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物聯網拼圖－
拼出你的智慧家庭

IoT Puzzle:
Build Your Own Smart Home

隊伍名稱　沉默的多數 Silent Majority
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研究領域
行動運算、人機介面、虛擬實境、雲端運算、虛擬化技術與虛擬機器、嵌入式系統與Android系統、平行處理、多執行緒與多核心技術、自動化系統。

作品摘要

隨著科技的快速進展，物聯網（IoT）在近年來成為最熱門的話題，但在物聯網快速成長的今日，要透過IoT系統達到智慧家庭理想仍非易事。最主要有以下幾個關鍵仍待解決：

- 傳統家電無法聯網，便無法構成智慧家庭的一環。

- 現今家庭電力網路與開關介面，物聯網系統的普及度較低。

- 新型智慧家電成本較高，且各廠家彼此間尚無統一的物聯網傳輸格式定義。

- 目前物聯網均需特殊硬體，內建的操作邏輯不易更改或自行客製化。

- 個別物聯網系統只有特定有限的感測器，無法自由新增或修改感測器。

現今常見的家電，諸如電蚊燈、果汁機、檯燈、電扇等家戶戶均有的傳統家電，均不具備聯網能力，因此要使這些家電整合至智慧家庭物聯網系統中，除非等廠商推出專屬規格的家電，否則光是要遠端開關這些傳統家電就非常困難，但對於廠商利益而言，並不會考慮將舊有的家電聯網化視為優先目標，加上各廠商之間的智慧家電無統一傳輸規格，導致消費者須為一種特殊功能購置一套物聯網系統且系統彼此間無法溝通，對智慧家庭的建置而言實不理想。

為了要解決以上所述的問題，我們設計並實作一全新概念的物聯網智慧家庭系統：「IoT Puzzle」。此物聯網系統能有效解決以上問題。簡述如下：

IoT Puzzle提供一隨插即用的連接介面，使用者可以任意選用想搭配的感測器，自由變更操作邏輯與自行客製化使用案例的能力，使用者可透過拼圖的方式，任意創造自己想要的智慧家庭功能，且能隨時變更各感測器與控制器之間的觸發條件，控制器的部分則藉由「智慧插座」以及「萬用紅外線遙控發射器」，便能以極低成本將傳統家電整合至智慧家庭系統，同時我們設計了能附掛在牆壁開關上的「開關拼圖」，能夠在不變動家庭電力網路與開關介面的前提下，將家庭開關智慧化，以達到低成本、高彈性的智慧家庭（Smart Home）理想。

圖1. 開關拼圖安裝

圖2. 以APP設計感測器拼圖與控制拼圖之間的關聯及觸發條件，無需接線，拼圖可遠距離擺放

Abstract

With the development of technology, IoT (Internet of Things) has become a well-known topic in recent years. However, it could be hard to build smart homes with current IoT systems since the following issues have to be improved: 1. Traditional appliances are usually not equipped the Internet connection ability, thus they could not link to one another and build smart homes. 2. IoT systems aren't widely applied in modern home electrical system and switches. 3. The cost of smart appliances is significant and there is no a universal IoT protocol for all manufacturers. 4. Each IoT product contains special specification, which is hard to modify and customize for unique requirements. 5. There are limited sensors in each IoT system, users are unable to add new sensors or modify existing sensors at will.

Common appliances like bug zappers, juicers, lamps, and fans are widely used in modern household, however, they are incapable of connecting to the Internet. As a result, it is extremely difficult to integrate these appliances into smart home systems and control those appliances remotely, unless the manufacturers release compatible devices. On the other hand, since improving existing devices to smart home systems cannot bring more profit, manufacturers don't treat it as a top priority. Moreover, the lack of standard protocols for smart home systems causes customers need to purchase another IoT set just for a particular requirement, which is not realistic for building smart homes.

In order to improve the issues which are mentioned above, we design and implement a brand new smart home system (based on IoT), which is called "IoT Puzzle". The IoT puzzle provides plug-and-play connections for each pieces, users are not only able to assemble any combination of sensors as well, but also customize the functions according to their scenario. Users can create any functions just like putting puzzle pieces together for building their smart homes. In addition, they are able to change trigger conditions of various sensors and controllers at any time with the developed app. Furthermore, we design and implement the "smart outlet", "universal IR remote controller" and "switch puzzle" as output puzzles. Therefore, the home electronic systems could be controlled by IoT without any modification and significant cost to reach the goal of a smart home.
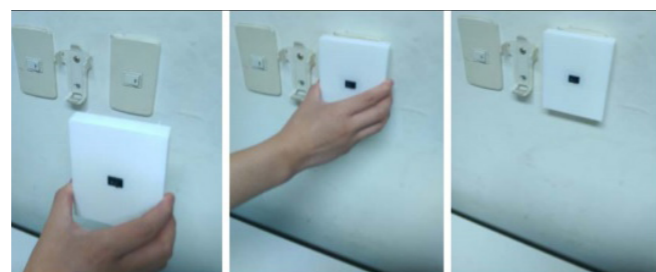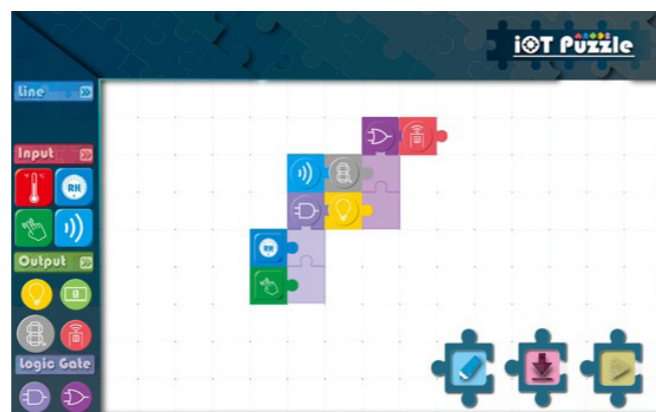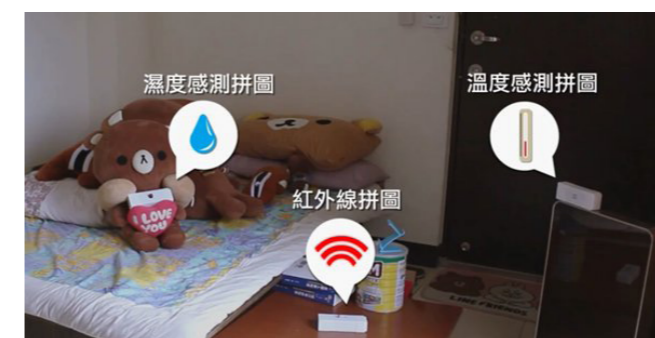
Fig.3 The combination of various IOT puzzles to build a smart home