Hong Kong Productivity Council as a Research Hub for the Government's Smart City Projects

香港生產力促進局作為特區政府智慧城市項目的研發樞紐

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The Hong Kong Productivity Council (HKPC) facilitates the Government's technology initiatives, and as such supports the Smart City blueprint released in 2018, which outlines six smart categories, namely Smart Mobility, Smart Government, Smart People, Smart Living, Smart Economy and Smart Environment.

The six smart categories are reflected in HKPC's projects: Smart People connects devices via the Internet of Things (IoT) to derive data; Smart Living helps the elderly improve their health among others; Smart Mobility maximizes transport efficiency and reduces collisions. Furthermore, the Smart City blueprint guides the HKPC's initiatives likely to be pursued in the near future.

To this end, HKPC utilises advanced technology to support and upgrade Hong Kong enterprises. HKPC collaborates with a variety of sectors and specialises in 5G applications outside of mobile operations. For instance, HKPC cooperates with institutions such as youth federations, schools and Government departments to transform Hong Kong into a Smart City. Dr. Lawrence Poon is spearheading the Smart City-related HKPC projects, in addition to the research and development of Automotive Platforms and Application Systems R&D Centre (APAS).

Smart City Projects

There are many aspects to consider when transforming Hong Kong into a Smart City, but the underlying factors are access to big data and low latency connectivity. One of HKPC's many Smart City projects is a Smart Street Lighting Management System. There are over 140,000 streetlights in Hong Kong and maintaining them all used to be a tedious and time-consuming task, since logging a malfunctioning light and replacing it could take up to a week. To address this issue, HKPC developed Smart Street Lighting Management System with Highways Department. The System is a predictive maintenance system to measures voltage, current and power of each streetlight, monitoring its real-time status. In case of malfunction, it will instantly and automatically alert engineers to arrange precautionary maintenance. Now, with two sensors (LoRa and narrow-band IoT) installed in each streetlight, the light's power and predicted life expectancy can be tracked, while a malfunction can be detected within 40 seconds – and with remarkable accuracy.

香港生產力促進局（生產力局）致力協助香港特區政府推行科技措施，更全力支持於 2018 年推出的「香港智慧城市藍圖」，該藍圖勾劃出六大智慧範疇，包括：智慧出行、智慧政府、智慧市民、智慧生活、智慧經濟及智慧環境。

這六大範疇可從生產力局不同的研發項目中反映出來，智慧市民可以通過物聯網（IoT）連繫不同設備而獲取數據；智慧生活幫助改善長者的健康；智慧出行則發揮交通運輸的最大效率並減低碰撞事故。此外，智慧城市藍圖同時引導生產力局在不久的將來所推動的措施與項目。

為此，生產力局善用先進科技助香港企業提升生產力及營運效率。生產力局更積極與不同界別的單位合作，例如青年組織，學校及政府部門等，共同專注研發流動通訊之外的 5G 應用，冀把香港轉型為智慧城市。在生產力局服務多年的潘志健博士，除了帶領團隊積極參與汽車科技研發中心（APAS）的研發，更致力推動局內智慧城市相關項目的發展。

智慧城市項目

要成功把香港轉變成為智慧城市，需要考量的層面有很多，但當中，尤以存取大數據和低時延的連接為基本因素。生產力局孜孜推出關於智慧城市的研究項目，其中一個是「智能路燈燈光管理系統」。全港共設有超過 14 萬盞路燈，要檢查與維護這些路燈是繁瑣且耗時的任務，若路燈出現故障，由記錄至安排維修可能需時長達一星期。有見及此，生產力局與路政署開發「智能路燈燈光管理系統」，這是一個預測性的維護系統，可量度每盞路燈的電壓，電流和功率，並實時監測其運作狀態。萬一路燈發生故障，該系統會即時自動通知工程人員，以便儘快維修，縮短故障時間。現時，「智能路燈燈光管理系統」利用 LoRa 無線傳輸技術及窄帶物聯網（narrow-band IoT）再配合傳感器，不但可以監測每盞路燈的電源及預測其運作壽命，並且可以在 40 秒內偵測異常，準確度極高。
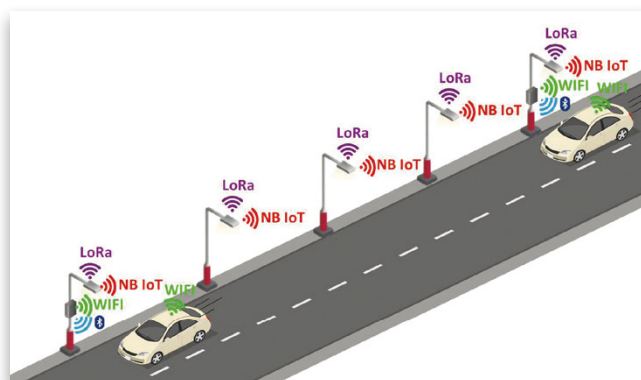
Applications like these are possible due to Hong Kong's unique advantages, such as being small and dense. As there is a lot of data in tight proximity, street furniture such as streetlight can be placed in the premium locations required to provide coverage to multiple devices. If Hong Kong were ten times bigger, the infrastructure needed would have to increase by approximately ten folds.

The density of Hong Kong, along with the short wavelength of 5G – which gives it more penetrative power – provides maximum coverage and speed. When there is ample coverage, street furniture placed in premium locations can track real-time data such as temperature, wind, humidity, movement, and traffic, which can be communicated to people via their smartphones in real-time with low latency. These initiatives help create Smart People, Smart Living, and Smart Mobility.

Although implementing 5G to transform Hong Kong into a Smart City takes time and immense coordination, the investment is worth it because many of the benefits will reduce costs in the long-term. This is because rapid connections between devices enabled by 5G eliminate the need for multiple industrial computers to store the data, since the sensors can revert data to one back-end server.

The increased capacity for data transmission reduces the cost of expensive hardware. In the near future, implementing 5G will impact Smart City development at many institutions and transform how education, healthcare, entertainment, and transport perform.

Smart Transport Research

In the realm of Smart Transport, HKPC has its own specialised Smart Transport division and encourages the commercial adoption of 5G in various ways. HKPC hosted Automotive Platforms and Application Systems R&D Centre, which the Centre is established by Innovation and Technology Commission.

In recent years, technological advances have stimulated significant research into driverless cars, but Dr. Lawrence Poon stresses that driverless cars need 5G to become practical. 5G drastically reduces latency, which is essential for autonomous driving because even a one-second delay makes a huge difference. A car going at 70-80 km/h would travel for more than 20 metres far even with the briefest delay in response time.

To pave the way for driverless cars, HKPC has been working on accident prevention, using collision avoidance algorithms. Preventing accidents can be achieved using big data to create the driving information for machine learning, where the car learns how it should behave in various situations. As machine learning progresses, a driverless car will learn to make its own correct decisions in all circumstances.

由於香港面積小及人口稠密，因為在密集的環境下有高數據流量，便可在優越的位置上安裝路面設備，如街燈以便為眾多的終端設備提供覆蓋，上述應用項目是可行的。倘若香港的面積要大十倍，那所需的基礎設施亦同樣需要增加十倍。

5G 特點之一是短波長，在香港高密度的環境下能提供較高的訊號滲透力，並提供最大的覆蓋和速度。有了廣泛的 5G 覆蓋，設置在優越位置的路面設備便可進行實時監測追蹤，例如偵察溫度、風速、濕度、人流和交通情況等；配合 5G 低時延的特性，人們可以輕鬆地透過他們的流動電話取得實時資訊，創建智慧市民、智慧生活和智慧出行。

儘管通過運用 5G 技術來將香港轉變成智慧城市，需要一定的時間和多方面龐大的協調，但依然值得投資，長遠而言可降低許多藉由 5G 帶動的效益的成本。由於 5G 支持的設備之間的快速連接，可藉由傳感器把數據迅速回送至一台後端伺服器處理，從而毋須使用多台工業用電腦去儲存大量數據，有助減低成本。

另一方面，增加的數據傳輸容量可減低昂貴的硬件成本，在不久將來，5G 將影響智慧城市在不同面向的發展，並改變教育、醫療保健，娛樂及交通的執行。

HKPC's virtual platform has made this possible through simulating multiple environment scenarios and manipulating a wide range of variables (such as number of people, bicycles, animals, cars, speed of cars). These simulations aim to recreate the city's transport patterns, to make cars entirely autonomous.

Driverless vehicles, however, are not only designed for the road. One other notable APAS development is the MiniMover. As Hong Kong has plenty of indoor spaces (shopping malls, hospitals and schools), there are opportunities for automated indoor robotics. Very soon, robots mounted with sensors/radars and a camera will be mobile, with wheels or legs, to collect data and accomplish different tasks.

Some robots have spider-like legs that are capable of scaling walls and exploring narrow areas, which are difficult for humans to manoeuvre in. Autonomous technology would allow MiniMovers to complete routine dirty tasks, such as taking out the garbage or cleaning vents, as well as being able to provide necessary surveillance.

Of course, Smart Transport is just one domain that requires strong coordination. As the success of a Smart City requires the support of enterprises in Hong Kong, HKPC has developed several initiatives for the commercial community to adopt the latest technologies. So, let us consider how HKPC supports small-to-medium enterprises (SMEs).

智能交通研究

在智能交通研究方面，生產力局設有專注研發智能交通項目的部門，並鼓勵 5G 商用多樣化，生產力局轄下的汽車科技研發中心 (APAS) 正是一例。該研發中心由創新科技署所成立。

近年，科技的進步刺激了大量無人駕駛車的研究，潘博士強調，自動駕駛車必須要 5G 技術的配合方可落實運作。5G 大幅度降低時延對自動駕駛至關重要，因為即使 1 秒的延誤亦可產生巨大差異。簡單來說，一架以每小時 70-80 公里車速行駛的汽車，即使以最短的時間反響，仍需要行駛 20 多米作緩衝。

為了將來自動駕駛車得以應用，生產力局不斷以預防碰撞演算法進行事故預防研究，並利用大數據去加入各種駕駛資訊進行機械學習，讓自動駕駛車能夠學會在不同情況下作出反應，以達致成功預防事故發生。隨著機械學習的演進，自動駕駛車可以學會自行判斷，從而在所有情況下作出適當反應。

生產力局的虛擬平台通過模擬多種環境場景設置並加入廣泛的變數，例如人數、單車、動物、汽車和車速等，務求完善自動駕駛汽車的成效。這些模擬應用旨在重塑城市的交通模式，以實踐完全自動駕駛車的目標。

然而，自動駕駛車不僅只限道路設計使用，APAS 另一項研發里程是「自動駕駛運載系統 (Mini Mover)」。鑑於香港的室內空間眾多，如購物商場，醫院及學校等，對推行自動室內機器人造就大量機會。備有傳感器／雷達及鏡頭再附設車輪及腿部的流動機器人將會很快面世，它們能幫助收集數據和完成不同任務，便利生活。

另外，有一些具有類似蜘蛛腿裝置的機器人，可以在牆壁上攀爬和鑽進狹窄的區域進行探索，這些都是人們一般較難駕馭的任務。自動駕駛技術亦可指令 MiniMover 完成一些重複性例行工作如清理積存的垃圾或清潔通風口及檢查等。

當然，智慧交通只是在眾多需要協調範疇中的其中一個領域。香港要成功轉變為智慧城市，有賴各行各業的企業共同推進，而生產力局亦協助制定多項措施，使商界能夠採用最新的技術。就讓我們探討一下生產力局如何支援中小企。

HKPC Supports SMEs

HKPC and APAS facilitates tech adoption by the commercial community, so that SMEs with 5G initiatives can test their business performance. HKPC's SME ONE initiative serves as a one-stop application support and consultation service for Government Funding Schemes. It provides seminars and workshops to solve potential technical problems, including patent registration, handling international property rights, certifying test performances and solutions.

Within HKPC, there are Electromagnetic Compatibility (EMC) test area providing controlled environments that stabilise external noise, and by extension, allowing variables to be manipulated for reliable quality. These highly controlled tests accurately measure the strength of data transmissions and latency for SMEs. Elsewhere, there are mobile teams that use HKPC technology and equipment to survey the data quality in outdoor areas. Initiatives that support SMEs will in turn allow 5G to become an ecosystem.

5G as an Ecosystem

The era of 5G will result in tons of data being uploaded to the cloud. Prior to 5G, cloud servers needed broadband or private networks, but 5G can provide bandwidth to access data-consuming information such as complex 3D videos. As data is uploaded to the cloud, millions of connected devices can easily access environmental and behavioural data with unique 5G characteristics. Individuals can access this data, enjoying robust security, location accuracy, connectivity, and low latency.

As an ecosystem, 5G becomes an enabler for industries and developers to create positive customer experiences. For example, HKPC has developed a novel "kNOw Touch" contactless panel to lessen the risk of coronavirus transmission whilst using an elevator. This cost-efficient technology only requires a small twist without the need of vast mechanical alteration to perform.

HKPC has also developed applications in the realm of Gerontechnology (tech for the elderly). Since Hong Kong has an aging population, it is important to fully exploit the advantages of big data to monitor the behavioural patterns of elderly people (movement, sleep quality) and their immediate environment (lights, temperature) with real-time sensors, in order to predict illnesses and proactively reduce sickness and stress.

Abnormal blood pressure, weight loss, heart rate, or movements will all be detected immediately, and reporting accidents will not rely on a doctor's physical proximity. Healthcare for the elderly will no longer become "after-the-fact," as 5G permits machines and sensors to be omnipresent caretakers.

In sum, HKPC's facilities, projects, and collaborations with SMEs aim to fulfil the Smart City blueprint set out by the Government. Implementing 5G and transforming Hong Kong into a 5G ecosystem is essential to attain the Smart City blueprint's six smart categories. ●

生產力局著力支援中小企

生產力局及 APAS 致力促進商界採用技術，以便中小企都受惠 5G 技術應用，幫助他們評估業務績效。生產力局轄下的「中小企一站通」（SME One）旨在提供一站式全面的營商資訊服務，包括香港政府的各類型資助及支援計劃的諮詢，透過定期舉辦不同的研討會及工作坊，為中小企解決一些技術性問題，如專利註冊、處理國際財產權，測試驗證和提供適切的解決方案，為本港中小企提升競爭力及掌握營商知識及實用技巧。

生產力大樓內設有一個電磁兼容（EMC）測試區域，提供可控制的環境進行測試實驗，以穩定外來噪音，並通過延伸，容許處理不同變數以達到可靠的質量。這些具備高規格的可控制測試有助中小企更準確地量度數據傳輸的強度和時延。另外，生產力局亦有專家，負責利用生產力局研發的技術與設施在室外環境進行數據質量測量。這些支援中小企的 5G 應用將有助構建一個健全的 5G 生態系統。

5G 作為生態系統

在 5G 時代，大量數據會上載至雲端，而在啟動 5G 之前，雲端伺服器需倚靠寬頻或私有網絡來運行，但有了 5G 提供的寬帶，為需要大量數據存取的資訊及應用帶來便利，如複雜的 3D 視頻影像。當大量數據都上傳到雲端後，過百萬的終端連接可從 5G 獨有的特性去存取環境及行為數據，有助進行分析，而人們亦可透過這些數據存取，享受更高的安全性、位置準確性，連接性和低時延的優勢。

5G 作為一個生態系統，已成為行業和發展商創造正向客戶體驗的推動力。 例如，生產力局開發了一種新穎的「kNOw Touch 無觸按鈕」非接觸式按電梯面板，透過隔空方式按動升降機，以降低傳播新冠病毒的風險。此項成本相宜的技術只需簡單安裝即可應用，毋需進行大幅度的機械結構改動。

生產力局的技術研發涵蓋不同領域及服務對象，其中包括研發樂齡科技（為樂齡人士及其照顧者而設的科技產品）。隨著香港樂齡人士人口日增，科技對於樂齡人士的日常生活越趨重要，而我們可充分利用大數據的優勢，讓照顧者及樂齡人士自己在需要時了解及檢視其情況（如流動性及睡眠質素），及使用實時傳感器為他們作檢查，例如對周圍環境的即時反應（如光線和溫度），以便及早預防病患。

樂齡科技又可偵測樂齡人士有否出現體重下降、血壓，心律或活動能力異常狀況，若遇上意外亦可及時發現，而不需要倚賴醫生的現場檢查。有了 5G 技術，可容許機械及傳感器為樂齡人士提供全天候照顧。

總括來說，生產力局的硬件設施、研發項目以及對中小企的支援服務，皆香港發展成為智慧城市在作出貢獻。啟動 5G 及把香港轉變成 5G 生態系統，對實現智慧城市藍圖的六大智慧範疇至關重要。 ●