COVID-19

Reimagining Life in a Post-Pandemic World

A Smart Cities and Transportation Technology Response Guide
COVID-19 is a transformative event that requires a very fast response from officials at all levels of government. Our first priority is saving lives and protecting livelihoods. But if history is any guide, cities are going to continue to grow because that’s where the opportunities are.

Rob Lloyd
CIO, San Jose

“The COVID-19 pandemic has catalyzed ingenuity around the globe to ensure our cities are safer and more secure. While we have all faced enormous challenges in fighting this pandemic, there is an extraordinary opportunity to accelerate technology to enable resilient societal value and better prepare for future crises.”

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TABLE OF CONTENTS

EXECUTIVE SUMMARY 5
COVID-19: A TECHNOLOGY BASED RESPONSE 6
COVID-19 OVERVIEW 7
SMART CITIES & SMART TRANSPORTATION 17
TRANSFORMATIVE TECHNOLOGIES 22
SOLUTIONS THAT CAN MAKE AN IMPACT 28
   PUBLIC SAFETY 30
   TRANSPORTATION 32
   SUSTAINABILITY 34
   HEALTHCARE 36
   EDUCATION 40
INTEL CONTACTS 43

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The COVID-19 pandemic is an evolving situation.

All information included here was accurate as of the date of publication.
EXECUTIVE SUMMARY

The global COVID-19 pandemic has temporarily separated human beings from each other as we collectively work to slow the spread of a potentially deadly virus. But the pandemic has also united humanity on a planetary scale. For the first time in history, a majority of people on planet Earth are experiencing a common set of challenges, simultaneously. We are all in this together, doing our best to combat the disease.

The pandemic has instituted a “new normal” for humanity. Indeed, according to experts, some aspects of this new normal—both increased caution as well as a new willingness to embrace remote connections with other people—may last for some time to come, perhaps even for years.

Approaches such as social distancing are not a cure for the disease. They are strategies to slow the spread and “flatten the curve” so our healthcare system and other emergency response institutions are not overwhelmed. In the meantime, medical experts across the globe—in universities, research labs and corporations—race towards the development of a vaccine or a therapeutic regimen to treat the virus.

We believe that technology will also play a role, short-term and long-term, in mitigating the impact of COVID-19 and helping us manage the new normal. Use cases from fever checks, contact tracing, contactless retail and delivery robots can help slow the spread of the disease. Public safety technology can keep our streets and neighborhoods safe. PPE compliance technology, medical delivery robots, and remote diagnostic capabilities can help keep our healthcare workers on the frontline of the pandemic safer.

This eBook is intended to provide context for this experience, and to showcase a selection of solutions that exist today and can possibly be used to help save lives and protect livelihoods.

We hope that officials of city, county, and state governments, in particular, will find this eBook useful in developing pragmatic solutions to manage life in a post pandemic “new normal.”
COVID-19: A TECHNOLOGY BASED RESPONSE

A DAY IN THE LIFE
Amelia, a New York City doctor, goes about her life in the city. Her day to day interactions showcase how technology can support the lives and livelihoods of the people in her community in a post COVID-19 world.

TRAVEL TO WORK
- Infrared Fever Detection
- Contact Tracing
- People, Behavior and Crowd Analytics
- Contactless Fare Collection
- Multimodal Transport
- Disinfecting Robotics

AT HOME - MORNING
- Remote Education
- Virtual Fitness Class
- Health Wearables

AT HOSPITAL
- Computer Vision PPE Compliance Check
- AI Medical Diagnostics
- Securing & Visualizing Patient Data
- Material Handling Robotics
- Disinfecting Robotics

ACQUIRE ESSENTIALS
- Chatbot Interactions
- Contactless Retail Payments
- Grocery Warehouse Robotics
- Food Delivery Robotics

AT HOME - EVENING
- Entertainment Streaming & Gaming Platforms
- Socializing Via Video Applications
- Work Remote
- Telemedicine
- E-Commerce
COVID-19 OVERVIEW

Introduction

The purpose of this eBook is to help foster and accelerate technology-enabled solutions to manage the impacts of the COVID-19 pandemic. The content will highlight the diverse challenges of the pandemic and specific innovative technology solutions. This resource represents a perspective at a point in time early in the response to COVID-19. Our understanding will evolve as we learn more about the disease itself and various mitigation strategies that arise.

The primary intended audience for this eBook includes federal, state, county and city public policymakers. Other potential audiences may include key stakeholders in healthcare, transportation and other public services.

The COVID-19 outbreak may accelerate city and transportation technology adoption trends that were already underway. AI, 5G, blockchain, analytics and virtualization offer tangible examples of emerging technologies—with IoT sensors as the linchpin—that are uniquely situated to combat the far-reaching impacts of the pandemic. Advances in these fields may also mitigate the impact of future outbreaks, as well as even potentially anticipate and help prevent them. Yet, in many cases, full recognition and active adoption of technology solutions requires socialization and communication of their impacts and benefits.
COVID-19 Requires Envisioning a “New Normal”

In late December, 2019, a global pandemic had its beginnings in the province of Wuhan, China, when a “novel” coronavirus initially called SARS-CoV-2 appeared in the region, presumably passed from bats to humans. The virus can cause a disease called COVID-19 with symptoms that include fever, dry cough and shortness of breath. COVID-19 can sometimes lead to severe and potentially fatal respiratory infections. Further, doctors have recently discovered that it also produces blood-clotting issues in some patients that can affect every major organ system in the body, including the kidneys, heart, intestines, liver and brain.¹

We have seen coronavirus-family epidemics before, but COVID-19 presents special challenges. Some people infected with the virus do not show symptoms immediately, and some people don’t show symptoms at all. This, along with widespread global mobility, helps to explain the rapid spread of the disease and its worldwide impact.

Most countries around the world are currently “locked-down” to some degree, either voluntarily or with government enforcement. How those societies “reopen” has been referred to as “the hammer and the dance,” taken from the title of an essay by San Francisco engineer and writer Tomas Pueyo.² After infections and deaths have been in decline for a period of time (usually two weeks or more), governments lift the “hammer” of social-distancing and citizens return in some limited way to the “dance floor.” If illness spikes again, the dance floor closes and the cycle starts again. If illness continues to decline, more citizens join the dance.

No one knows how long the cycle of “hammer and dance” will go on. Donald G. McNeil Jr., a science and health reporter for the New York Times who specializes in plagues and pestilences, points out that the fastest vaccine development, for Mumps in the 1950s, took four years. Today, technologies like AI can speed up some parts of the research and development, and opinions differ on how long our absence from the “dance floor” could last.

But McNeil’s vision of the future is still one of hope. “If you look at the periods after the two World Wars, our economies came back. After the one-two punch of World War One and the Spanish Influenza, we had the Roaring 20s. After World War Two…people in the U.S. had this sense of having gone through an incredible period of hardship together…and they expected more of themselves because of that. They wanted the GI Bill, federally sponsored mortgages, better healthcare. And to some extent they got all that. A similar era of societal improvement could emerge from this.”³

Governor Andrew Cuomo of New York expressed similar optimism during his regular coronavirus updates, using an analogy to the repair of the L-train tunnel connecting Manhattan to Brooklyn. The tunnel was in serious disrepair, and the Metropolitan Transit Authority proposed closing it completely for 12-18 months. However, 400,000 people depend on that train every weekday. Shutting it down would represent a huge disruption. When engineers from

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¹ “A Mysterious Blood-Clotting Complication Is Killing Coronavirus Patients”
² “Coronavirus: The Hammer and the Dance”
³ “The Next Year (or Two) of the Pandemic”
Cornell and Columbia universities proposed a way to repair the tunnel that would require closing it only on evenings and weekends, the Governor faced an explosion of negative reaction. “People said I didn’t have an engineering degree, that these new experts were from outside the city bureaucracy, that they didn’t understand how the subway system worked,” Cuomo said during one of his televised coronavirus updates. “And yet we closed the L-train only partially, for less than 12 months, did the job under budget, and are reopening the train completely today on April 26. We always have to question why we do things the way we do. Is there another way to re-imagine them? If you don’t run the risks of change, you don’t have the benefit of advancement. If you don’t change, you don’t grow.”

“When we reopen after COVID-19,” the Governor concluded, “we’re determined to be better for it. Reopening our society means reimagining our lives. We’re going to improve. ... There is no return to yesterday in life. It’s about moving forward, taking your experience, what you learned, and bringing it to a positive effect.”

Today, the most densely populated cities are ground zero for viral spread and high death tolls. The combination of urbanization and a hyper-connected global society means that infectious disease epidemics are likely to become increasingly common. And yet increasing numbers of people continue to move to cities, and thus most of our future opportunities will be bound by urban reality.

For these reasons, technical innovation becomes essential to achieving resilience in modern city life. We fully expect the COVID-19 outbreak to accelerate the adoption of emerging and convergent technologies that were already moving into deployment and use in cities. We hope and expect that these technologies will help cities save both lives and livelihoods in “the new normal.”

National Responses Have Differed

The social and economic impacts of COVID-19 have been profound across the entire world, but immediate responses to the pandemic have differed significantly across nations. The Chinese government began aggressive testing, contact tracing, and sequestering its infected population soon after the emergence of SARS-CoV-2. They had the virus under control within four months. The city-state of Singapore achieved similar results with “old-fashioned detective work,” according to Prime Minister Lee Hsien Loong in an interview with journalist Fareed Zakaria. Mr. Lee maintains that Singapore’s rapid response owed much to advance preparation. “We’ve been preparing for this since SARS, which was 17 years ago.”

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4 “New York Governor Andrew Cuomo Holds Coronavirus Briefing”

5 On GPS: What the U.S. can learn from Singapore on Covid
THE NEW MEGACITIES OF THE WORLD

Megacities are defined as metropolitan districts with over 10 million inhabitants.

Many of the newer urban areas, located in LATIN AMERICA, ASIA AND AFRICA have an entirely different look, feel, and outlook than their older European or North American counterparts.

Currently there are 33 MEGACITIES around the world, with 6 more expected by 2030.

CHICAGO will be the United States next megacity.

Dense urban areas have a much SMALLER ECOLOGICAL FOOTPRINT PER CAPITA than more suburban or rural areas.

JAPAN is the only country whose megacities will experience a decline in population size.
South Korea’s “Smart City Data Hub” allowed epidemiological investigators to request, obtain, and confirm data about coronavirus cases and people they have come into contact with through a single platform. Germany has had a rate of infection comparable to other western European countries, but with death rates far below those of France, Italy and Spain. The difference seems to be Germany’s aggressive testing of its population from the outset. In the United States, New York State alone has had more confirmed cases than any nation outside America, even as the implications of the pandemic are continuing to play out nationwide.

The economic impact on the U.S. has also been severe. For example, the Congressional Budget Office’s revised Q2 2020 forecast projects:

- Gross Domestic Product will decline by more than 7%
- The U.S. unemployment rate will exceed 10%
- Interest rates on 10-year Treasury notes will fall below 1 percent

Further, some analysts suggest that the next CBO forecast will include a deeper U.S. recession with even higher unemployment.

Social Responses and Distancing Are Not a Cure for the Pandemic

Maintaining “social distance,” wearing face-masks in public, thoroughly washing one’s hands, and disinfecting objects brought into the house are the primary means of “flattening the curve” of the disease. This helps to avoid sharp spikes in infections that can harm our healthcare systems’ chances of saving lives. But social distancing is not a cure for COVID-19.

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6 How South Korea’s smart city startups curbed the spread of COVID-19
7 Why is Covid-19 death rate so low in Germany?
8 New York state now has more coronavirus cases than any country outside the US
We all want to believe that isolating ourselves and practicing good hygiene will allow normal life to return in eight or twelve weeks. But Dr. Anthony Fauci, Director of the National Institute of Allergy and Infectious Diseases, told the New York Times podcast The Daily, “Even if we can mitigate down to the lowest possible number of deaths...this isn’t something that’s just going to go away... As long as there’s virus circulating in the world, there will be a threat of a resurgence if we’re not properly prepared.”

Whenever people finally go back to work worldwide, the virus will still be “at large.” It will continue to circumnavigate the globe, possibly slowing down in our summer but speeding up in the Southern Hemisphere’s winter. A second wave of the coronavirus is expected to hit the United States next winter and could “actually be even more difficult than the one we just went through,” said Robert Redfield, the director of the Centers for Disease Control and Prevention. “We’re going to have the flu epidemic and the coronavirus epidemic at the same time,” he said, and that combination would put even greater strain on the nation’s healthcare system than the first outbreak.

As Singapore’s Prime Minister put it, “There are other huge parts of the world where we don’t quite know what is happening...but I think that it will happen in India, it will happen in Southeast Asia, it will happen in Africa and Latin America. By the time it goes around the world and finally runs its course, that’s several years... The only visible...off-ramp is either a treatment or an effective vaccine, and that’s some distance down the road.”

A treatment in the form of mitigating drugs is expected to appear soonest, and more than 100 compounds are being tested. But this process takes time, and an effective vaccine is expected to take even longer, despite recent positive developments at Oxford University, Moderna and CanSino Biologics on a vaccine, and at Gilead Sciences on their experimental COVID-19 drug “Remdesivir.” Most specialists predict that development of a vaccine will require at least 12-18 months of discovery and testing, after which it must be produced and administered to the populations of the world.

Even if we can mitigate down to the lowest possible number of deaths... this isn’t something that’s just going to go away... As long as there’s virus circulating in the world, there will be a threat of a resurgence if we’re not properly prepared.

Dr. Anthony Fauci
Director of the National Institute of Allergy and Infectious Diseases

In the meantime, national and state entities are adopting policies ranging from delivering healthcare resources to victims, to income-substitution for unemployed citizens, PPE to protect essential workers, and financial aid for corporations. All these responses are necessary, but they are merely a reaction to the most obvious needs.

Understanding the Life Cycle of a Pandemic

In life, it is natural to adapt to changes in the environment, and humans are complex organisms capable of sensing and responding to many changing factors. Anyone feeling the bitter cold of winter will put on more clothing or seek out other sources of warmth. Just as humans evolve in an endless reciprocal cycle within their environment, so too must cities and societies seek to use innovation and technology to do the same. This is particularly true when faced with global challenges like COVID-19.
SOCIAL DISTANCING & THE FACTS

Social distancing measures can play a critical role in controlling the spread of pandemics, but only if carried out properly.

Scientists measure the intensity of an infectious disease by its reproduction number ($R_0$). The average number of people a sick person will infect is denoted by $R_0$.

**COVID-19**

$R_0 = 2.5$

*Source: ISGlobal*

**REDUcing SOCIAL EXPOSURE BY 75%**

<table>
<thead>
<tr>
<th>Day</th>
<th>Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>1 person infected</td>
</tr>
<tr>
<td>Day 5</td>
<td>0.625 people infected</td>
</tr>
<tr>
<td>Day 30</td>
<td>2.5 people infected</td>
</tr>
</tbody>
</table>

**REDUcing SOCIAL EXPOSURE BY 50%**

<table>
<thead>
<tr>
<th>Day</th>
<th>Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>1 person infected</td>
</tr>
<tr>
<td>Day 5</td>
<td>1.25 people infected</td>
</tr>
<tr>
<td>Day 30</td>
<td>15 people infected</td>
</tr>
</tbody>
</table>

**NO SOCIAL DISTANCING MEASURES IN PLACE**

<table>
<thead>
<tr>
<th>Day</th>
<th>Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>1 person infected</td>
</tr>
<tr>
<td>Day 5</td>
<td>2.5 people infected</td>
</tr>
<tr>
<td>Day 30</td>
<td>406 people infected</td>
</tr>
</tbody>
</table>

*Source: Singer Laboratory, University of Massachusetts Amherst*
Pandemics, like their human hosts, evolve through a progressive series of cycles. Societies, governments, and communities must strive to continually sense the changes in the pandemic environment and adapt accordingly. One essential tool is an understanding of a pandemic’s life cycle, which can be visualized as:

- Ramp (of the virus / infections)
- Recovery
- Resilience
- Recede

### The “New Normal”

**Smart Spaces**

We spend 90% of our time indoors.\(^{14}\) In order to enhance peoples’ safety in shared spaces—offices, indoor shopping centers, theaters, stadiums, schools and universities—we need systems in place to protect people from infectious disease. Shared spaces are communal environments, and as such the safety of the environment depends on every person inside. Even one infected person can infect many others without proper precautions. Common sense guidelines are already being implemented: staying home if you feel ill, washing your hands regularly, not touching your face, covering your mouth when you cough, wearing a facemask, maintaining social distancing. Technology-based options also exist, such as reprogramming escalators and elevators to encourage one-way traffic and prevent masses of people from gathering. Indoor spaces can be made safer by improving air ventilation and filtering to control microbes and mold in the air. In addition to these approaches, it is critical to consider high-tech Internet of Things-based solutions that are available as valuable tools to prevent sick people from entering a building, maintaining the appropriate social practices inside the space, facilitating contactless interactions while in the space, and relying upon robotics to maintain a sanitized environment.

\(^{14}\) EPA: Indoor Air Quality
Public Transit and Commuting
At least at first, commuters are likely to view personal cars as safer than public transit or shared options like e-scooters and ride-hailing. Will a return to shared transportation develop over time? As of late March, 2020, China’s transit trips had barely hit 50% of normal traffic, while auto traffic had already ramped back up to 90+. There could be a fairly long lag before people are comfortable getting on a crowded train or a packed bus at rush hour, which creates a tailwind not only for personal vehicle trips but also personally owned bikes and scooters.

Airports
Air travel, especially internationally, was a factor in the spread of COVID-19, so we should expect long-term impact on this industry. Temperature checks and other health screenings will likely become more common. Enforcing social distancing will continue for some time in places that are usually packed with people. Non-aggressive methods include painted lines on floors or rope lines to remind people to give each other space.

Urban Infrastructure Changes
How we shop, eat and gather will change dramatically. People will be eager to be out and about when the pandemic eases, but they’ll pay closer attention to crowds in stores and the hygiene of restaurants. The benefits of social distancing may lead to widening sidewalks and closing some city streets to let people maintain healthy space from others. While some of these changes will be temporary, the general desire to lessen social density will be lasting.

Remote Work
This prolonged period of working from home is expected to accelerate the corporate world’s acceptance of remote work as a more permanent part of workplace culture. In this new normal environment, some employees won’t necessarily need to live within commuting distance of a company’s headquarters or regional office location. Thus, remote work may help to disperse the work force away from densely populated city centers. Additionally, it may help reduce commuting-related pollution and the public health risks associated with crowded cities. However, population movement won’t happen overnight.

Digital City Services
With many municipal offices closed and staff working remotely, most cities have been forced to deliver more citizen services digitally. Some city governments are holding meetings virtually. They may find that there are certain efficiencies to continuing to work this way. At the very least, they will be more prepared to do so in the future.

Because we’d been through SARS and MERS, we all understood that pandemics could occur. But when it actually happens, it all comes down to training. Have you practiced enough so that all the agencies can work together?

Retired Major General Joe Logan
Former Director Emergency Response Management
State of Hawaii

15 “COVID-19 and Passenger Airline Travel” (Congressional Research Service PDF)
COVID-19: SMART SPACES
A TECHNOLOGY-BASED RESPONSE

As we begin to transition from working remotely to life back in the office, implementing technology-based solutions can offer workers the reassurance they need as they enter work buildings, collaborate with co-workers, socialize, and navigate their work life in this new normal. These technology solutions would be equally applicable to other venues such as indoor malls, stadiums, and airports.

BREAKS & SOCIALIZING
- Contactless Payment
- Digital Ordering (Snacks/Lunch)
- Voice-Enabled Coffee Makers
- Contactless Vending Machines

COMFORT & CLEANLINESS
- Fresh Air Circulation & Quality Monitoring
- Ambient Temperature Control
- UV & Disinfecting Robotics
- Smart Trash Cans & Recycling Bins
- Touchless Hand Sanitizer Stations

WORKING & COLLABORATING
- Virtual Meetings
- E-Learning & Training
- Virtual Whiteboards

GETTING AROUND
- Touchless & On-Demand Elevators
- Automated Room Access
- People Counting & Spacing Analytics

ENTRY
- Keyless & Touchless Entry
- Face Mask Detection
- Fever Detection
- Contact Tracing
SMART CITIES & SMART TRANSPORTATION

Why Smart Cities and Smart Transportation Matter

COVID-19 may alter human society for the long term. Even after an effective vaccine has been developed and administered, we may not see a full return to everyday life as we knew it before. In such a context, talking about smart cities and transportation may seem a strange non sequitur. Why are we discussing "Internet of Things"-based systems enabled by embedded-computing devices, cloud networking, and artificial intelligence in the midst of what is essentially a public health pandemic?

The answer is simple: We believe smart technologies to be more relevant to humanity now than ever before in human history. Prior to the appearance of this coronavirus, smart city technology development was moving along at a decent clip, but in a pre-COVID-19 economic envelope. The unprecedented disruption of the pandemic has increased the urgency to protect ourselves from similar outbreaks. Today—and into the foreseeable future—city, state and federal entities will want commensurately more innovative tools to minimize new infections, manage contactless interactions, sanitize our environments, and prevent or cope with equivalent global events. Cities know that accelerating the pace and economic support of smart technologies will help them, even though they may lack the financial wherewithal to adopt them immediately.

“Rapid data sharing is the basis for public health action,” begins a World Health Organization editorial on the COVID-19 crisis.16 It would be difficult to find a public official who doesn’t agree with that assessment. “Data is suddenly on Maslow’s hierarchy of needs,” says Adam Beck, the head of the Smart Cities Council for Australia and New Zealand. “Cities with an extensive data culture and leadership, like Wellington, the capital of New Zealand, are way ahead in this crisis.”

In the U.S., San Jose, CA, is another one of those fortunate cities. “We always want more data,” says Rob Lloyd, San Jose’s Chief Information Officer, “but we’re fairly satisfied with what we have—except for COVID testing data, because the tests themselves are in short supply.” How does he envision the future of smart cities? “I don’t see movement toward cities stopping. History tells us that people come back to where the jobs are. But right now, our immediate focus is saving lives and protecting livelihoods.”

To respond to the needs of civic and business executives around the world, the Paris-based data-exchange provider Dawex has set up a COVID-19 data platform that will allow cities, corporations, healthcare entities and others to request and provide data sets related to the pandemic. They intend it to serve both urgent short-term needs and research over the long-term. “In the midst of this crisis, our purpose is to help organizations find each other and share data, not to make money,” said Didier Navez, Senior Vice President of Dawex, who noted that they are providing the platform on a pro bono basis and will not own any of the data that members share there.17

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16 WHO Editorials: Data sharing for novel coronavirus
17 Dawex: COVID-19 Data Exchange
PUBLIC HEALTH & WELLNESS ACTIVITIES WILL BE AT THE CORE OF THE CITY’S NEW NORMAL

**AIRPORTS**
Airport security agencies are likely to add health checks to their security screens. This will only be feasible with the use of touchless thermometers & other innovative medical devices.

**PORTS**
Increased investments in blockchain to empower traceability & transparency of supply chains.

**COMMERCE (RETAIL)**
The accelerated road to digital maturity will shift more retail business online.

**HEALTHCARE**
Telehealth will become the new normal for providing a broad range of healthcare services.

**BUILDINGS**
We spend 90% of our time in buildings. Automated air ventilations and filtration systems can help control microbes and mold in the air.

**PUBLIC TRANSIT & COMMUTE**
Those who can will opt for using their cars in fears of confined spaces.

**SCHOOLS**
Schools will make much greater use of online tools to communicate messages, send out paperless materials and incite collaboration amongst students & faculty in more contemporary forums.

**HOSPITALITY (HOTELS & RESTAURANTS)**
Intelligent agriculture supply chain and food distribution solutions could solve the challenge of shifting demand for farmers.
How Smart Cities Technologies Can Help

Smart cities are about people. The technology that enables them is essential, of course, but it is as invisible as our water, heating, and communication systems are today. The top three categories of use cases across the globe are:

- **Public safety.** People want to feel safe and be safe.
- **Mobility.** People and goods need to move easily and efficiently from one point to another.
- **Sustainability.** People want to ensure basics like clean air and water.

Of the technical realities that make all this possible, the smart city’s fundamental signature is the robust networking that joins citizens to each other and connects a galaxy of devices into the underlying, invisible “machinery” of modern urban life. With most people sheltering in place today, the load on communications infrastructure—for work as well as diverting entertainment—is under strain everywhere, whether or not systems have been updated. Many older neighborhoods in New York City, for example, are still not wired for fiber optic connections. This is a reminder that ongoing funding for communications infrastructure is a vital piece of what makes “smart cities” work.

Another piece of that puzzle is the need to adopt open-standards-based Internet of Things protocols and solutions. Cities that seek a “first mover advantage” by adopting proprietary solutions risk the long-term disadvantage of being locked into systems that don’t interoperate with others. The projected savings of adopting standards-based IoT solutions is estimated to be $341 billion by 2025.18

To date, connecting the physical systems within cities has largely been focused on simple remote diagnostics and basic tracking and location services. The financial return from “simple” applications, while valuable, is limited to a specific class of device such as toll machines within transportation systems.

The value of connectivity does not end with simple applications focused on a single class of devices such as street lighting or video surveillance cameras. As mature, open standards become the norm, applications based on deeper, peer-to-peer interactions between devices, systems and people will drive increasingly complex interactions. “Everything will talk to everything else” via ultra-fast, pervasive next-generation networking. This will open up new collaborative business model opportunities with much greater value for citizens as well as the potential to address real-world mitigation and management needs of the type we see in the COVID-19 pandemic.

Moving from “simple” to “compound” applications involves multiple collaborating systems. No longer is the focus solely on a supplier’s ability to deliver support for their product efficiently. Rather, value is brought to the customer through business process automation, systems optimization, and potentially via new business and service delivery models.

Creatively Collaborating Openly to Leverage Smart City Data and Systems

While many cities are beginning to modernize aging infrastructure, the embrace of new technologies to improve essential urban systems is a complex challenge. To truly qualify as a smart city, all data must be able to travel freely across systems, allowing information from disparate city operations to feed one another, increasing their overall value to citizens. Siloed data is the enemy of smart cities.

Although adoption patterns are not moving as fast as our real-world needs, city-wide platforms can help unify the physical infrastructure, back-office operations, and personnel of a city as well as speed up the time to market for relevant services to citizens. We see an increasing necessity for a new generation of open data platforms that can

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18 Smart Cities Could Waste $341 Billion by 2025 on Non-Standardized IoT Deployments
**SAN JOSE**

Rob Lloyd is the CIO of the city of San Jose, CA. Earlier in his life, he directed information technology services for Avondale, AZ and Ashland, OR, and was the CIO of Colorado Parks and Wildlife.

“Overarching everything is the fact that pandemics almost always start economic downturns, so as soon as we saw COVID-19 we put in hiring freezes and project freezes because we knew we'd have budgetary shortfalls. So you're approaching the state, county, city, and federal level at a moment when everybody is being forced to be remote, advanced, and strategic at a time when resources are declining rapidly.

“Smart city technology is relevant if it answers two questions: 1) How does it save money or staff so that you can do the same things in a simplified way. That's what almost all cities and counties are concerned with right now. 2) What is responsive to the community's needs in the moment? What do smart cities add in terms of how we're monitoring health and helping respond to the pandemic situation or emergency management overall?”

**HAWAII**

“In the 1990s to the mid-2000s in Hawaii we used to do pandemic exercises every other year with the National Guard and all the Fed and state agencies. So we felt pretty well prepared for something like this. But in the last 5 years, that training dropped off the map. There was no more funding for pandemics and similar emergencies.”

Retired Major General Joe Logan served for 41 years in the U.S. Army. He then went to work for the State of Hawaii, where he served as Adjutant General responsible for disaster response and emergency management. He also reported to the Governor on homeland security and cyber-security.

“The use cases for Hawaii are primarily about establishing and protecting our perimeter. The speed of technology is one of the things that's going to help us respond. We need to replace the human element in terms of surveying large populations.”

Andrew Lanning served more than 8 years in the U.S. Navy where he worked on missile and weapons systems. In the mid-1990s he started a company that provides physical and electronic security systems to the Department of Defense and to critical infrastructure for city and county governments.
integrate diverse device data and citizen interactions into a seamless set of services. Understanding the requirements for such platforms and their adoption is lagging, but the opportunity for a new generation of platforms to address many of the challenges of pandemics is substantial.

Smart City programs cannot be defined by a single “top down” approach or central organizing schema that sets preprogrammed limits. These programs will be defined by individual citizens who are motivated to collaborate with each other to create new use cases and applications that solve specific local problems. Smart cities will be places that foster creativity, where citizens are generators of ideas, services and solutions, rather than subservient and passive recipients of them.
TRANSFORMATIVE TECHNOLOGIES

How They Can Help Navigate the New Normal

The COVID-19 outbreak will accelerate technology trends that were already underway. AI, blockchain, analytics, and virtualization offer tangible examples of emerging technologies that are uniquely situated to combat the far-reaching and long-lasting impacts of COVID-19. Advances in these technologies may also mitigate the effects of future outbreaks, as well as potentially anticipating and helping to prevent them. Yet, in many cases, full recognition and active adoption of tech solutions requires education and communication of their impacts and benefits.

The current crisis illuminates the diverse roles that emerging technologies can play in the prevention and management of future pandemics.

Core Technologies

IoT

Earlier in this report we referred to Internet of Things sensors as the linchpin of the emerging technologies that humanity uses to combat the impacts of all public emergencies, including pandemics like COVID-19. However, IoT is much more than embedding sensing; it represents a vast digital ecosystem of interconnected devices and technologies that have been structured and designed to enable value from the underlying data across our world—from things to people and processes. Humble sensors are largely invisible to the human eye (your cell phone contains dozens of them) but they are the root of all big data. These tiny devices report on the physical world around—and increasingly inside—us, and their data are what is carried by networks to feed AI analytics. Twenty years ago it was known as “machine-to-machine communication.” Today it is the foundation of all major economies.
5G NETWORKING

Mobile technology is taking a significant leap forward. Fifth-generation networks (5G) are transforming the way we use wireless devices in extraordinary ways. With increased speeds, reliability, and the ability to connect billions of devices, 5G opens up the possibility of uses and applications that will enable the Smart Cities of the future.19

Combined with artificial intelligence (AI) and the Internet of Things (IoT), 5G will dramatically change the way citizens live, work, and get around in the city of the future—where 68% of humanity will live by 2050. Compared to 4G networks, 5G-transformed networks deliver 10X less latency, 50X more speed, and 1000X more capacity.20 Offering gigabit speeds and edge computing, 5G makes cities run smoother, safer, and smarter using real-time, data-backed insight to improve lives.

With 5G, Smart Cities achieve massive device connectivity, higher data rates, reduced latency, higher system capacity, energy savings, and cost reductions. It can enable wireless connectivity in unprecedented locations and enable IoT sensors to monitor everything from air quality to energy use, security, traffic patterns, and transportation.

5G is more than a cellular network that provides connectivity to this broad range of technology. It is the connective fabric tying it all together, and it will help citizens and cities move forward in the new normal by meeting the demand for virtual services (e.g. remote work; telemedicine; remote learning).21

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19 Intel 5G Economist
20 Cisco, Cisco VNI Forecast and Methodology, 2016-2021.
21 Ericsson, 5G will be the platform for tomorrow's smart cities
Cloud

What started out as a company’s “data servers” has been hugely multiplied and virtualized into “the cloud” where big data lives. But it’s still remote data storage, and it’s still maintained by private owners. Our networks are fast and about to get much faster, but the latency of the remote cloud will always exist, which means that the compute power of small devices at the “edge” is an increasingly important part of the future landscape. To support the delivery of cloud services and applications to end customers, innovations around multi-access edge computing will close the gap between developers and edge devices, eliminating the lag and increased latency created by a centralized cloud. Considering these shifting requirements, it is critical to create a configured end-to-end cloud environment to serve real-time applications at the edge as well as compute-intensive services in the cloud itself.

Artificial Intelligence & Analytics

An AI system was allegedly the first entity to spot the COVID-19 outbreak in Wuhan, China. About a month later, a different AI system discovered that a rheumatoid arthritis drug might dampen some of the most severe effects of the new virus. The economic impact of the current crisis will accelerate the trend toward data mining and analytics, and increase the demand for pandemic prediction technologies.

As AI matures, it has shown an increasing ability to draw reliable inferences from small data sets. AI is also playing a role in the search for treatment, diagnosis, and containment of COVID-19. It can help predict which mitigating drugs might be effective in treating the disease, and in isolating candidates for an effective vaccine. It is also used to analyze imaging and make diagnoses, and to predict which patients are likely to experience respiratory failure or sepsis.

One application of AI, machine learning (ML), can be used to train hospital systems and mobile applications to better predict the severity of COVID-19 in patients and the general citizenry. Hospitals and governments can use this information to better match patients with the appropriate medical treatment. Also, in the development of a vaccine and treatments, ML can aid researchers by forecasting infection rates and identifying antivirals that can treat symptoms in patients.

Other Technologies

Data Exchanges & Platforms

For years, the U.S. Department of Health and Human Services (HHS) has invested heavily in creating the infrastructure necessary to freely store, analyze, and exchange healthcare data at a massive scale. Some of these initiatives include Centers for Medicare & Medicaid Services’ (CMS) Health Information Exchange (HIE) and the NIH's Open Data Commons, which prioritizes the open exchange of hospital/patient and biomedical research data, respectively. However, due to difficulties stemming from uneven EHR adoption and the strict privacy regulations safeguarding protected health information (PHI), these healthcare data exchange efforts have largely fallen flat. However, if the success of surveillance in China spurs demand for COVID-19 response solutions that sacrifice some citizen privacy in return for the wellbeing of the general population, open health data exchanges may be widely adopted in Western nations.

22 How Canadian AI start-up BlueDot spotted Coronavirus before anyone else had a clue
23 AI Uncovers a Potential Treatment for Covid-19 Patients

“There is no functioning economy unless we control the virus.”

Lindsey Graham
Senator, South Carolina
Even if this pandemic fails to permanently change consumer sentiment regarding personal data privacy, open data platforms are critical to the evolution of Smart Cities and have capabilities that governments can leverage to contain COVID-19 and future pandemics. For example, open-source data platforms that largely feature de-identified data based on public data reporting, such as the John Hopkins University dashboard\textsuperscript{24}, are already widely used to aggregate and share high-level healthcare data such as patient outcomes. Similar data platforms can be leveraged in conjunction with Smart Cities-adjacent use cases, such as temperature screening at ports of entry or traffic data for social distancing enforcement and patient tracking. Open platforms that use non-medical data can help catalyze humanitarian response and expand the capabilities of social organizations to allow citizens to assist healthcare researchers with containing the virus.

\textsuperscript{24} COVID-19 Dashboard by the Center for Systems Science and Engineering at Johns Hopkins University
Blockchain
Most social, political and administrative institutions depend upon in-person interaction. Blockchain technologies can replace these potentially contagious contacts with confidential online participation, providing convenience while preserving the safety of citizens and public employees. The distributed ledger technology that underlies blockchain applications provides more data security through its transparent tracking of all transactions and interactions. Because of this security, hospitals and medical research organizations are turning to blockchain technology to securely and quickly share patient data between hospitals and research centers.

“I think what happens is we begin to open up the way we shut down, and that’s where our governors and our mayors and our county judges look at local conditions... We can think about in each of these circumstances, in each of these states, what the right set of protocols are to begin to open our economy and let people go back to work.”

John Cornyn
Senator, Texas

In addition, blockchain technology can help support other aspects of the COVID-19 response outside of clinical settings. For example, Germany is leveraging blockchain to help citizens securely acquire their prescription medication while still maintaining social distance. In Honduras, blockchain applications help enforce stay-at-home orders and schedule telemedicine appointments with doctors while protecting user data privacy. Researchers around the world are exploring the potential for blockchain technology to support future applications such as widespread symptom and infection tracking—all while remaining secure.

Speech Recognition and Natural Language Understanding
Doctors and nurses will increasingly conduct contactless interactions with patients. Future outbreaks of communicable disease will be hindered by touchless interaction with everything from public doors and elevators to point-of-sale (PoS) devices using natural language processing (NLP) to add voice-based interfaces to replace physical screens and reduce the amount of high-touch contact. For example, a point-of-sale system in a grocery store might adopt voice recognition for a customer’s signature so they don’t have to pick up a pen or use their finger to scrawl their signature across a PoS screen.

Virtual User Interface
Participating in events without actually “being there” started with the telephone. Today it’s business-as-usual for telecommuters, but we’ve still only scratched the surface. As core technologies like haptic feedback devices, VR interfaces, and especially 5G networks become more common, people will live fuller professional lives without exposing themselves to the “petri dish” of congested physical environments.

Multi-Modal Sensing
Multi-modal refers to the fusing of multiple types of sensors and data feeds in real time. For instance, in responding to a vehicle accident, we need to notify multiple public safety agencies about the incident, determine the best route to a hospital, transmit sensor readings on the physiological state of the victims in the ambulance, organize, and distribute medical records to physicians, and schedule resources at the hospital.

Creative Combinations of Technology Solve Big Real-World Problems
Multiple parallel technology developments are increasingly reinforcing and accelerating one another. Cloud infrastructure resources are providing unprecedented computing scale. Mobile computing devices are extending the reach of computing. Machine learning and AI are bringing intelligence to diverse things. And embedded systems and IoT technology are connecting and integrating a broad array of physical and digital applications.
Each of these technologies is powerful on its own, but creative combinations multiply their impacts. Human-connected devices and machine-connected IoT devices enable exponentially more data, which can be processed at the edge to eliminate latency and reduce network costs by distributing computing resources. These distributed systems will be complimented by the cloud which provides greater computational capacity to conduct analysis and modeling of historical data. This, in turn, sets the stage for AI and machine learning tools to analyze and capture new insights.

As more technologies converge and multiply their effects, we'll begin to inhabit a world with fewer unforeseen surprises. Achieving such foresight can conflict with personal privacy considerations, and this too may become part of “the new normal.” Considering the human suffering and social disruption that COVID-19 has brought, sacrificing some privacy to avoid a future pandemic might be something most people would welcome.
SOLUTIONS THAT CAN MAKE AN IMPACT

INNOVATIONS FROM INTEL PARTNERS

Overview
Previous sections helped us understand the “new normal” of the COVID-19 pandemic and how much of our response to that crisis is centered around technology. This section is intended to help answer the question: “How to get started building for this new normal?”

To help answer that question, we have created a curated list of solutions from Intel and our partners. The solutions in this chapter are broken down into 6 sections: 1) Public Safety, 2) Transportation, 3) Sustainability, 4) Healthcare, 5) Education, and 6) Smart Spaces. Many of the solutions have uses that span multiple segments. In those cases, you will find them listed under multiple section-headings in the table of solutions provided on the next page of this eBook. You can use that table to quickly look up a solution that fits a specific segment.

Healthcare
Healthcare is at the forefront of the COVID-19 Pandemic. Using a hospital’s resources most efficiently can be the difference between life and death. Additionally, precautions must be taken to protect healthcare workers from contracting the virus. This section focuses on products and solutions that can be used to diagnose and treat COVID-19, along with solutions enabling hospitals to run more safely and efficiently. Additionally, telehealth has already emerged as a powerful tool to help fight COVID-19, and we expect it to become part of the new normal moving forward.

Public Safety, Transportation, and Smart Spaces
To re-open society safely, precautions must be taken to minimize the spread of the virus and maximize the safety of transportation hubs, grocery stores, schools/campuses, shopping centers, and offices. As we begin to carefully re-open these spaces, precautions must be taken such as maintaining social distancing, identifying potentially sick people, regular cleaning, and disinfection.

Sustainability and Education
Many jobs and educational experiences are now taking place remotely, and this is expected to continue into the future. Some of the biggest challenges with remote work are maintaining productivity and interactivity, and sustaining collaboration and learning while practicing social distancing. Solutions for remote working and education will help mitigate these challenges and even potentially enhance the remote working and educational experience.

The solutions that follow are available now or will become available in the near future. This is not intended to be a comprehensive catalog of all products or product-categories in existence. Rather, these are illustrative possibilities to demonstrate the breadth of solutions that can help us adapt to life in the new normal. Because the COVID-19 pandemic is a rapidly developing situation, we expect that many more solutions will be released in the near future, and we plan to update this eBook as the pandemic evolves.
If a solution has uses that span multiple segments, you will find them listed under multiple section-headings in the table below. The navigation tabs to the right will let you jump directly to the segments themselves.

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<thead>
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PUBLIC SAFETY

VIDEONETICS SAJAG* PANDEMIC MANAGEMENT SUITE

**Solution Overview**
Actionable intelligence with in-depth insights to combat spread of the novel coronavirus

**Value Proposition**
- Immediate and automatic feedback of PPE detection
- Help re-open economy in a sustainable manner

**Solution Components**
- Real-time video analysis
- Intel® distribution of OpenVINO™ toolkit – models for social distancing, crowd management, facemask & PPE Detection, and vehicle of interest detection

**Solution Summary**

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GORILLA* SMART SURVEILLANCE

**Solution Overview**
Real-time analytics capabilities for facial and behavior recognition

**Value Proposition**
- Prevent overcrowding in high-traffic locations
- Monitor suspicious activities
- Alert when safety thresholds are crossed

**Solution Components**
- People/face recognition
- Behavioral analysis
- Business intelligence
- Intel® distribution of OpenVINO™ toolkit
- Intel Atom®, Intel® Core™ or Intel® Xeon® processors

**Solution Summary**

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**PUBLIC SAFETY**

**SAIMOS**

**Solution Overview**
Flexible and Scalable Video Analytics for Social Distancing and Mask Detection

**Value Proposition**
- Help re-open economy in a sustainable manner
- Real-time analysis of overcrowding and mask detection
- Alert when safety thresholds are crossed
- Help protect building employees and customers

**Solution Components**
- 2D & 3D sensors
- Occupancy counting and heatmapping
- Intel® Core™ i5 / Intel® Core™ i7 processors
- Face detection and recognition

**Solution Summary**
- **Company**: Saimos*
- **Audience**: Public Places
- **Readiness**: Available now
- **Geo**: Europe

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**iOmniscient IOMNISCIENT IQ-FEVERCHECK* CAMERAS**

**Solution Overview**
Cost-efficient, en-mass fever monitoring* to detect and isolate people with fever

**Value Proposition**
- Help prevent cross-infection
- Identify and alert people with fever
- Additional resilience at border, transportation hubs, grocery stores, schools, campuses, office and residential buildings.

**Solution Components**
- Dual camera (thermal and color)
- IQ-FeverCheck* Analytics software
- Intel® Core™ i5 to Intel® Core™ i9 processors
- Suspect tracking between cameras
- Alert authorities

**Solution Summary**
- **Company**: iOmniscient
- **Product**: iQ-FeverCheck* Cameras
- **Audience**: Public Places
- **Readiness**: Needs FDA Approval*
- **Geo**: Worldwide

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**TRANSPORTATION**

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### ADVANTECH* EDGE SOLUTION FOR 5G PATROL ROBOT

#### Solution Overview
Accomplish inspection patrol and epidemic control tasks in risky working environments, and effectively utilize manpower.

#### Value Proposition
- Help prevent cross-infection
- Enable safe travel in airports, train stations, etc.
- Record historical information
- Allow for remote supervision

#### Solution Components
- Body temperature screening
- Mask identification
- Remote communication (5G)
- Historical information backtracking

#### Solution Summary
- **Company**: Advantech*
- **Product**: Edge Solution for 5G Patrol Robot
- **Audience**: Public Places
- **Readiness**: Available now
- **Geo**: Worldwide

---

### ZMP PATORO* ROBOT

#### Solution Overview
A robot that sprays disinfectant to handrails and elevator buttons while it autonomously drives planned routes. Compatible with existing elevators to drive multi-floors.

#### Value Proposition
- Help reduce risk of infection
- Help reduce dull and dangerous human labor
- Fast time to market; only two weeks for deployment

#### Solution Components
- Autonomous navigation
- Disinfecting spray
- Intel® Core™ i7 processor

#### Solution Summary
- **Company**: ZMP
- **Product**: Patoro* Robot
- **Audience**: Transportation Hubs
- **Readiness**: Near Future
- **Geo**: Worldwide

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TRANSPORTATION

AETHON TUG* ROBOT

Solution Overview
Moves materials and clinical supplies around hospitals. Reduces cost-per-delivery by up to 80%.

Value Proposition
• Reduced cost-per-delivery of goods
• Help reduce chance of cross-infection
• Help improve efficiency of medical staff

Solution Components
• Touch screen
• Autonomous navigation
• Delivery of materials and clinical supplies

Solution Summary

Company | Aethon
Product | TUG* Robot
Audience | Hospitals
Readiness | Available now
Geo | Worldwide

APPLICATION: CONTACT TRACING

Solution Overview
Quickly and proactively identify potentially infected people based on historical proximity to infected people

Value Prop
• Help get society back up and running safely
• Proactively identifies and recommends testing for people who may be infected
• Help governments and health agencies reduce the spread of the virus

Solution Components
• Secure and anonymized databases of confirmed infections and people who have been in close contact with infected persons
• Identify, trace and proactively test possibly infected people

Solution Summary

Product | Contact Tracing
Audience | Public Places
Readiness | Available Now
Geo | Worldwide

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**SUSTAINABILITY**

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**CAMIO* SOCIAL DISTANCING**

**Solution Overview**
Monitor and collect statistics around social distancing

**Value Proposition**
- Help re-open economy in a sustainable manner
- Identify scenarios where social distancing practices are not being followed
- Provide real-time notification when social distancing practices are not followed

**Solution Components**
- Integration with video management systems
- Alarm/event notifications
- Auditable proof for compliance with social distancing guidelines
- Intel® Distribution of OpenVINO™ Toolkit
- Intel® Core™ i5 processor

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**Solution Summary**

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**GENETEC KIWIVISION* ANALYTICS SUITE**

**Solution Overview**
Monitor and analyze areas for crowd density and overcrowding

**Value Proposition**
- Help re-open economy in a sustainable manner
- Help maintain social distancing practices
- Realtime understanding of occupancy, density and behavior of crowded area

**Solution Components**
- People counting
- Intel® Distribution of OpenVINO™ Toolkit
- Intel® Core™ to Intel® Xeon® processor
- European Privacy Seal approved surveillance system

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**Solution Summary**

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<td>Product</td>
<td>Kiwivision* Analytics Suite</td>
</tr>
<tr>
<td>Audience</td>
<td>Public Places</td>
</tr>
<tr>
<td>Readiness</td>
<td>Available now</td>
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<tr>
<td>Geo</td>
<td>Worldwide</td>
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</table>
VENDRON* SMART VENDING AND AUTOMATED RETAIL

**Solution Overview**
End-to-end smart solution that enables powerful and customizable smart vending capabilities

**Value Proposition**
- Help provide automated vending/retail
- Scalable to full contactless retail
- Remote management
- Help reduce operating costs

**Solution Components**
- Multimedia interactivity
- Cashless payment
- Digital signage
- Video analytics
- Social media and mobile interactivity

**Solution Summary**

<table>
<thead>
<tr>
<th>Company</th>
<th>Silkron</th>
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<tbody>
<tr>
<td>Product</td>
<td>Vendron* Smart Vending &amp; Automated Retail</td>
</tr>
<tr>
<td>Audience</td>
<td>Public Places</td>
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<tr>
<td>Readiness</td>
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**MEDICAL INFORMATICS CORP. SICKBAY**

**Solution Overview**
 Clinical intelligence edge platform for remote monitoring and analytics allowing remote rounding

**Value Proposition**
- Minimize human interaction and contagion risk
- Enables efficient care of the most critical patients
- Spot deterioration and alert the rest of the team proactively
- Improve ventilator utilization
- Helps hospitals rapidly expand intensive care unit (ICU) bed capacity

**Solution Components**
- Patient data collection
- Data analysis tools to spot deterioration

**Solution Summary**

<table>
<thead>
<tr>
<th>Company</th>
<th>Medical Informatics Corp.</th>
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</thead>
<tbody>
<tr>
<td>Product</td>
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<td>North America</td>
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<td>More Info</td>
<td>Link</td>
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</table>

**CAPSULE TECHNOLOGIES**

**Solution Overview**
 Integrated clinical healthcare platform, simplifying patient vitals acquisition and utilization for overloaded medical staff

**Value Proposition**
- Help identify at-risk patients sooner
- Help reduce contagion risk
- Extend the reach of ICU staff
- Capture streaming data on ventilated patients
- Centralized alarming and alerting

**Solution Components**
- Patient data collection
- Ventilated patient Surveillance workstation
- Bernoulli One Enterprise Software
- Surveillance smart rules to support clinical decision makers
- Centralized alarm system

**Solution Summary**

<table>
<thead>
<tr>
<th>Company</th>
<th>Capsule*</th>
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</thead>
<tbody>
<tr>
<td>Product</td>
<td>Capsule Platform</td>
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<td>Link</td>
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</table>
HEALTHCARE

REVLIS* TELE-HEALTH CARE

Solution Overview
Remote monitoring solution designed for people who may have cardiovascular disease, geriatrics or chronic disease but do not necessarily need to go to the hospital immediately.

Value Proposition
- Help reduce number of high-risk people in hospital
- Convenient and easy to use
- Access to professional monitoring and advice without frequent follow-up visits

Solution Components
- Intel® Quark™ processor
- Continuous ECG
- Monitoring for up to 24 hours
- Remote monitoring
- Remote consultation

Solution Summary

Company | Revlis*
---|---
Product | Tele-Health Care
Audience | Remote Health Care
Readiness | Available now
Geo | Europe & APJ
More Info | Link

CMATE® Home Portable ECG

1. Accurate waveform
2. Experts' approval
3. Long-term storage
4. Easy to use

MEDPOD* HEALTH

Solution Overview
A complete healthcare technology and infrastructure ecosystem that facilitates consultations between patients and remote providers.

Value Proposition
- Capture and analysis of patient clinical data
- Facilitate consultations between patients and remote providers
- Telemedicine, virtual care, and diagnostics

Solution Components
- Pan tilt camera
- Ultrasound
- Spirometry (lung function)
- EKG (electrocardiogram)
- Multiscope
- Portable X-Ray
- Concussion testing
- Bone density

Solution Summary

Company | Medpod*
---|---
Product | Remote Healthcare Solutions
Audience | Remote Healthcare
Readiness | Available now
Geo | Worldwide

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INTOUCH HEALTH*

Solution Overview
Ensure easy access to high-quality virtual care, telemedicine and triage

Value Proposition
• Help reduce the number of people in hospitals – enabling sustainable healthcare  
• Help provide high-quality virtual healthcare solutions  
• Help improve efficiency and time savings

Solution Components
• Virtual care  
• Portable cart with microphone, video, camera

Solution Summary

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<th>Company</th>
<th>InTouch Health*</th>
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<tbody>
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MSI* AI-UVC DISINFECTION ROBOT

Solution Overview
Robot that can disinfect hospital rooms with Ultraviolet (UV) light

Value Proposition
• Help reduce the spread of the virus by disinfecting hospital rooms  
• Improve efficiency of medical staff

Solution Components
• Autonomous navigation  
• UV lights to disinfect  
• Automatically create map of area traveled through

Solution Summary

<table>
<thead>
<tr>
<th>Company</th>
<th>MSI*</th>
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</thead>
<tbody>
<tr>
<td>Product</td>
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</table>
HEALTHCARE

PUDU* DELIVERY ROBOTS

Solution Overview
Transports materials across hospitals, saving clinical staff time, reducing human interaction and chance of infection

Value Proposition
• Improve efficiency of medical staff
• Help reduce chance of infection
• Reduce amount of PPE required

Solution Components
• Touch screen
• Mobile robot with 4 shelves
• Intel® RealSense™ depth camera

Solution Summary
Company | Pudu*
---|---
Product | Delivery Robot
Audience | Hospitals
Readiness | Available now
Geo | China

SAVIOKE RELAY*

Solution Overview
Reliable, friendly, and nimble robot for delivery of medication, specimens, and other items throughout the hospital

Value Proposition
• Improve efficiency of medical staff
• Help reduce chance of infection
• Reduce amount of PPE required

Solution Components
• Secure chain-of-custody
• Autonomous navigation

Solution Summary
Company | Savioke
---|---
Product | Relay*
Audience | Hospitals
Readiness | Available now
Geo | USA

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EDUCATION

CRESTRON® COLLABORATION SOLUTION

Solution Overview
Enables educators and staff to focus on providing a high-quality learning experience with technology

Value Proposition
• Enable future-proof, flexible, and efficient collaboration experiences
• Improve meeting productivity
• Compatible with a range of meetings programs like Microsoft Teams, Skype, and Zoom

Solution Components
• Crestron Flex to create a unified communication platform
• Xi Cloud in Azure IOT Hub
• Intel® Core™ i7 CPU, Intel® Movidius™ VPU Technology, Intel® Arria® FPGA

Value Proposition
Enables educators and staff to focus on providing a high-quality learning experience with technology

Solution Overview
Digital education solutions that aim at making learning and collaborating easier, more effective, and more fun

Value Proposition
• Digital education made more accessible for everyone
• Collaborative learning, one-on-one education and class management
• Adjustable to demands of schools around the world

Solution Components
• Chromebook with Intel® Core™ i5 processor
• Intel vPro® and Unite®
• Student-based machine learning
• Collaboration/video tools for teachers

Solution Summary
Company: Crestron®
Product: Collaboration Solution
Audience: Virtual Meeting / Education
Readiness: Available now
Geo: Worldwide
More Info: Link

Company: Prowise®
Product: Full Solution for Education
Audience: Virtual Meeting / Education
Readiness: Available now
Geo: Worldwide
More Info: Link

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**EDUCATION**

**ViewSonic**

**Solution Overview**
Collaborative capabilities for 21st century boardrooms and classrooms

**Value Proposition**
- Help foster an interactive learning environment to students learning from home
- Prepare, present, and participate in a single solution platform

**Solution Components**
- 4K Ultra HD resolution InGlass touchscreen display
- myViewBoard digital whiteboard
- Intel® Unite® application

**Solution Summary**

<table>
<thead>
<tr>
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<th>ViewSonic*</th>
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<tbody>
<tr>
<td>Product</td>
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**Newline TruTouch X**

**Solution Overview**
Enhance meeting efficiency and productivity with multi-touch display and built-in videoconferencing equipment

**Value Proposition**
- Maintain efficiency and productivity
- Support workforce and education shift to remote communication

**Solution Components**
- Multi-touch display
- Built-in videoconferencing

**Solution Summary**

<table>
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<tr>
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<tbody>
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EDUCATION

ECS* SMART CLASSROOM

Solution Overview
Designed to connect teachers and students with innovative technologies to create an efficient learning environment.

Value Proposition
- Enhance student learning experience by promoting interaction
- Simplifies deployment
- Improve efficiencies with content management access point

Solution Components
- Tablets, laptops, interactive flat panel, Content Management Access Point (CMAP)
- Inspiring knowledge Education Software (iKES)
- Intel® Core™ i3/i5, Intel® Celeron® processors

Solution Summary

<table>
<thead>
<tr>
<th>Company</th>
<th>ECS*</th>
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<tbody>
<tr>
<td>Product</td>
<td>Smart Classroom</td>
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<td>Audience</td>
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NEC INFINITYBOARD*

Solution Overview
Collaboration tools for viewing experience with latest application for sharing, reviewing and editing content.

Value Proposition
- Maximize employee productivity
- Support multiple presenters
- Promote brainstorming, reviewing and collaboration
- Future-proof: embedded PC can be upgraded at any time

Solution Components
- Audio + camera
- Touch screen
- Intel® Core™ processors
- Intel® vPro® technology
- Microsoft Windows 10 Professional

Solution Summary

<table>
<thead>
<tr>
<th>Company</th>
<th>NEC</th>
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<tbody>
<tr>
<td>Product</td>
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The Importance of Working Together

Technological changes are bringing an end to traditional strategies among companies. Alliances, ecosystems and collaborative development are hardly new, but as the rapidly evolving impacts of the COVID-19 pandemic become evident, ecosystems become the central organizing schema for radical new and novel responses.

Businesses, governments and cities will come to understand that creative and effective responses to the “new normal” will all be driven and enabled, in large part, by ecosystems and new value delivery networks comprised of complimentary innovations and players. Why? Because participating companies are not prosecuting a fully visible or completely known threat. Rather, they are creating an environment in which new tools, applications and use cases can emerge and flourish.

Organized to pursue multiple parallel solutions simultaneously, a dynamic network of connected innovators, city stakeholders and users will drive new information values which, in turn, create new responses to this challenge.

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ABOUT HARBOR RESEARCH

Harbor Research has over thirty years of experience working with clients on growth strategy and new business creation. At the core of Harbor’s approach is a deep understanding of the core technologies, markets and business characteristics, as well as the management and organizational challenges that companies face when adopting and developing digital and smart systems technologies. We strive to generate deep insight into how emergent technologies drive value creation and competitive advantage in our clients’ businesses and the economy as a whole.
Intel creates world-changing technology that enriches the lives of every person on earth.