作品名稱

基於人工智慧邊緣運算之
視障者行走障礙物警示系統

An AI Edge Computing Based Obstacles Warning
System for Visually Impaired People Walking

隊伍名稱

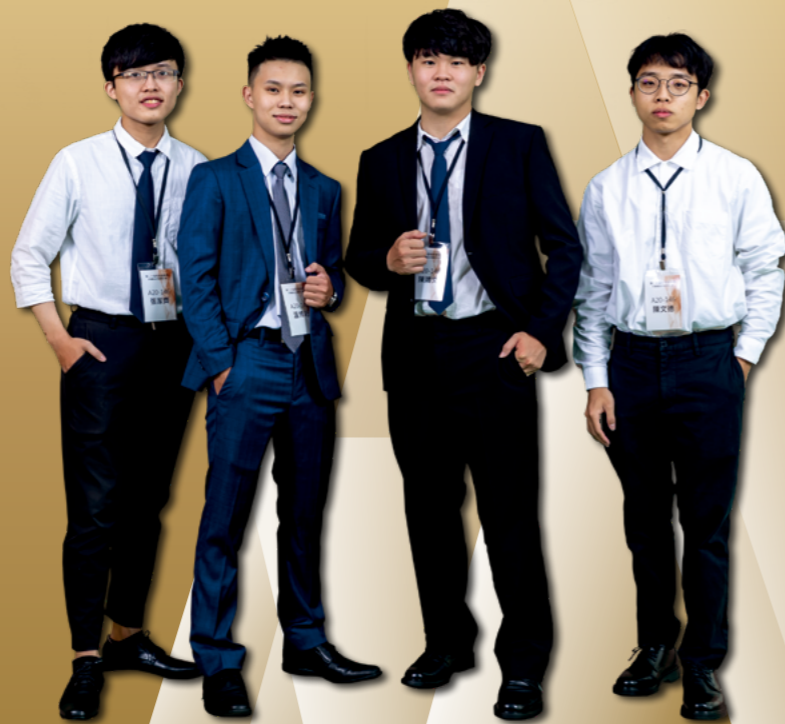## Go–to Guide

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作品摘要

根據 WHO 的統計，截至 2019 年底已有 22 億的視障人口，佔世界總人口 28%。統計指出有 95% 的視障者曾在行走時撞上障礙物。因此針對視障者於戶外複雜環境中，最常遇到的障礙物分為兩大項：

1. **懸空障礙物導致碰撞受傷：**
   因為手杖不易偵測懸空障礙物（如：路樹、招牌等），視障者行走時可能撞上而發生受傷風險，統計指出有 15% 視障者平均每月會撞到懸空障礙物。40% 視障者每年會因撞到懸空障礙物導致受傷。

2. **地面施工路障導致迷失方向：**
   雖手杖能偵測常見地面障礙，但地面施工路障會延伸其他問題，根據論文指出視障者平時走在常走的路線，一旦被地面施工路障擋住，便無法得知替代路線時，有 80% 視障者會產生迷失方向，其中有 61% 產生迷路的情況。

為解決以上兩種障礙物延伸的兩種問題，我們研發「基於人工智慧邊緣運算之視障者行走障礙物警示系統」（稱為 Go–to Guide）包含視障者配戴之「智慧墨鏡」外型與一般墨鏡類似、可收納至包包或腰包也可掛在腰上之「智慧辨識器」、與客服人員可使用之「守護視界雲端服務平台」所組成，目的為解決視障者於外出行走時常遇到懸空障礙物（如：路樹、招牌等）或地面施工路障（如：施工三角錐）而導致碰撞懸空障礙物受傷或遭遇地面施工路障阻擋而迷失方向之兩大問題。

智智慧墨鏡內嵌攝影機可即時將影像無線傳輸至智慧辨識器並以人工智慧物件辨識技術（YOLO）即時辨識視障者行走前方是否有懸空障礙物或地面施工路障。若辨識出懸空障礙物智慧辨識器回傳檢測結果提示視障者，視障者便能提早注意前方有潛在危險，小心避

開障礙物；若辨識為地面施工路障，智慧辨識器一樣回傳檢測結果給視障者，視障者得知前方可能施工無法通行，找不到替代道路而迷失方向時，可以按下智慧墨鏡上的 call out 按鈕，將通知、即時影像與位置資訊回傳至守護視界雲端服務平台，客服人員收到通知與影像等資訊後即時回 call，以語音引導視障者解決眼前問題。

本系統能解決視障者在外遇到的兩大問題「因懸空障礙物導致碰撞受傷」，「因地面施工路障導致迷失方向」主要為了視障者在行走之安全，並且能夠減少龐大的長照費用及長期的精神壓力，因此不需時時關切，即在需要協助的時候，透過系統導入人工智慧與串流影像技術服務等，幫助視障者避免因障礙物導致事故發生。

圖 1. Go–to Guide

圖 2. 智慧墨鏡實體照

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Abstract

According to WHO statistics, there were 2.2 billion visually impaired people as of the end of 2019, accounting for 28% of the world's total population. Statistics indicate that 95% of the visually impaired have hit obstacles while walking. Therefore, the most common obstacles encountered by visually impaired people in complex outdoor environments are divided into two major categories:

1. **Suspended obstacles cause collision and injury:**
   Because using the cane is not easy to detect suspended obstacles (such as road trees, signboards, etc.), visually impaired persons may bump into them when walking, and statistics show that 15% of visually impaired persons will hit suspended obstacles on average every month. 40% of visually impaired people are injured every year by hitting a suspended obstacle.

2. **Ground construction barriers cause disorientation**
   Although the cane can detect common ground obstacles, ground construction roadblocks will extend other problems. According to the paper, visually impaired people usually take the usual route. Once blocked by the ground construction roadblock, they cannot know the alternative route, 80% Visually impaired people get disoriented, and 61% of them get lost.

In order to solve the two problems of the above two obstacle extensions, we have developed the " An AI Edge Computing Based Obstacles Warning System for Visually Impaired People Walking " (called Go-to Guide), which includes "smart sunglasses" worn by visually impaired persons and the appearance is similar to general sunglasses. "smart box" can be stored in a bag or waist bag and can be hung on the waist. And consists of a "Go-to Guide cloud information platform" that can be used by customer service personnel. The purpose is to solve the problem of visually impaired people. When going out, you often encounter suspended obstacles (such as road trees, signboards, etc.) or ground construction roadblocks (such as construction triangle cones), which cause collisions with suspended obstacles or get lost because facing encounter ground construction roadblocks.

The built-in camera of smart sunglasses can wirelessly transmit the image to the smart box in real time and use artificial intelligence object recognition technology (YOLO) to instantly recognize whether there are suspended obstacles or ground construction roadblocks in front of the visually impaired walking. If recognizing the results of the detection of the suspended obstacles by the smart box, the visually impaired person will be able to pay attention to the potential danger ahead and avoid the obstacles early; if the identification is a road construction barrier, the smart box will return the detection result to the visually impaired. When the visually impaired learns that the construction may be impassable in front of them, when they cannot find an alternative road and get lost, they can press the call out button on the smart sunglasses to send the notification, real-time images and location information to the Go-to Guide Cloud Service Platform, customer service personnel immediately call back after receiving notifications and images, and use voice to guide the visually impaired to solve the immediate problem.

This system can solve the two major problems encountered by visually impaired people "crash injury due to suspended obstacles", "disorientation due to road construction barriers" is mainly for the safety of visually impaired people walking, and can reduce the huge cost of care and long-term mental pressure, so there is no need for constant attention anytime, that is, when assistance is needed, artificial intelligence and streaming video technology services are introduced through the system to help visually impaired people avoid problems caused by obstacles.

Fig. 3 Service platform