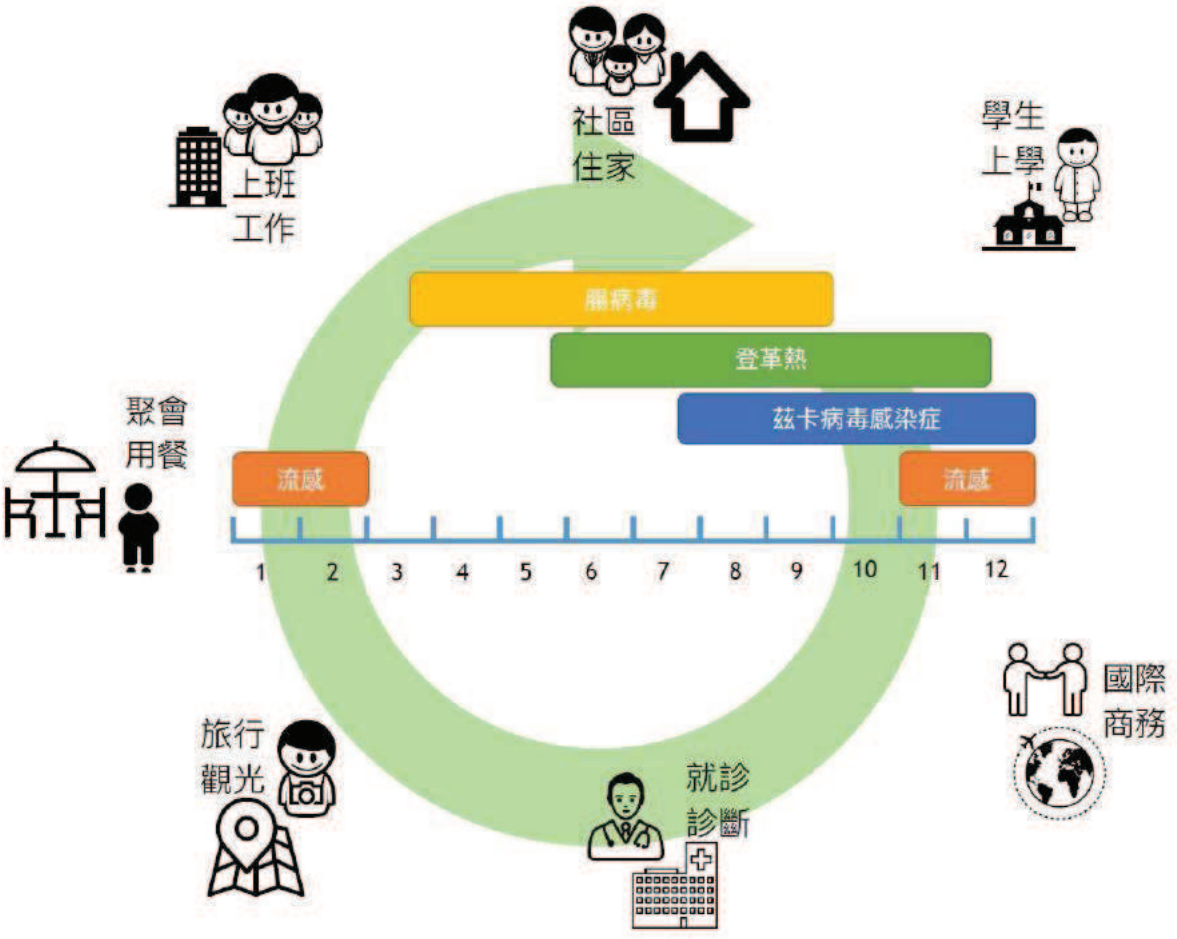
成功大學/莊坤達教授

防疫科技的產業化機會

成功大學 - 聯發科技 城市物聯智慧防疫聯合實驗室
成大資訊工程學系 & 醫學資訊研究所
莊坤達


中央政府單位
政策規劃
學校社區
公衛教育宣傳
民眾生活
工作居家旅遊
地方縣市村里
防治執行
醫療單位
監測救護
掌蚊人

3


社區
住家
上班
工作
學生
上學
腸病毒
登革熱
茲卡病毒感染症
流感
流感
聚會
用餐
1
2
3
4
5
6
7
8
9
10
11
12
國際
商務
旅行
觀光
就診
診斷

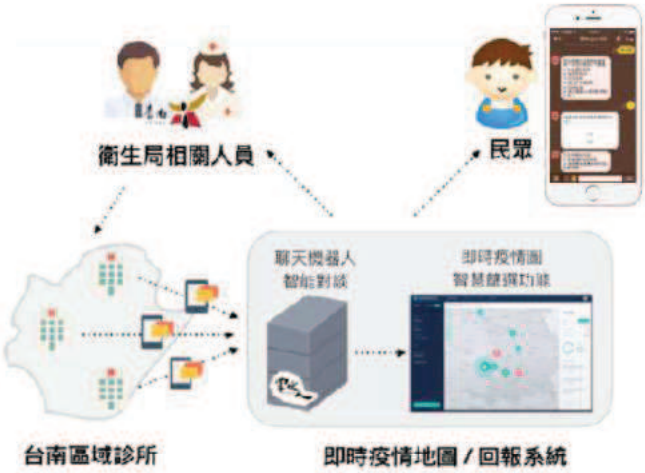
4

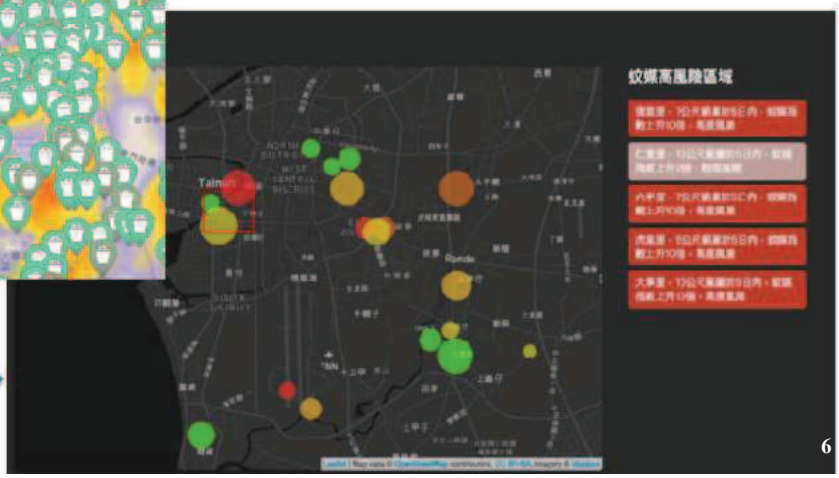
防疫雲API架構

防疫產品認證機制

創新產學研鏈結

以防疫思維驅動
新一代消費性產品升級





智慧系統與晶片產業發展策略會議

《智慧科技於防疫之應用》

引言人

國衛院/廖經倫所長

智慧系統與晶片產業發展策略會議 (SRB)

AI智慧科技於防疫之應用

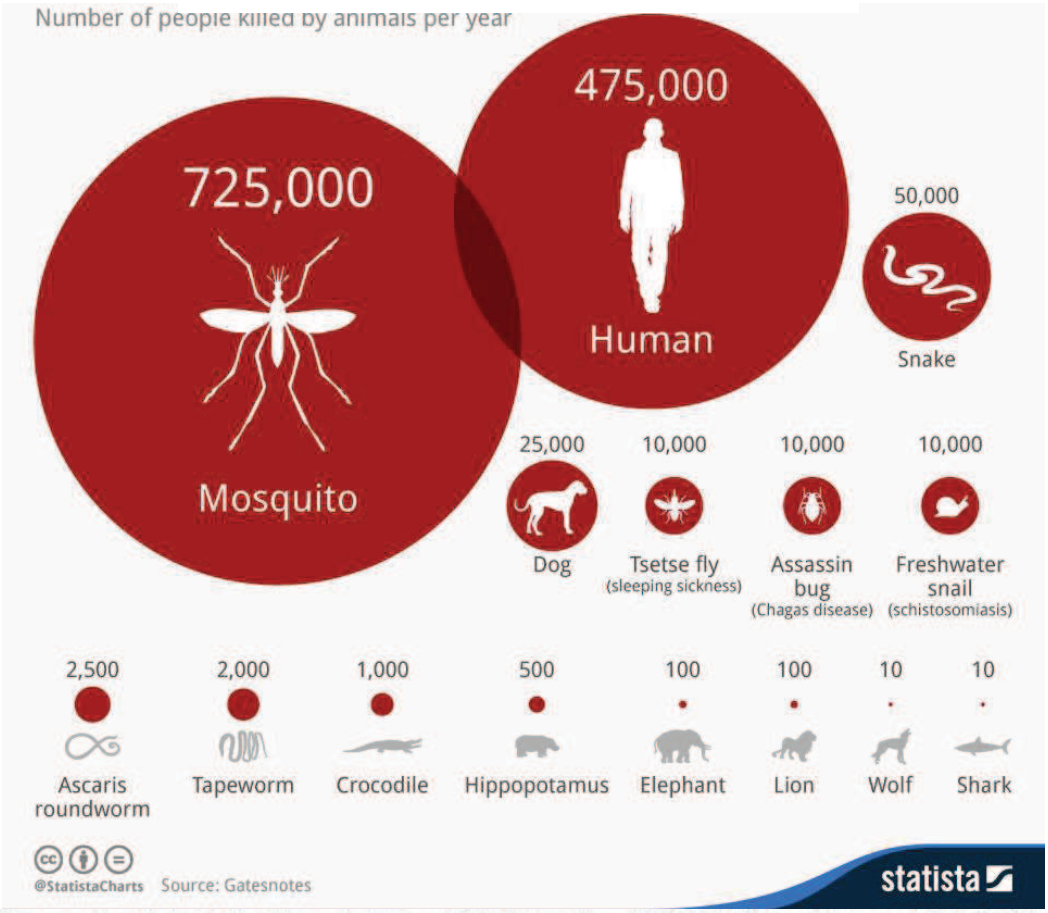
國家衛生研究院
National Health Research Institutes

國家蚊媒傳染病防治研究中心

廖經倫

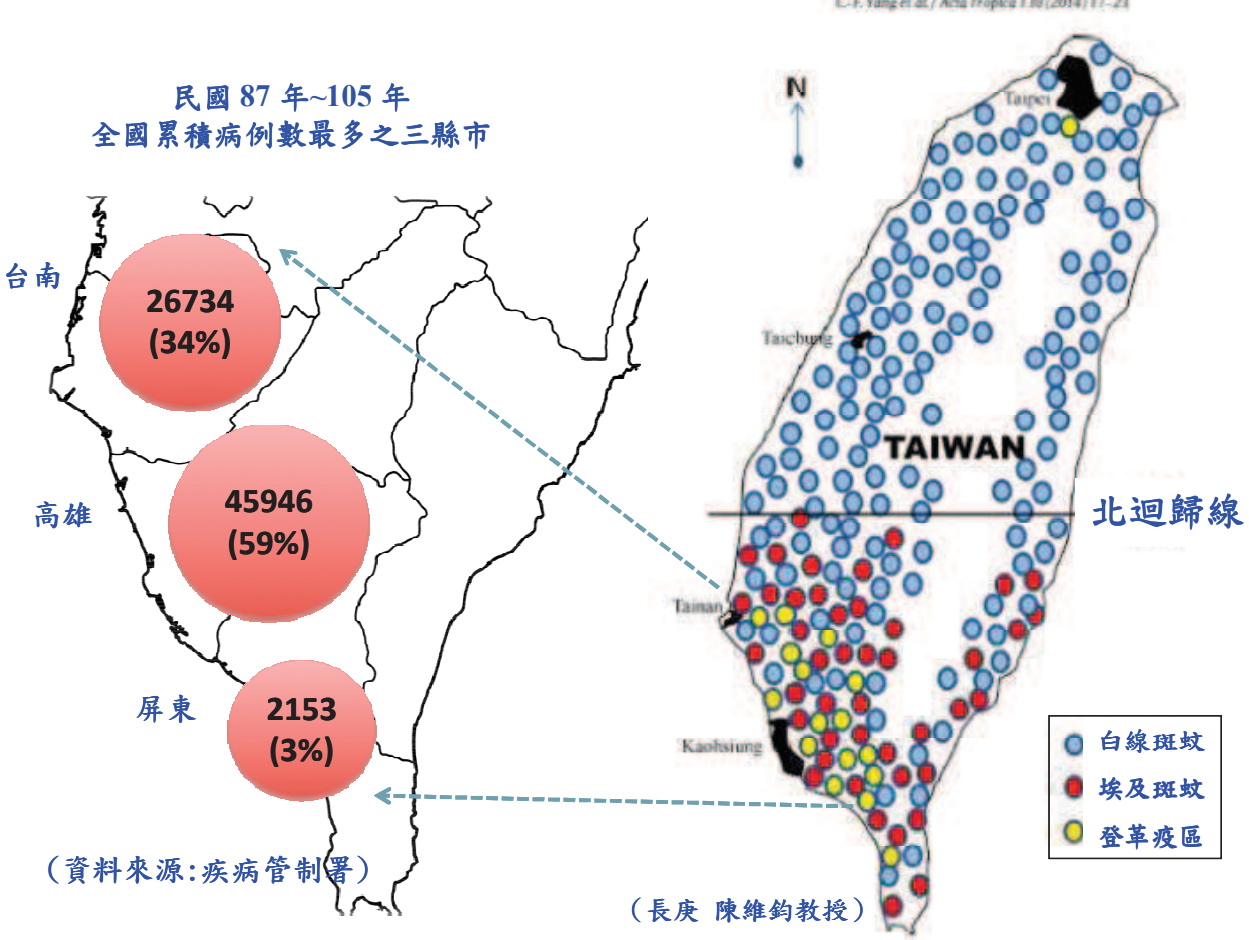
2017. 07. 12.

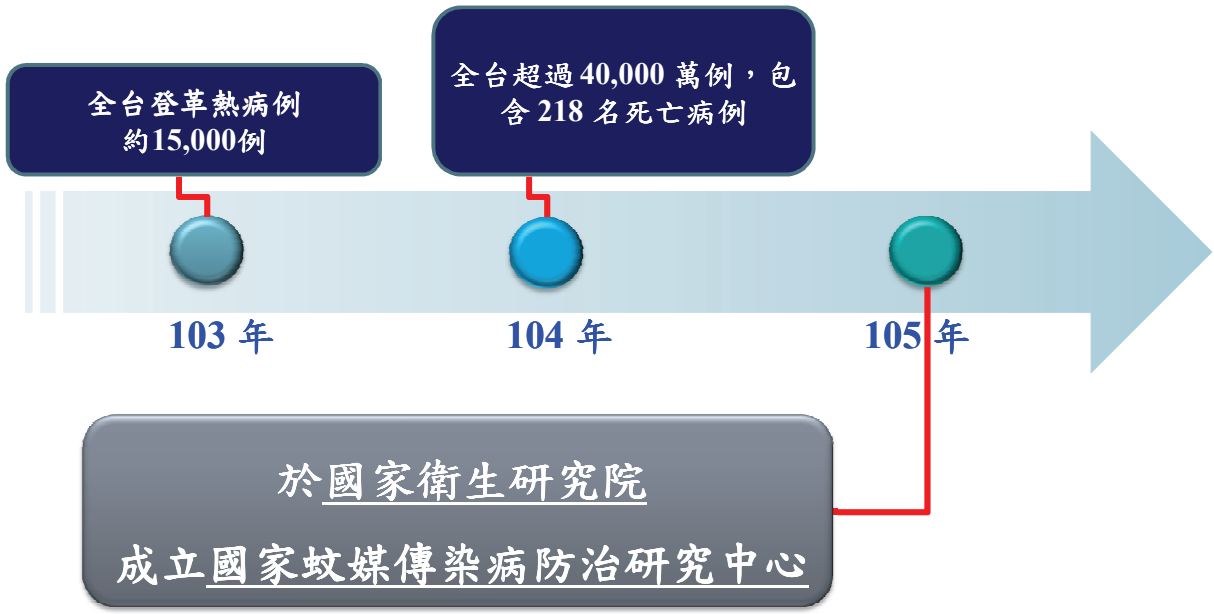
蚊媒傳染病是人類的頭號公敵



SOURCES: WHO; crocodile-attack.info; Kasturiratne et al. (doi.org/10.1371/journal.pmed.0050218); FAO (webcitation.org/6OgpS8SVO); Linnell et al. (webcitation.org/6ORL7DBUO); Packer et al. (doi.org/10.1038%2F436927a); Alessandro De Maddalena. All calculations have wide error margins

全國登革熱本土病例主要分布於南台灣





定位

本中心與中央、地方防疫團隊積極建立合作夥伴關係，並以科學實證為基礎，導入AI智慧科技防疫之新作為

策 略

以科技部之 AI 智慧型晶片發展策略為為骨幹，導入並整合病蚊媒傳染病防治專家的現有研究動能，聚焦於「AI 病媒生態大數據收集與防治」、「整合 AI 偵測與預防」、「AI 智慧晶片於空間地理資訊之預警系統」等所面臨之防治缺口運用 AI 智慧科技於第一線之防堵作為，預計將可結合國內 12 所學研機構，共約百位專家共同參與。

台灣目前防疫現況

105 年台灣登革疫情能被有效控制
地方及中央的第一線防疫團隊居功厥偉

(統計資料迄106年6月30日止)

中央與南部三縣市之防疫需求

智慧科技對於防疫之應用

A. 病媒蚊監測

B. 病媒蚊密度控制技術

C. 病媒蚊抗藥性測試

D. 病媒蚊帶病毒之分析

E. 病媒蚊風險地圖之建立

F. 邊境防疫

G. 社區血清流行病學之探究

H. 高危險群重症成因之探討

I. 新穎防疫科技之研發

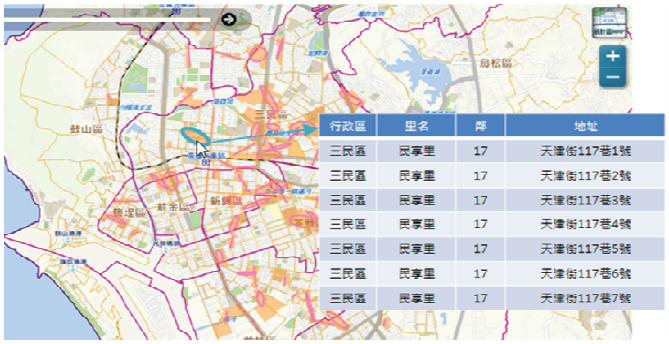
J. 防疫資訊平台之建置

AI 智慧科技/大數據: A, C, D, E, F, G, H, I, J

智慧晶片/物聯網: A, B, I, J

AI 智慧技術於防疫科技上之可行性範例 (1/5)

整合 AI 智慧科技開發之病媒蚊預警平台及高風險場域分析系統

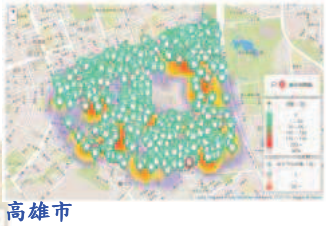


縣市	誘卵桶		誘殺桶		總和
	縣市政府	蚊媒病中心	縣市政府	蚊媒病中心	
台南市	1,840	406		263	2,509
高雄市		393	1,180*	402	1,975
屏東縣	250	180		60	490
總和	2,090	979	1,180*	725	4,974

* 另有滾動式病媒蚊密度調查未列入計算

針對可能的高峰險區域進行分析，並利用空間統計的最近鄰居法，進行病例數密度分析

台南市



高雄市

屏東縣