iViu Technologies

Capacity Alert & Prevention System (CAPs)

Balancing Safety and Revenue in a Post-COVID World
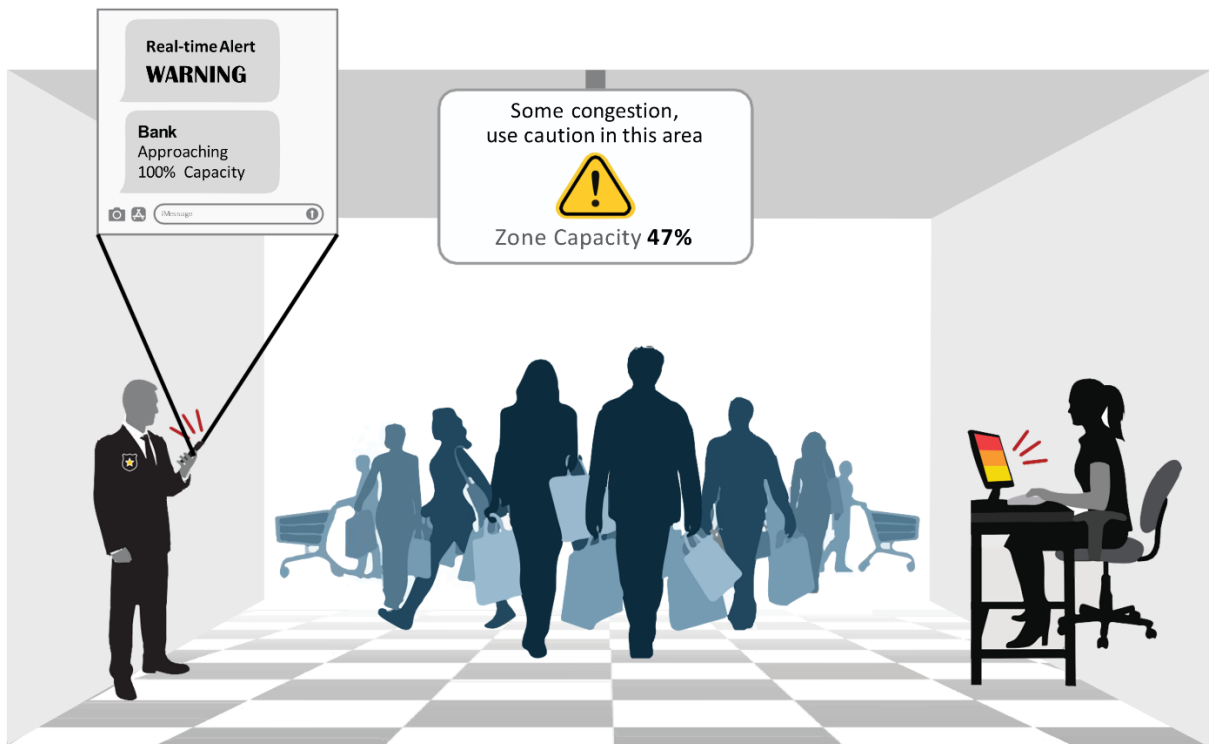
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Executive Summary

The COVID-19 pandemic has presented challenges to individuals, businesses, and governments unlike anything we have seen in our lifetime. In an effort to "flatten the curve" and slow the person-to-person transmission of the disease, stores, restaurants, offices, schools and government facilities worldwide shut down and "social distancing" – staying at least 6' from others – quickly became the norm. As these facilities re-open, retailers, restauranteurs, and office workers ponder what the "new normal" looks like, and how long it will last.

Re-openings of businesses and public facilities as of this writing feature requirements for people to socially distance and wear cloth face coverings most of the time, and for facilities to frequently disinfect "high touch" surfaces such as door openers, counters, and payment terminals and space customer service assets such as teller windows, gym equipment, and restaurant tables at least 6' apart. In many jurisdictions, government regulations have temporarily reduced facility occupancy rates to 50% of fire code capacity, or less. It's unclear when these restrictions will be eased.

COVID-19-related occupancy restrictions limit the revenue potential of retail businesses to a fraction of the traffic on which their business model was designed. Thousands of retail businesses have declared bankruptcy or their non-intention to reopen based on their inability to operate profitably. Longer term, the businesses and facilities that survive COVID-19 may find their client interactions and facility management processes permanently affected.

Better tools than counting the number of people entering and leaving a facility, separating entrances and exits, and placing markers 6' apart on the floor or sidewalk are needed. These roughly-hewn solutions for social distancing simply miss the mark: most of us have seen the YouTube videos showing Costco shoppers making a rush on the toilet paper aisle. What's needed is not a "new normal" but instead a "smart normal" under which facility operators re-balance policies, staff and the flow of people within their facility in order to generate sufficient revenue and provide excellent customer service while also providing a safe environment for all.

Three classes of solutions exist to help facilities monitor and manage social distancing: manual perimeter monitoring, camera-based perimeter monitoring, and in-facility sensor-based occupancy monitoring.

<u>Manual perimeter monitoring</u> requires the positioning of "door monitors" who physically count the number of people entering and leaving the facility and admit new patrons as others depart. While this solution helps to maintain overall facility occupancy limits, it does not provide any insight into where patrons may be clustering inside. Entry and exit counts have to be manually compiled, and the counts that are collected are prone to error: groups and high-volume passageways are difficult to count and distractions undoubtedly occur. Perimeter monitoring only provides accurate results when all facility entrances and exits are monitored: un- or under-monitored employee, handicapped, and service entrances/exits – common at large facilities – may provide the opportunity for perimeter counts to be inaccurate. Manual perimeter monitoring is also costly, as it requires at least one full-time employee at every entrance and exit during the facility's operating hours, and potentially wireless communications to keep the monitors in contact.

Camera-based perimeter monitoring systems have been deployed in retail establishments for several years for marketing research purposes such as measuring foot traffic and passers-by. These systems provide facility operators with information about the number of people entering and leaving the facility, but are subject to most of the same counting errors as manual perimeter monitoring systems. In addition, a camera alone will not stop people from entering a facility if the facility's occupancy limits are approaching or have exceeded limits. Door monitors at the entrances are likely still required.

In-facility sensor-based occupancy monitoring systems, such as iViu Technologies' Capacity Alert & Prevention System (CAPs) use sensors deployed throughout a facility to detect occupancy trends in various zones/departments in real-time. These systems segregate the interior of a facility into "zones" that are monitored by one or more sensors. Each zone, in essence, is a "store within a store" with its own occupancy limit developed to ensure adequate social distancing within the zone. The sum of allowed/budgeted zone occupancies may be greater than the "X%" of fire code capacity allowed for the store as a whole: with appropriate approvals, implementing such a system could raise the revenue potential of the store by allowing more patrons in a controlled and auditable manner.

Infrared (IR) beams, cameras and Wi-Fi devices are the most popular sensors used for in-facility occupancy monitoring. IR sensors are the most "blunt" tool in this arsenal: while they can be deployed to detect movement at a zone's entry and exit points and within a zone, they are not effective for counting zone occupancy as they often undercount people moving through the beam together. Cameras used for occupancy monitoring are often security cameras pressed into double duty or cameras dedicated to people counting, these can be expensive to provide appropriate coverage and give rise to privacy issues. Wi-Fi sensors, such as the ones used in CAPs, are inexpensive, provide reliable occupancy counts and trends, and the data they collect is easily anonymized to keep privacy issues at bay.

In-facility sensor-based occupancy monitoring systems send alerts to facility personnel when a zone is approaching, has reached, or has exceeded occupancy limits. Facility personnel can then implement corrective action when and where it's needed to maintain occupancy and social distancing guidelines. Audit trails and reporting demonstrate the facility's level of compliance with occupancy guidelines, provide feedback on actions taken to improve compliance, and can be used to optimize in-store performance by tracking new and repeat visitors, visitor routes through the facility, visitor dwell time by zone, conversion rate of visitors to sales, and more.

Perimeter monitoring and in-facility occupancy monitoring systems are not mutually exclusive: a gradual implementation of in-facility occupancy monitoring systems may be the best approach. Perimeter monitoring is a natural starting point for many facilities and often satisfies the minimum requirements imposed by relevant regulatory authorities. A gradual implementation of in-facility occupancy monitoring on top of perimeter monitoring can be used to investigate whether people are clustering in specific areas within the facility – that is, whether zone monitoring will improve the facility's ability to comply with occupancy and social distancing guidelines and/or requirements.

Like it or not, social distancing is here to stay, at least for the foreseeable future. Many jurisdictions require facilities to create written COVID-19 containment plans, and social distancing is a key element of these plans. Compliance reporting, in the face of a regulatory challenge or civil action, should be anticipated. In addition to promoting social distancing through physical strategies such as

applying floor markers, rerouting foot traffic, and/or removing or relocating displays, a robust occupancy monitoring system is needed – one that considers the revenue and customer service potential of the facility balanced with the safety of the people inside a facility. An in-facility sensor-based occupancy monitoring system such as iViu's CAPs provides the most robust and reliable occupancy monitoring information to help a facility manage and achieve its occupancy and social distancing goals.

iViu CAPs System Overview

CAPs relies on sensors that are about the size of a deck of cards that collect anonymous Wi-Fi data to determine the occupancy of user-defined zones within a facility. An overview of CAPs is shown at Figure 1.

iViu engineers have taken the company's patented location detection technology and algorithms, layered in alert components and a user interface to detect overcrowded areas within a facility based on site- and zone-specific parameters. Visitor data collected by CAPs is anonymized and encrypted, and never identifies specific individuals.

The system collects capacity counts by location and zone, and provides alerts based on three user-configurable thresholds:

- Warning: Approaching capacity
- Caution: High occupancy
- Breach: Over capacity

When an alert comes in, facility staff can visit the alert zone to see what's causing people to congregate there. In zones with limited capacity, such as the bank or customer service desk, people waiting for service may be driving up zone occupancy. Temporary floor displays or a large stocking cart may be partially blocking an aisle, so people are waiting to pass. More registers could can be opened if the checkout zone is getting crowded. Worse case, facility staff can limit the number of people allowed in a zone or close it altogether if social distancing cannot be maintained.

CAPs provides facility operators with the opportunity to understand zone and total occupancy issues, try out improvements, and measure the results of those improvements. CAPs also provides an ongoing ability to identify "hidden" zone and total occupancy issues that can arise after the obvious issues have been addressed.

In short, CAPS provides facility operators with the intelligence they need to implement a continuous improvement process with respect to facility occupancy and social distancing. Robust reporting not only provides facility management with an audit trail of how the facility is performing against social distancing goals, but also useful insights into social distancing trends and feedback on management's efforts to improve traffic flow and social distancing.
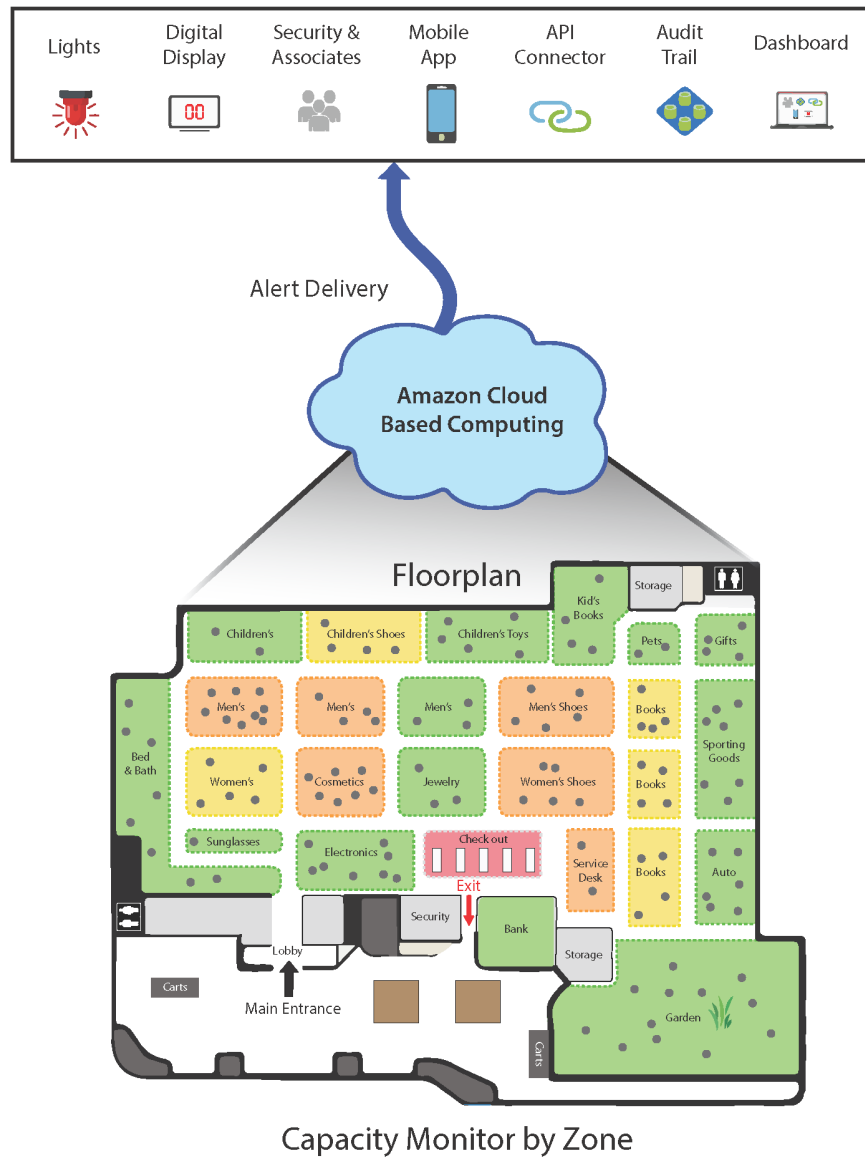
Figure 1 - Capacity Alert & Prevention System (CAPs) Overview

Case Study: Big-Box Retail Store

iViu Technologies piloted CAPs at one location of a popular U.S. "big box" retailer in April 2020. In one day, CAPs uncovered 49 Warning occupancy alerts, 28 Caution alerts, and 15 Capacity Breaches.

Had the CAPs system been operating in the store in real-time, CAPs alerts would have provided opportunities for store personnel to take action to relieve congestion in alerting zones, as suggested below. Store personnel could then have monitored the effectiveness of actions taken and chosen additional measures if occupancy guidelines continued to be exceeded in the affected zones.

Examples of real-time CAPs alerts are shown in Figure 2. These alerts are accessible via an API, so they can be delivered to a computer dashboard stationed at a Security or Service desk, delivered to mobile devices by in-store personnel, and logged in corporate/back-office systems.

Figure 2 -Sample CAPs Real-Time Zone Alerts

Occupancy alerts for selected zones are shown in Figure 3. This information shows that actions need to be taken to improve social distancing compliance within the Bank, Checkout, Cosmetics and Service Desk zones. Existing social distancing practices in the Entrance and Garden zones seem to be working, so while store management should continue to monitor these zones, corrective action does not appear to be needed.
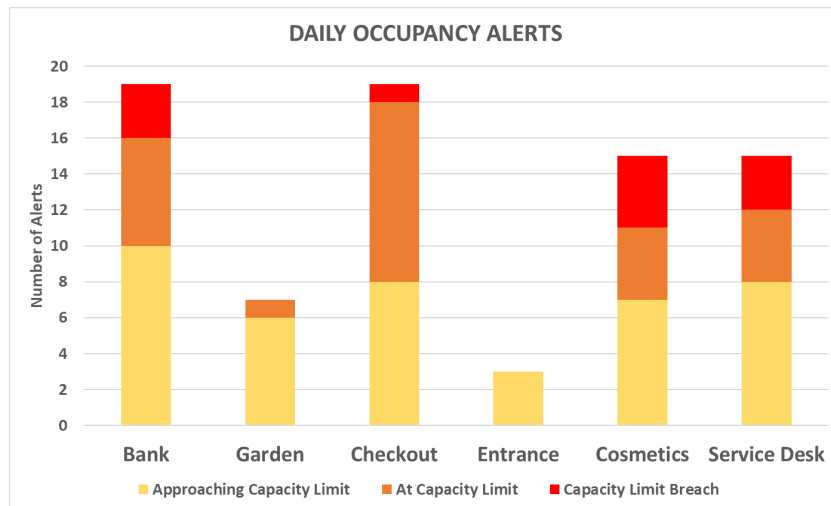

Figure 3 - CAPs Occupancy Alerts by Zone

The average duration of occupancy alerts by zone are shown in Figure 4. While overall capacity Breaches during this pilot averaged just under seven minutes' duration, average Breach duration varied widely by zone and was an unacceptable 18.3 minutes at the Service Desk. Breach duration is affected by a number of factors including what a patron is trying to accomplish within a zone and zone attributes such as the type of inventory, cluttered or dead-end aisles, limited patron service capacity, and the presence of self-serve stations. Solutions to reducing alert duration will also vary by zone.
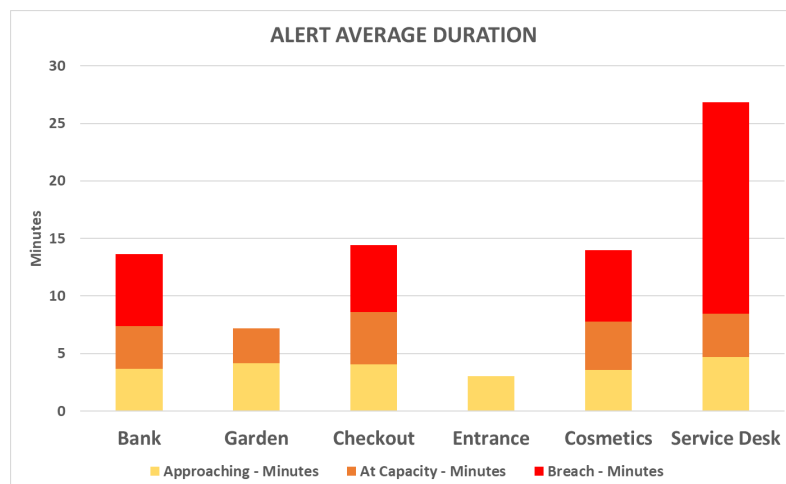

Figure 4 - Average Duration of CAPs Alerts by Zone

Here are a few examples of actions store management are planning to take to improve social distancing by zone.

Checkout

The Checkout zone is an area within the store where capacity is physically limited: transactions take place at a fixed number of registers, which can be opened or closed depending on customer demand. One Breach alert and ten Caution alerts were logged at Checkout during the monitoring period, with an average duration of 5.9 minutes. While store management seems to be doing a good job of averting Capacity Breaches in this zone, to reduce occupancy alerts and alert duration in the Checkout zone, beyond putting social distancing stickers for the checkout waiting line on the floor, the store will evaluate:

- Opening or building additional cashier-staffed and/or self-checkout stations to accommodate fluctuating demand
- Using mobile checkout to reduce the number of patrons requiring in-person checkout
- Limiting in-person checkout to bulky or items without attached barcodes
- Emphasizing online ordering and curbside pickup to reduce in-store checkout demand.

Bank and Service Desk

The Bank and Service Desk are also zones where service capacity is physically limited, with a smaller number of stations than the Checkout zone. Together, these two zones generated a 10 Caution and 6 Breach alerts, and the longest average Breach durations: 6.3 minutes at the Bank and 18.3 minutes at the Service Desk.

To reduce occupancy alerts and alert duration in the Bank and Service Desk zones, the store will evaluate:
- Putting up a digital sign with red/green indicators based on real-time occupancy to tell patrons when they can safely enter the zone or even a simple light fixture that will notify patrons of the state of the zone
- Evaluating service time by type of transaction, and then exploring ways to shorten the time to complete the longest types of transactions
- Issuing numbered tickets or mobile check-in, then calling patrons by number from a waiting area outside the Bank or Service Desk zones
- Assigning a security guard to admit patrons when a service station becomes available
- Promoting and rewarding the use of online or mobile banking services and the store's website instead of in-person services
- Installing banking and customer service kiosks outside of the Bank and Service Desk zones to provide self-service options.

Cosmetics

The Cosmetics section, along with Jewelry, Womens' Accessories, and some types of sporting gear such as fishing lures, present social distancing challenges because these zones house a large number of small, similar items stocked close together. Dwell time is increased as customers browse the

shelves to find the product they are looking for, and then choose between items such as colors of lipstick or nail polish. Many of these zones were designed to promote longer dwell times with the expectation that longer dwell times correlate to more sales. Cosmetics generated 4 Breach alerts during the measurement period, with an average Breach alert duration of 6.2 minutes.

To reduce occupancy alerts and alert duration in the Cosmetics zone, the store will evaluate:

- Reorganizing inventory and/or improving signage to reduce the time customers spend searching for a particular item
- Evaluating sales trends for the zone, determining the most and least popular items, and considering moving those items either to another aisle, a separate display, an end cap, or stand-alone display outside of or bordering the zone
- Reducing inventory in the zone by removing or relocating seasonal items that are currently out of season
- Removing or relocating promotional displays and/or services that cause customers to lengthen their dwell time in the zone
- Stationing a staff member in the zone to help customers find what they are looking for
- Worst case, segregating the zone and limiting the number of zone patrons using any of the methods outlined above.

This CAPs pilot provided the retailer with empirical data on occupancy by zone within their store, which will allow store management and corporate leadership to make data-informed decisions that improve the store's ability to provide a safe environment for their staff and patrons through social distancing. CAPs is a flexible system: zone occupancy targets are easily updated as the store trials different floor/display configurations, moves inventory around, and/or changes entrance/exit or other foot traffic patterns. Store management can finally know not only how many people are in their facility, but also where they are and how long they stay there – and then use this information to identify zone occupancy challenges and take meaningful, auditable actions to improve social distancing in their store.

Conclusion

Reopening the world for business, school, and government services is a priority for addressing the economic damage, educational disruptions, and backlog of government and private services that COVID-19 related shutdowns and stay-at-home orders have created. But re-opening must be done in ways that allow both employees and visitors to public spaces to feel safe and prevent additional spread of the disease.

iViu's Capacity Alert and Prevention System – CAPs – provides a new way for businesses, offices, government facilities, and public spaces to manage physical space occupancy and workforce deployment to better balance safety and revenue generation in a pandemic/post-pandemic age. CAPs provides retailers and other facility operators with the information tools they need to create a post-COVID "smart normal" that allows them to shift from thinking about safety/survival to generating "safe" revenue and providing a positive customer service experience.

CAPs' configurable occupancy alerts tailored to a facility's unique layout and foot traffic patterns can provide meaningful insights into the effectiveness of a facility's social distancing strategy, prove to

regulators or other interested parties that the facility is taking reasonable action to maintain social distancing, and provide audit logs in the event social distancing-related enforcement actions or lawsuits are threatened or taken.

CAPs can also be deployed in pubic spaces to identify potential crowd-control situations as they emerge – such as a group congregating in a little-used area of a city after normal operating hours – to alert officials to a public security issue that may be arising.

In the end, the biggest benefit to retailers from CAPs is business intelligence and marketing research based on in-store visitor tracking. CAPs provides "Google Analytics-like" data for brick and mortar businesses including how many people move through the store, their most common paths and dwell points, how many people entering the store make a purchase or simply leave, and more. This business intelligence can help retailers market to visitors more effectively to raise store visitor conversion rates. iViu's deployments of in-store visitor intelligence demonstrate strong return on investment (ROI).

By combining a robust tool for social distancing with a market-proven in-store visitor business intelligence platform, CAPs provides facility operators and retailers with the tools they need to ensure a safe experience for their visitors and improve performance against the organization's sales and service performance goals.

About iViu Technologies

iViu Technologies has been a leading developer of indoor positioning technologies since 2013, focusing on scalable and real-time positioning solutions. Over 1,200 retail locations around the world rely on iViu's SaaS services in their most critical decision-making processes. By leveraging our knowledge of indoor positioning, we've built a platform for indoor analytics that is easy to deploy, very accurate, and most importantly, real-time.

iViu's solutions are GDPR and CCPA compliant, which means that they incorporate the highest standards for protecting privacy of staff and guests. The CAPs system only detects mobile device presence and movement, and then reports on real-time occupancy levels. No personally identifiable information is collected or reported.

iViu's Capacity Alert & Prevention System is a patent-pending platform that monitors zone occupancy and alerts based on configurable thresholds.

iViu's CAPs and iDPlatform are powered by AWS. Both systems use the same patented Wi-Fi sensors called iDTags and 3rd party devices to detect and collect anonymous data.

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