MONITORING PEDESTRIAN MOVEMENT IN MAJOR RETAIL AND PUBLIC ENVIRONMENTS

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INTRODUCTION

With public safety among the most critical points on the current UK agenda, there has been a rise in demand for accurate tracking and monitoring of pedestrian movement in areas of high risk and/or interest. Areas categorised as high risk could include open urban areas such as city centres, major retail parks, event venues and public transport stations. These areas are identified to have several common key components that are central to our goals, these include but are not limited to; several points of entry and exit relating to the zone(s) being monitored, an unknown or unlimited volume of visitors at any given time and over any duration and that there are undefined routes for pedestrians within the area to take leading to limitless route possibilities.
If we take the events venue example for clarity and suggest a football stadium has a match on a coming Saturday, we can measure pedestrian volume and individual routes on match-day at an unlimited number of strategic points in and around the stadium, in surrounding areas and on the local public transport system. From here we could determine unique travel patterns to the stadium, individual routes into and around the stadium, with overall volumes and dwell times within strategic zones. This would provide rich information with which the local authority/event management team could make critical decisions. These decisions historically include road closures and evacuation, with evacuation optimisation as one of our highest priorities in our application of this development.

DEVELOPMENT OF AN INTELLIGENT SOLUTION

The concept

As a dedicated data collection technology developer, Innotech Insights were the ideal candidate to diagnose technological shortfalls of current methods of pedestrian data collection and design alternative solutions and engineer elegant workarounds. The most common method of tracking pedestrians in crowd environments incorporates the scanning of Bluetooth devices within the vicinity, using the MAC address as a unique identifier. The biggest problem with this is the sample rate which is estimated at anywhere between 6% and 14%. This is due to the fact that Bluetooth technology has seen a dip in usage in recent years with the introduction of advanced alternatives for communications. As a result, users are more likely to turn off Bluetooth when the technology is not required. In an attempt to increase sample size, we decided that WiFi scanning would be a more robust and consistent method of data collection.
WiFi is widely available in most homes, workplaces, on public transport and in public areas. Consequently, users are very unlikely to turn off WiFi on their devices at any time and therefore will be constantly sending search signals throughout a high proportion of travellers and visitors.

The System

Alongside our partners, Innotech Insights have developed a unique off-grid system that is fully independent for power and communications that can be deployed in any environment to capture unique MAC addresses to track visitors throughout any predetermined zones(s) and anonymise those MAC addresses at source on the device in order to satisfy confidentiality and data protection laws. Each sensor uses the same algorithm to ensure the anonymised codes are identical across any

network of devices. Each system then sends real-time data into a cloud database that feeds our proprietary Crowded™ software platform.
With our knowledge of the data collection industry, we have designed Insights to ask the most common queries including but not limited to dwell times, overall visitor volume and individual journeys. The software offers clients an online log in to the interactive dashboard where they can view visual tools and charts based on their specific project data as well as have access to the raw anonymised dataset.

APPLICATION IN A SPECIFIC AREA OF INTEREST

With transportation a viable and attractive albeit saturated market, we chose a major retail environment to perform our initial pilot scheme. This provided us with a rich and purely pedestrianised environment that would offer many unique visitors throughout the timeline. We used two scanners, one at each main entrance to the retail park that would scan both WiFi and Bluetooth for the purposes of comparison and would send data packets to a secure external database.

Figure 1: Scanning Technology installed on street furniture at a major retail park.

FINDINGS

Upon analysis, we found that there was indeed an enormous increase in sample size from WiFi over Bluetooth per location. Also, more importantly the sample size at each scanner was within the same ballpark figure whereas there was a significant discrepancy on the Bluetooth scans from one scanner to the other. We can make an educated assessment from this that WiFi is indeed more robust and consistent than Bluetooth.
The main objective of the software we have created as an interactive analytics platform is to offer live data visualisation tools alongside anonymised raw data that is both rapidly available to Innotech Insights and the client base as well as being reliable and robust. We tested this against our own video equipment deployed on-site during the same time period and the footage counted post

survey. The results from this were that WiFi scanning was in the 90% sample range with Bluetooth being within expected low parameters.

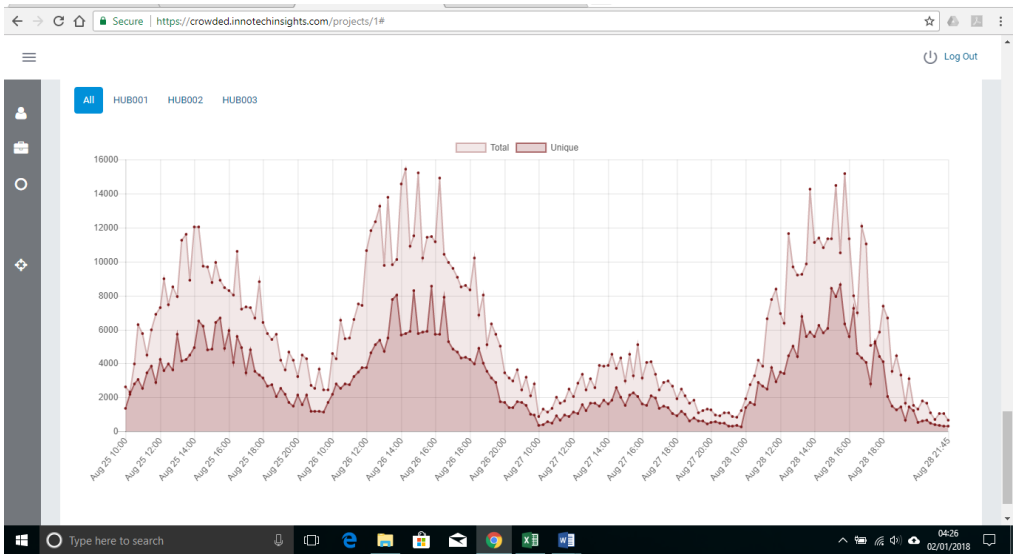

Figure 3: The Crowded™ analytics platform shows the total unique daily visitor in 5 or 15 minute segments.

Our main criteria for the analytics were made up of key queries and specific communications requirements. Each system utilises a UK 4G network to send data packets directly to the dashboard, providing the fastest, most capable connection available. We report no loss of connection throughout the project.
Key queries for this project included:
• Journey times between locations
• Duration of stay at each location
• Duration of stay overall
• Tracking individual routes throughout the site. (Journey mapping)

These criteria were all met and has provided a valuable reporting tool for a range of purposes. We achieved results over our expectation regarding sample rate and successfully created a reporting tool that offered the retail park greater visibility of footfall, individual journey information and crowd behaviour.

CONCLUSION

The Crowded™ system has proven to be a vast improvement on Bluetooth scanning alone. This provided more robust results that work equally as well in areas of low saturation or pedestrian flow. The sample rate achieved was sufficient enough to account for over 90% of the local population for this project. We would therefore consider this technology robust enough to apply to improving safety in public areas by creating models for event planning and evacuation purposes.
Regarding the economic component of off-grid data collection through temporary surveys, we have identified that Crowded™ offers clients an alternative to costly, retrospective methods of data collection. Our unique ability to apply our own Lithium development to the project alongside 4G capability has allowed us to offer this technology in a mobile form that has yet been unavailable. Further development and optimisation will continue over time as the system is applied to more projects for a wide range of clients. Here we again find the advantage of our proprietary ownership

of the platform in that as clients provide feedback on the system on the whole and as our technologies improve, we can react quickly to provide them with specific requirements.
The dashboard has been and will continue to be developed in conjunction with our partners to strive for the best available practice. Our current development of pollution sensors including but not limited to noise level and emissions, will also be available to view alongside saturation data.
In this case we utilised our IC-01 HD CCTV systems to capture video footage of the site locations relative to each scanning device. We will continue to do so for future projects to provide a widely accepted method of calculating sample rates.