Application Group

A11-124

作品名稱
劫盜地圖

Marauder's Map

隊伍名稱
定位隊 Positioning Team

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作品摘要

隨著科技迅速發展，行動定位服務也越來越備受重視。縱使目前全球衛星定位系統的技術已趨於成熟，但因在室內無法使用，在應用上有很大的侷限性。由於我們日常生活大都位在室內，所以對於室內定位服務的提供是需要的。在現今已發展出的室內定位技術中，Wi-Fi無線定位技術以高度的市場普及性和易於建置網路等特性，在應用方面占有極大優勢。然而受到環境因素的影響，同一定點位置在不同時間所收到的AP訊號強度均不同、穩定性不佳，導致定位出來的結果誤差極大。而近幾年的研究始終無法突破這個問題，所以Wi-Fi無線定位技術的精準度一直無法有效提升。

在本系統中，我們提出了全新的想法。我們認為造成這項誤差的原因在於：幾乎所有的Wi-Fi無線定位技術，一開始的AP都是隨意擺置，這樣會導致室內空間的訊號穩定性不均勻的現象，定位的參考依據將不可靠，進而無法得到準確的定位結果。但如果我們事先運算出AP適當的擺放位置，使AP之間互相覆蓋穩定性不足的地方，應可有效提高室內空間整體的訊號穩定性，進而降低誤差。

然而，在計算AP的正確擺放位置前，必須先獲得如室內平面配置圖與訊號分佈圖等室內環境的相關資訊，而若能自動取得這些資訊，將可使得系統可以應用在任何的室內空間上，不受限於任何環境，大幅提升本系統的實用性與自動化程度。因此，我們在系統中加入了三輪機器車，利用記錄三輪機器車的行走路徑來蒐集繪製平面圖所需的資訊，再藉由手機在機器車掃描平面時同步搜尋訊號強度資訊繪製訊號分佈圖，這樣自動化的方法將省下大量的人力和時間。而本系統使用的機器車為自組機器車，其最大的特色是可藉由控制馬達的轉動方向與速率，讓三個全向輪同時同方向、同速率的旋轉。因此機器車轉彎時將可不必倒退，還可以藉由控制轉動速率做各種角度的轉彎，減少了轉彎時所花費的時間，提高機器車的工作效率。

本系統將藉由上述獲得的實際訊號分佈圖和理想訊號分佈圖來計算AP適當的擺放位置。完成環境架設的前置作業後，即可而運用定位技術，計算出持手持裝置的使用者目前的所在位置。

ABSTRACT

As a result of the rapid advancement of recent technology development, the importance of mobile positioning service cannot be casually overlooked. Although the study in the field of Global Positioning System is more mature than ever, one problem, signal attenuation, often occurs when it is employed in interior areas. This problem is ill-posed and puts a lot of limitations when applying to practical applications. Since we stay in the interior area most of the time, the need for a robust in-door positioning service is undisputed. In recent developments, Wi-Fi Positioning rises to prominence for its market ubiquity and the ease to setup, granting itself enormous advantages in practical applications. But due to the environment's nature of instability, the signal strength at a fixed position tends to vary as time passes. The signal variation often produces undesirable result as it is unable to faithfully represent the true position. As a matter of fact, Wi-Fi Positioning is often challenged for its precision and recent development has not been able to effectively improve its performance.

In our system, we have proposed a novel method. We have identified that the problem is caused by a common situation we will be elaborating shortly after; of almost all Wi-Fi positioning systems, the wireless access points are arbitrarily placed. This can produce a problem where the transmitted signals are not evenly distributed in the interior area; when the source being referred to is unreliable, the estimated position is therefore imprecise. But if we pre-calculate the optimum setup positions for each access point, we can compensate each access point's weaker coverage area, improving the signal robustness as a whole and thus minimizing the estimation error.

However, before calculating the optimum positions for each access point, we will need information about the interior such as indoor floor plan and signal strength map. If the needed information can be acquired automatically, we can deploy our system on virtually anywhere interior without limitations, vastly improving the robustness and certain degree of automation. Therefore, we seek to solve the problem by extending our system with an additional three-wheeled robot car. The three-wheeled robot car will be roving across the environment and tracking its own trail, while the handheld smartphone mounted on the robot car scans for signal power which is needed for constructing signal strength map. This automated process saves manpower and conserves time. The self-built, three-wheeled robot car used in our proposed system features three omnidirectional wheels, which has some major advantages. By manipulating the rotating direction and angular velocity of the motors, it is possible to maneuver the car with all three wheels the same direction and speed, avoiding the need to pullback the car while turning directions, so to improve its working efficiency.

Our proposed system will be utilizing the above-mentioned measured signal strength map and ideal signal strength map to calculate the optimum position for the wireless APs. After the preliminary procedures are all set, we can now use our novel positioning system to calculate the user's current position by the user-owned handheld device.