國立臺北科技大學產學合作一般計畫【簽約用印】申請書 序號:6139

會計編號（主要經費來源）	- 2088177	申請日期（最後修改日期）	108年09月17日
計畫名稱	宜蘭縣智慧防汛網建置與測試計畫(第二期)		
執行期間	自 108年08月21日 至 110年12月31日 (計畫期程：2)		
委託單位	國內委託單位 :中華電信股份有限公司臺灣北區電信分公司宜蘭營運處 國際(兩岸)委託單位:無		
合作單位	國內合作單位 :無 國際(兩岸)合作單位:無		
受惠機構	臺北科技大學		
計畫主持人	10843 張哲豪	所屬學院系所	工程學院 土木系
無共同主持人，您分配予本計畫之金額為:1,050,000元，您分配本計畫之先期技轉授權金為:0元			
合約版本	其他版本	合約備註	無

1. 主要經費來源：中華電信股份有限公司臺灣北區電信分公司宜蘭營運處
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會計編號	營業稅	經常費	設備費	管理費	管理費執行/分配單位	先期技轉授權金	合計
-	50,000元	869,565元	0元	130,435元	研發中心 防災工程科技中心	0元(其他理由請說明)	1,050,000元

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合計各項費用總合	營業稅：50,000元	經常費：869,565元	設備費：0元
	管理費：130,435元	先期技轉授權金：0元	
總計畫經費	1,050,000元 (總計畫經費有誤或不符合時，請洽產學合作處詢問。)		
管理費備註原因	無		
是否適用科研採購法	否		
備註	無		

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☑計畫主持人已閱讀並同意依學校規定辦理。

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國立臺北科技大學產學合作一般計畫【簽約用印】申請書 序號:6139

計畫主持人（承辦人）	單位主管 院長	產學合作處	主計室	校長
張哲豪	單位主管 主任張哲豪 院長 長宋裕祺(甲)	合約書已查閱 0918 產學長授權	0920 高級組員陳秀合 主任授權 會計組長楊馥菁	校長王錫福(代) 0920

已蓋印

經濟部

MOEAWRA1080105

宜蘭縣智慧防汛網建置與測試計畫(第二期)

The plan of the implementation and the probation for the intellengent flood monitoring system in Yilan County

（Second stage）

委辦機關：經濟部水利署

代辦機關：宜蘭縣政府

受託機關：中華電信股份有限公司

臺灣北區電信分公司

中華民國 109 年 3 月

摘要

鑒於近年氣候劇烈變化，為減少災害造成損失及落實預警疏散作業，宜蘭縣政府於本計畫第一期配合科技部「前瞻基礎建設計畫-數位建設-水資源物聯網計畫」執行，並更新貴府洪水預警系統，以朝向雲端作業發展。

此系統於 101 年建立，已具備相關監測、預警及展示功能，宜蘭縣內水患防災之重點為閘門操作，藉由關閉閘門來阻擋外水，因此在颱風豪雨期間，閘門操作之時機非常重要，而本計畫將建置閘門內外水位計，並配合數值模擬運算建立一套客觀準確之機制，來提供閘門操作之參考依據。

故整個水情設備的建置、運作、傳輸、收集到呈現，都應高密度的佈設且長時間確保資料品質良好，以水情感測重點區域建構宜蘭縣物聯傳輸網，作為後續擴展物聯傳輸網之基礎。107 年度已針對美福排水及冬山河流域完成都市淹水感知器 11 處及排水閘門監測站 10 處建置。承上年度成果至本年度，分為感測設備建置及既有設備維護、淹水模擬範圍擴張、宜蘭縣智慧防汛網擴充、資料傳輸安全在地化及教育訓練，四大項工作章節。

感測設備建置及既有設備維護，完成全縣水位監測設備 61 處共 118 點裝設建置，且全數完成高程測量。亦成功針對縣府所轄 12 處抽水站布建 14 組監測設備以收納抽水站即時運作狀態，電力系統則使用抽水站內市電。通訊則採用 NB-IoT 技術，資料同時傳輸至水利署水資源物聯網平台以及宜蘭縣政府資料倉儲系統。且完成 3 次設備維護保養作業，並將公館橋、大坑橋等七處的故障設備進行汰換以恢復該測站監測功能。

淹水模擬範圍擴張，將 SOBEK 二維淹水模式擴張至全縣範圍，採用最新地文資料如 1m DEM 及一河局路堤普查資料等，完成調校。因應作業化運算，劃分流域集水分區為四區，調校本計畫高效能模式比原潛勢圖模式縮短計算時間達 27 倍以上。AI 淹水預報拓展中提出定量降雨映射區域淹水模式(QPF-RIF)，運用未來 72 小時系集預報雨量做為輸入項，並根據淹水特性劃分子區域，結合 SOM 分類和 SVM 預報等方法論，產出未來長期預報之全縣網格淹水深度圖，其不需要設置都市淹水監測站，以過去物理模式建置之淹水深度圖資庫即可預

報未來全縣網格中之淹水深度。

宜蘭縣智慧防汛網擴充，開發物聯網閘道器，介接既有測站資料共 333 站，涵蓋路面淹水感知器、雨量站、水位站、抽水站。並利用監測設備成果與預報模式，經由平台介接後，完成交互反饋應用完成(1)即時校正，透過計畫所建置路面淹水感知器所回傳即時淹水觀測資料，回饋至預報系統後，計算前時刻預報模式結果和即時淹水觀測資料的誤差，以此誤差進行當時刻淹水預報之即時校正，進一步提升淹水感知器之淹水預報成果(2)即時反應與控制，依據感測器所傳回抽水設備啟動狀況，即時調整模式內對應物件狀態(3)閘門操作建議，以閘門內外水位監測數據為基礎，提供米塔事件歷程中，閘門啟閉操作建議探討(4)應變方案評估，以移動式抽水機介接成果，擬訂抽水機於事件中最佳配置位置。本階段的成果，主要是將所有防汛相關的資訊含兩年度共四組模式 SOBEK 二維模式、SOBEK 二維即時校正模式、第一期 AI 模式 RRIF、第二期 AI 模式 QPF-RIF 整合於圖台上呈現，除即時的物理量測值，即時的抽水機的狀態與位置，並包括淹水模擬的整合，透過 dashboard 的呈現，提供防汛期時的戰略參考。

資料傳輸安全在地化及教育訓練，於宜蘭縣府所配發的虛擬主機內佈署一套在地化資料倉儲系統以落實資料可安全存放於府內之需求。並針對行動水情網頁(WebApp)擴充資料檢視功能與擴增本計畫增設的抽水站資訊頁籤以強化水情網頁展示效果。且針對縣府內防汛相關人員，安排系統操作與功能展示、現地設備維護保養的教育訓練課程內容。

綜觀整個計畫，達成 1.各種設備的整合介接 2.落實在地化應用，及 3.智慧防汛的未來發展，以達智慧防汛網成功運作。

關鍵字:智慧防汛、物聯網整合、SOBEK 二維模式、AI 二維模式

Abstract

Duo to the drastic weather change in recent years, in order to reduce the damage caused and implement early warning and evacuation operations, the Yilan County Government cooperated with the Ministry of Science and Technology's "Forward-looking Infrastructure Project -Water Resources Internet of Things Project" in the first phase of this plan. Update the flood warning system and move towards the cloud -base operations system.

This system was established in 2012 and already have monitoring, early warning and display functions. The focus of flood prevention in Yilan County is the operation of the gate. The gate is closed to prevent river external water flooding. Therefore, the timing and operational management of the gate is very important during the typhoon season. This year build the inner and external water gauges between the gates and like with numerical simulation to establish rule operation of gate controlled.

The equipment, operation, transmission, collection, and presentation of the entire hydrological information should be arranged in high density and ensure the quality of the data for the long term and reliable supply. The Yilan County's Internet of Things network will be constructed with the key areas of hydrology data measurement as a subsequent expansion of the Internet of Things The foundation of a transmission network. In 2018, there are 11 urban flooding sensors and 10 drainage gate stations have been completed in the Meifu Drainage and Dongshan River Basin. Continuation of last year project, this year has four main topics of the project. Installation and maintenance of the equipment, Expand of flood simulation area, Expand of Yilan County's intelligent flood prevention system, Cybersecurity and education training.

Installation and maintenance of the equipment are completed 118 points in 61 water level monitoring equipment with elevation measurement. Also deployed 14 sets of monitoring equipment for 12 pumping stations to get the real-time operation status of the pumping stations. The communication uses NB-IoT, and the data is also transmitted to the Water Resources Internet of Things platform of the Water Resources Agency and the data warehouse of the Yilan County

Government. This year completed 3 times equipment maintenance operations and replaced the faulty equipment in seven places, such as Gongguan Bridge station, Dakeng Bridge station.

Expand of flood simulation area, using the SOBEK two-dimensional flooding model was expanded to the county. In the model was using the latest geological data such as 1m DEM and 1stRMO embankment data. In the other hand for the operational calculations, the catchment area of the river basin is divided into four areas, and the high-performance model of the adjustment plan shortens the calculation time by more than 27 times compared with the original model. The quantitative flood mapping area flooding model (QPF-RIF) is proposed in the AI flooding forecast extension. The next 72 hours forecast rainfall is used as an input item, and the sub-regions are divided according to flooding characteristics. The methodologies are combined with SOM classification and SVM forecasting. It can produce future long-term forecast grid flood depth maps in the whole county. This method can predict floods grid in the county for the future by setting up a database of flood depth maps based on physical flood models.

Expand of Yilan County's intelligent flood prevention system was expanded to develop IoT gateways that interfaced with existing station data of 333 stations, covering road flooding sensor, rainfall stations, water level stations, and pumping stations. And use the monitoring equipment results and forecast mode, after the platform interface, complete the interactive feedback application complete (1) real-time correction, through the plan to build the road flooding sensor sent back real-time flood observation data, feedback to the forecast system Then, calculate the error of the prediction model result at the previous moment and the real-time flood observation data, and use this error to perform the immediate correction of the flood forecast at that moment, and further improve the flood forecast results of the flood sensor (2) Real-time response and control. The starting status of the pumping equipment returned by the sensor, and the status of the corresponding objects in the real-time adjustment mode (3) Gate operation recommendations, based on the water level monitoring data inside and outside the gate, provide suggestions for the opening and closing of the gate during the Mita event history (4) Contingency plan assessment, using mobile pumps to

interface with the results, to draw up the optimal configuration of pumps in the event. The results of this stage are mainly the integration of all the flood control related information including four groups of models in two years: SOBEK 2D model, SOBEK 2D real-time correction model, Phase I AI model RRIF, Phase II AI model QPF-RIF. Presentation on the platform, in addition to real-time physical measurement values, real-time pump status and location, and integration of flood simulation, through the presentation of the dashboard, provides a strategic reference during the flood period.

Cybersecurity and education training. A localized data warehousing system is deployed in the virtual host distributed by Yilan County Government to fulfil the requirement that data can be safely stored in the government. It also expands the data viewing function of WebApp and expands the pumping station information tabs added to this project to enhance the effect of the display. It also arranges education and training courses for system operation and function display, and local equipment maintenance for flood control related personnel in the county government.

Looking at the entire plan have reached 1. Integration of various equipment 2. Implementation of localization applications, and 3. Future development of intelligent flood prevention system to achieve the successful operation of the system.

Keywords: Intelligent flood prevention system, IoT integration, SOBEK 2D model, AI 2D model