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WHITE PAPER

Introduction to IoT in Smart Cities

"Cities are our economic engines. They create jobs, cultivate innovation, culture, and inclusion."

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IoT ENABLES SMART BUILDINGS, CREATING SMART CITIES

The idea of smart cities was first developed by technology giant IBM, which created a worldwide initiative called Smarter Cities aimed at helping cities and companies leverage data to improve operational performance in many sectors.[1] Now, worldwide, there are already over two dozen smart cities, with that number expected to rise to 88 by 2025.[2] But what exactly is a smart city, how does it function and what impact does it have on residents living and working within its borders?

The ultimate goal of a smart city initiative is to attract businesses and citizens to ensure a vibrant city economy.[3] Smart cities utilize the Internet of Things (IoT) to achieve sustainable economic development and quality-of-life improvements. IoT refers to devices connected to the internet that transmit data and according to industry experts, by 2020, 10 billion+ new devices and connections will be added to the internet. This will increase the amount of IoT devices and connections to over 26.3 billion.[4]

WHY BUILD A SMART CITY?

Cities are the centers of resource consumption and the UN predicts that by 2050, 70 percent of the world's population will be urban and cities will have more than 10 million inhabitants.[3] Because of this, there are technological advances that IoT can provide to improve city living, some of which are already in place:

Barcelona, Spain, uses smart trash bins, which are only picked up when full, saving approximately 10 percent of current costs.

Glasgow, Scotland, has intelligent street lights, turning on and off automatically when someone walks past.

In Singapore, traffic and control systems are using IoT technology to maximize road network efficiency capacity as well as monitor and manage traffic flow.

In order to achieve these connectivity feats, partnerships between private industries, tech giants, and nimble startups will be necessary.[5] Using tools, policies, and tech to improve economic efficiency, all sectors must work together to tap into the huge amounts of data a smart city generates, analyze said data, and put insights into action.

FUNDAMENTAL IoT COMPONENTS OF A SMART CITY

INFRASTRUCTURE

There are many components that comprise a smart city, including smart homes, transportation, utilities, public services, healthcare, and smart buildings, which utilize advanced automation and integration to measure, monitor, control, and optimize operations and maintenance.[6] To achieve more optimal performance and cut costs, smart cities rely on "smart" infrastructure to increase visibility, collect data and more.

CONNECTIVITY, SENSORS, AND HARDWARE

By 2020, there will be an estimated 50 billion networked appliances and sensors worldwide[6], making up the "Internet of Things." To begin gathering data regarding movement, heat, light and the use of space, buildings are installing sensors to help building management systems (BMS) to make real-time adjustments to a building's environment. In fact, in the UK, smart electricity meters that use sensors to record energy use are helping to regulate energy and lower bills; this is the first step in building a national smart grid.

A government mandate that went into effect in 2011 stipulates that smart meters will be installed in 100 percent of households and business by 2019 and will likely deliver $8 billion in net benefits to consumers, energy suppliers, and networks by creating more accurate and lower bills by increasing customers' control of electricity usage and broadening the choice of payment methods.

INVESTMENT

Smart cities are projected to rise fourfold by 2025, with approximately 31 in the Europe-Middle East- Africa (EMEA) region, 32 in the Asia-Pacific region, and 25 in the Americas.[2] Annual investment is set to surpass $12 billion in 2025 and projects are typically deployed via partnerships between the public and private sectors.[2]

Different countries have various budgets and plans for smart city development. India's Smart Cities Mission, for example, aims to create 100 smart cities in the country as a model for development and to bring improvements to nearby cities and towns.[7] India has set aside $15 million for the development of the 100 smart cities and rejuvenation of 500 other cities over a five-year period.

In Australia, the competitive Smart Cities and Suburbs Program encourages projects that apply innovative technology based solutions to urban-challenges. Grants of $100,000 to $5 million have been made available to cover up to 50 percent of eligible project costs.[7]

In the United States, "The 2016 Smart City Challenge" awarded Columbus, Ohio, $40 million for its idea to create an integrated smart transportation system to move goods and people more efficiently. Funded largely by the U.S. Department of Transportation (DOT), the agency announced an additional $65 million in grants to support advanced technology transportation projects in cities across the nation.[7]

Although every city will embark on unique challenges, each can learn from other cities already forging ahead to avoid wasted time, effort, and money while following their own smart city strategy.

ENERGY AND SAVINGS

Smart infrastructure can help reduce water leakage, carbon dioxide emissions, and close the digital divide, all factors that save money. For instance, in North Miami Beach, Florida, they've already saved 27 million gallons of water through the deployment of smart water infrastructure with leak-detection technology.[8]

Only halfway through the full deployment, 23 leaks have been fixed, saving $38,000 annually.[8]

San Diego, California, expects to save more than $250,000 annually in electricity and maintenance by remotely controlling 3,000 lights with its intelligent streetlight network.[8] Lastly, New York City is closing the digital divide by upcycling 7,500 payphones into Wi-Fi enabled devices, offering free phone charging and national calling.[8]

PEOPLE AND PERFORMANCE

WHAT'S IN IT FOR CITIZENS?

Smart Cities have the potential to "give back" measurable rewards to citizens, including time. Each city dweller has the potential to gain three working weeks' worth of time every year.[9] This is accomplished via several categories:

- Smart traffic systems, including dynamic traffic light phasing and smart parking, save 60 hours
- Public safety using machine learning software used to predict crime spots on any given day and prioritize emergency service vehicles through traffic light phasing and driver rerouting saves 35 hours
- Healthcare, via preventative apps and telehealth, aim to reduce physician visits by promoting better overall well-being, saving [9] hours
- Productivity saves 21 hours using apps or digital services, simplifying processes when citizens interact with city agencies.

Smart Cities also give city inhabitants more time for family and friends, helping them get active, take longer vacations, improve recovery time, decrease the risk of depression and improve earning potential.[9]

WANT TO LEARN MORE ABOUT IoT CONNECTIVITY?

Visit our **Insights** page
for additional resources:

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IoT USE CASES FOR SMART BUILDINGS IN SMART CITIES

In the U.S. alone, businesses spend about $100 billion on energy for their offices every year.[10] But with smart buildings, estimates predict a savings of $20-25 billion in annual energy costs.[10] There are several examples of successful pilot programs that are showcasing how smart buildings and data-driven optimizations can reduce energy consumption.

SYSCO

Sysco found success in a corporate environment across its 140 facilities located in North America. Beginning in 2005, Sysco underwent a 3-year energy efficient program, using analytics as a critical component in decreasing energy use by 28 percent across its portfolio. This translates to a savings of 18 million kWh.

Although Sysco found success with its initiative, inhibitors to smart building adoption do exist, including:

- Connectivity and integration
- Depth and breadth of available data
- Usability
- Organizational support and change management
- Budget challenges

MICROSOFT

At its corporate headquarters campus, Microsoft rolled out smart building solutions from three different vendors at its corporate headquarters in 2011. With 118 buildings accounting for 14.9 million square feet of office space, the organization has 30,000 pieces of mechanical equipment, 7 major building management systems, and average daily consumption of 2 million kWh of energy, producing approximately 280,000 metric tons of carbon emissions annually.

The pilot focused on 13 buildings, representing 2.6 million square feet of office space, and focused on three areas for improving energy consumption and cost:

- Fault Detection and Diagnosis
- Alarm Management
- Energy Management

By adding an analytical layer to its building data, Microsoft was able to utilize its existing building management system without the need to replace infrastructure.

FAULT DETECTION AND DIAGNOSIS

With the number of buildings on campus and only periodic spot checks, a building operated for around five years before it was inspected for faulty output or under-performance. With the new, smart technology, annual energy cost savings from continuous commissioning enabled by automated fault detection alone may exceed $1 million.

ALARM MANAGEMENT

Buildings contained many alarm systems, some serious (power outage or fire alerts) and others minor (testing alerts); however, with no prioritization system, some important notifications could be easily missed. Developing a way to sort and analyze the thousands of alerts systematically to detect patterns can help engineers identify opportunities for efficiencies and cost savings.

ENERGY MANAGEMENT

With the help of smart building solutions, engineers can optimize building base load and the power consumed by major building systems. By utilizing analytics, engineers can tune set points and schedules, isolate wasteful equipment and address other opportunities by obtaining a better understanding of energy use and trends across the building portfolio.

THE FUTURE OF SMART BUILDINGS

Using a cloud-based approach, smart buildings are set to transform technology by making third-party applications readily available as a service over the Internet. For smart building solutions, this will deliver several benefits including accessibility, scalability, and ease of deployment.

WHY INVEST IN IoT FOR SMART CITIES?

JOB MARKET AND THE ECONOMY

Smart infrastructure investments lead to additional jobs and, in turn, economic growth.[8] What exactly will this look like from an infrastructure cost vs. benefits breakdown?

- 13,000 jobs for every $1 billion invested in federal highway and transit infrastructure
- 12,000 jobs-years of employment for every $1 billion invested in wireless infrastructure
- Nearly 50,000 jobs from smart grid projects funded through the American Recovery and Reinvestment Act
- 10-15 jobs per $1 million investment in alternative water supply projects
- 5-20 jobs per $1 million investment in urban conservation and efficiency
- 14.6 jobs per $1 million investment in restoration and remediation
- 10-72 jobs per $1 million investment in restoration and remediation
- 2.3 million potential jobs in 2030 by diverting 75% of waste from landfills to recycling facilities

To put the potential impact into perspective, the integration of smart cities may make just as significant (if not greater) impact as the transcontinental railroad, the interstate highway system, the rural electrification act, and the ARPAnet.[8]

COST SAVINGS AND INCREASED ROI

Additionally, there are cost saving benefits and increased ROI for smart building implementation. Currently, buildings consume 70 percent of the electricity load in the U.S. and account for 39 percent of U.S. Co2 emissions.[11] The U.S. Department of Energy shows that buildings account for 40 percent of U.S. energy use and waste 30 percent of the energy they consume, reaching over $100 billion in operational costs per year. [11]

With smart building implementation focusing on HVAC, lighting, and some types of electrical loads, it's reasonable to expect savings in the range of 10-25 percent as a result of implementing proactive energy management programs in mid-sized buildings.[11]

Investing in IoT-based controls and monitoring in a building can range from $5,000-$50,000, which is a fraction of the basic Building Management System (BMS) costs.[11]

DATA COLLECTION

Smart Cities, specifically sensors and smart connected infrastructure within those cities, will contribute to huge amounts of global data collection. By 2020, it's predicted that 37.2 zettabytes of data will be collected by smart infrastructure.[12] The analytics collected via this infrastructure can contribute to achieving improved service delivery, more efficient use of resources, and implementation of financially and environmentally sustainable practices.[3] This translates to cutting energy waste, creating lower bills for consumers, saving time and more on a global level.

HOW CAN MOMENTA PARTNERS HELP YOU SUCCEED?

Smart infrastructure is worth investigating for your business and here's why: a smart building solution can be established with an upfront investment of less than 10 percent of annual energy expenditure, with an expected payback period of fewer than two years.[10]

At Momenta Partners we understand the incredible advances on the horizon thanks to IoT, the preparation for Smart Cities and the potential yet to come. We help organizations, municipalities, government institutions and more benefit from all IoT has to offer, especially as it relates to the generation of actionable insights that contribute to energy and cut costs; it's realistic for some organizations to save millions annually by integrating smart building technology while optimizing these factors.

Our team of IoT experts can help you navigate the IoT ecosystem successfully:

- Do you want to know what adopting IoT means to your bottom line?
- How it will cut costs and by how much?
- Where will it help you create new revenue?
- How much business value can you can expect to attribute to IoT-related initiatives?

Let us help you get the answers and monetize with IoT in today. Contact Momenta Partners to learn more about our IoT experts and IoT Strategy and Execution program or visit www.momenta.partners/iot-advisory

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ABOUT MOMENTA PARTNERS

Momenta Partners encompasses industry-leading Strategic Advisory, Talent, and Venture practices. We're the guiding hand behind leading industrials' IoT strategies, over 200 IoT leadership placements, and 25+ young IoT disruptors.

Schedule a free consultation to learn more about our Connected Industry practice. Learn more about our team, capabilities, and experience at www.momenta.partners

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This whitepaper was originally created by 151 Advisors, which is now a Momenta Partners company. We have updated most of the data from the original format.

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