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作品名稱	螢光閃閃－同步的奧秘 Secret of Fluorescence Synchronization
隊伍名稱	同心齊步 Walk Together
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作品摘要

近年來，在無線感測網路方面的應用愈來愈廣泛，舉凡智慧家庭、工廠監控、生態觀測，以及工安維護等，很多領域都可見到無線感測網路的身影。在無線感測網路中，因為受限於有限的電量、處理器運算能力的限制及環境因素等，如何在無線感測網路各節點進行時間同步的過程中，在減少其消耗電源的同時，如何有效達到時間同步，一直是眾多學者致力研究的重點。在本作品中，我們提出了一種有別於傳統時間同步的方法。本研究團隊的主要想法是以大自然中螢火蟲群的螢光同步為參考概念，每個節點的能階皆會持續單調的累積增加，當超過一門檻值時，此時則發送一個觸發信號，且週遭附近的節點受到此脈波影響，會瞬間加速其能階的累積，像這樣週期性的反覆運行，彼此以觸發脈波相互耦合，促其模擬螢火蟲群在原野間的螢光閃爍同步現象。並經過多次的數值模擬，比較傳統的耦合方法及我們的耦合方法，驗證我們提出的時間同步機制，比起傳統的方法能更快速的達到時間同步。將此種機制運用在無線感測網路的時間同步時，每一個無線感測器只需要做簡單的運算和發送一個低資料量的封包，大大的降低處理器運算時間和感測器發送同步封包時所消耗的電量，並且可以快速達到同步的效果。為了方便控制和觀察無線感測器的同步狀況，我們撰寫了一個同步化人機介面，利用圖形化的方式呈現同步狀況。最後，我們製作仿鄉村生活的場景，並利用14個無線感測器，呈現螢火蟲群在鄉野中，螢光同步閃爍的現象。

Abstract

In recent years, the applications of Wireless Sensor Networks (WSNs) are getting broader and broader. The applications in our lives include intelligent home systems, factory and ecological field monitoring, and maintenance of industrial safety. Clock synchronization in WSNs is a crucial issue. How to achieve the synchronization is affected by power consumption, computing constraint of processing units, and environmental factors. In this project, we propose a new kind of synchronization method, which comes up from the flash synchronization of fireflies in the natural. The basic idea is that the potential in each node sensor would pile up continuously till the potential passes a prescribed threshold. At this moment, the node will send a pulse to neighboring sensors simultaneously. When the neighboring sensors are influenced by the pulse, their potentials will jump up a little bit of amount instantaneously. Based on this mechanism, we can see that the synchronization can be achieved. When this type of clock synchronous mechanism is implemented, we only need to do simple computation and send a low capacity of package. It reduces the power consumption greatly when the processing units of sensors exchange the coupling signals, and can reach the effectiveness of fast synchronization. In order to control and observe the synchronization condition of WSN, we program a synchronization Human Machine Interface (HMI), and utilize Graphical User Interface (GUI) to show the synchronous condition. Finally, we make an imitation country landscape, and utilize 14 wireless sensors to show the phenomenon of fireflies flashing synchronously in countryside.