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## How Technologies Help Reinforce Workplace Safety In The Post-COVID World

Whitepaper | Aug 2021

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## <u>Abs</u>tract

Following the decline of COVID-19 cases, many businesses have reopened and are operating in full swing. Though we handled the pandemic to the best of our abilities, it still poses a threat, and we have to ensure we are not brought to a standstill by another disease outbreak. However, only a few enterprises have invested in workplace safety measures other than masks, sanitizers, and social distancing protocols—and incorporated technologies into their buildings. The right use of technology can ensure safe workspaces, monitor occupants, and keep the possibilities of infections in check.

This whitepaper outlines how technology can help keep buildings and their occupants safe from COVID-19 and other diseases in the future.

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## New Normal: The Change in Safety

COVID-19 has shown the world how unprepared we are against disease outbreaks, and the world is slowly adopting countermeasures. Businesses are concerned about the safety of their employees, workplaces, and business interests. Many businesses have been forced to go remote, and many operate with less workforce on-site. They have employed body temperature measurement devices and urged employees to wear masks and practice social distancing. And employees can only return to workplaces that are safe; a Morning Consult report says 56% of employees working remotely wants to return to the office as soon as it is safe.

Customers require the business establishments they visit to ensure no contaminants are present and that they are safe in the environment. But that is not practical with just sanitizing and social distancing protocols.





## How Technologies Help Reinforce Workplace Safety

#### Thermal Imaging

Elevated body temperature is one of the symptoms of many diseases including COVID-19, which if detected early can help isolate the infected individual and stop the disease from spreading. However, traditional thermometers are not feasible as they are inefficient and can lead to cross-contamination.

Thermal imaging offers an alternative that enables contactless body temperature measurement. Since all objects and animate bodies that are not in absolute 0° emit heat (infrared radiation), IR thermometers focus this radiation from a specific area onto a sensor that determines the temperature. Infrared or thermal imaging cameras use the same principle but have an array of sensors. Each sensor captures the IR radiation from a specific place and together forms a matrix of the target area, which is displayed as a color map according to the temperature.

IR thermometers are cost-efficient and can detect the temperature of a single target in less than a minute with  $\pm 0.5$ °F. While thermal imaging cameras cost a little higher, they can identify the temperatures of multiple targets and are ideal for high foot traffic establishments such as malls, hotels, airports, etc. This ensures safety while also maintaining the flow of the foot traffic.

Thermal imaging has been integrated with machine learning to add face recognition and face mask identification for access control. These devices can be programmed to allow only those with normal body temperature and are wearing a mask; in workplaces, face recognition can be used to provide access only to employees. Integrated into eyeglasses, Thermal imaging enables multi-target temperature screening of hundreds of people in under a minute.

#### Autonomous Disinfection (Disinfection Robots)

Disinfecting air, water, and surfaces neutralizes the microbes in the workplace and ensures a safe environment for its employees. However, it must be performed with utmost care for effectiveness; autonomous disinfection robots achieve this without human intervention. While efficiency between manual disinfection and robotic disinfection is comparable in a small area, robots are significantly more efficient in large areas.

- **1.** The manpower needed to cover a large area in a short time is high.
- **2.** Humans are prone to error, and in large areas, the chances of leaving a space untended are equally high.
- **3.** The individuals taking care of the disinfection routines, though equipped with personal protective equipment, are not completely out of the risk of contracting infections.

Disinfection robots, on the other hand, can disinfect workplaces precisely, faster, and safer. They start mapping the facility the moment they are deployed, and disinfection follows through the mapped course immediately after. The frequency of disinfection can also be customized according to the need of the hour.

Since the disinfection robot's algorithm ensures that it travels to all the locations and disinfects right, business owners can, without a doubt, assure workplace health and safety. The robots' functionalities are not limited to one type of disinfection. Many disinfection robots have liquid atomizers, UVC lighting, multi-target temperature measurement, navigation, and face recognition.





#### Air Quality Monitoring

From COVID-19 and chickenpox to the common cold, many diseases spread through the air. Further, pollutants such as ozone, carbon dioxide, carbon monoxide, volatile organic compounds, etc. pose severe threats to occupant health. Air quality monitoring systems help understand what the air inside workplaces contains to take preventive action. The myriad sensors in air quality monitors identify the components in the air and inform administrators whether the workplace is safe.

It should also be noted that air quality checking devices are built for various purposes, so it is crucial to understand the need before looking for quality options. Most air quality monitors classify vape, cigarette smoke, and identify particles as small as PM 2.5 (2.5  $\mu$ m), however, there are also systems that count every particle from 0.1  $\mu$ m - 10  $\mu$ m in real-time.

By integrating air quality monitoring with disinfection and purification systems, workplaces can ensure clean and safe air for every occupant. This also increases the efficiency and effectiveness of disinfection systems as periodic schedules can be overruled to disinfect every time contamination is detected.

### Ultraviolet (UVC) Disinfection

Ultraviolet light is electromagnetic radiation of wavelengths shorter than visible light ranging from 100 nm to 400 nm. UVC lighting (100-280 nm), one of the classifications of UV radiation, is termed germicidal for its ability to neutralize microbes and is one of the most effective disinfection methods. When microbes are exposed to UVC lighting, the radiation penetrates their outer layers and damages the DNA leaving them incapable of performing functions necessary to survive. However, the duration required to disinfect various types of microbes differs according to their structure.

Studies report that UVC lighting neutralized 99.7% of the coronavirus on surfaces in 30 seconds, total inactivation in water in 9 minutes, and 99.9% inactivation of airborne virus in 25 minutes.

While UVC lighting at 254 nm (most common in UV lamps) may cause harm to human skin and eyes, far-UVC, at 222 nm, is reported to be completely safe for humans. But many researchers claim that there is not enough evidence to guarantee safety; it may take a few years before far-UVC receives wide acceptance. So, practice caution when using UVC lighting for disinfection; it is ideal to use when there aren't any occupants in the space. One exception to this would be disinfecting the air. Overhead UVC lamps that are placed above occupants' reach disinfect the circulating air safely. Equipping high-dosage UVC lamps in air conditioning units and ventilation systems are also reliable ways to neutralize airborne microbes.

UV disinfection also has unique merits. Since liquids are not used, UVC lighting is ideal for disinfecting electronics. With growing concerns over microbes developing disinfectant resistance, UV technology is expected to remain a reliable way to neutralize microbes and reinforce workplace safety.





#### Digital Contact Tracing

Digital contact tracing mitigates the risks of a disease outbreak. While measures to disinfect workplaces and identify infected individuals reinforce safety, many diseases do not show symptoms immediately. This implies that by the time someone is identified with an infection, it has at least been a **couple of days** since the person was infected. Although two days isn't a lot, the infection could have spread to other people and set off a transmission chain resulting in an outbreak.

Contact tracing involves questioning infected individuals to identify everyone they have contacted to diagnose for infection. However, this relies on the infected person's memory and is not reliable. Digital contact tracing helps businesses identify the people the infection could have transmitted to accurately. Done right, digital contact tracing can prevent disease outbreaks and help save lives.

#### Type 1: Mobile Application

Contact tracing mobile applications continuously scan their surrounding using Bluetooth for other mobile phones. When in proximity, the devices share their anonymous ID codes and keep track of the time they remain connected. With signal strength, the app also guesses the distance between the devices.

Infected individuals can notify other phones they have been close to and warn them about potential exposure. The app also notifies the owner if it identifies the device has been in the proximity of flagged devices for a set time.

#### Type 2: In-Office Tracking

This digital contact tracing method is ideal for office spaces and other similar establishments. It involves installing a network of sensors in the facility and providing employees a unique badge that the sensors continuously track.

The sensors also provide a live relay of the movement of badges in the facility map with desk-level accuracy, providing insights into room-level occupancy, crowding, and social distancing.

This method overcomes the limitations of mobile application tracking and increases the potential of preventive methods. In addition to monitoring occupant proximity to isolate exposed individuals, the accuracy of badge movements in the facility map provides a heatmap to understand the places (hallways, conference rooms, cafeteria, washrooms, etc.) the carrier has been to. The administrators can use this information to seal off spaces and prioritize disinfection.



### IoT Solutions

The Internet of Things (IoT) is a network of physical objects or devices that are connected over the internet to share information. It often involves a sensor network to gather non-computerized information such as occupancy, crowding, movement, daylight levels, etc. For instance, digital contact tracing (in-office tracking) uses IoT to gather and transmit information on how employees interact with the facility and with each other.

IoT connects all the devices and technologies in the facility to create a safety management system and improve infection prevention and control. When air quality monitors, autonomous robots, thermal imaging systems, contact tracing, and UVC lighting are enabled to exchange information, disinfection can be highly optimized. Here are some use cases of how it improves workplace safety:

- 1. When the sensor network in the building identifies zero occupancy, UVC lighting or robotic disinfection can be carried out based on availability for safe workplace disinfection.
- 2. Automatically disinfect spaces where individuals with elevated temperatures are detected.
- 3. Execute UV air disinfection when the air quality monitor identifies contaminants.
- **4.** The sensor network in the workplace, since it monitors every occupant, can also inform about the facility usage patterns, high foot traffic routes, and least used spaces at various times of the day to regulate facility usage in a way that restricts crowding and streamline disinfection.



#### The Dire Need for Workplace Safety

The loss we all experienced in this short time is here to stay, and the threat of another outbreak will linger for a long time. This can make a paradigm shift in how people view safety and take protective measures.

A business without safe spaces is unwelcoming to customers; the threat of contracting a disease and transmitting it to their loved ones back home is far greater. Moreover, no enterprise can afford to lose its employees, for a CAP study suggests that replacement costs

- 1. 16% of the annual salary for employees salaried \$30,000 or less
- 2. 20% of the annual salary for employees salaried \$75,000 or less
- 3. up to 213% of the annual salary for top executive roles

And workplace safety is one of the reasons that can push employees to quit. If that's not the case, lost time due to injury/illness hurts the business's productivity and finances. According to Circadian, unscheduled absenteeism costs \$2,660 per year for each salaried employee. Integrating safety technologies and systems can be of great assistance to ensure safety in your workplaces, gain customers' trust, increase employee morale, and propel growth.

A health & safety project for the reopening of Atlanta Ice House, a premium ice rink, coupled disinfection with air quality monitoring to ensure the safety of its patrons and is witnessing great results. **Case study** 



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