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THE INTERNET OF THINGS (IoT) IN THE RESTAURANT INDUSTRY

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ABSTRACT

25 Years ago, the internet suddenly changed the way we do business: from one day to another, enterprises could work faster and be more cost efficient, thanks to the world wide web and all of its innovations. Today, we find ourselves once again on the verge of such a drastic shift in business opportunities. 250 years after the industrial revolution began, we have arrived at a critical threshold in the evolution of computing. Over the next five years, around 50 billion devices will be connected to the internet, the majority of which will not be computers, tablets or smartphones, but newly invented tools to monitor, analyze, filter, control, optimize and improve the entire world. The Internet of Things (IoT), as this intelligent interconnectivity between the real and the digital world is called, will rapidly transform every aspect of how we work and do business. I would rather refer to it as the Internet of everything, where the real, physical & virtual world, interact with each other. It is the independent communication between objects, that helps optimize operations, reduce costs, boost productivity, & improve lives. All of these connected dots and devices could change the customer experience in the food service industry. This study thus examines the way IoT has so far affected the foodservice industry and what the immediate future foresees for this industry and the technology.

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INTRODUCTION

The Internet of Things may be a hot topic in the industry but it's not a new concept. In the early 2000's, Kevin Ashton was laying the groundwork for what would become the Internet of Things (IoT) at MIT's AutoID lab. Ashton was one of the pioneers who conceived this notion as he searched for ways that Procter & Gamble could improve its business by linking RFID information to the Internet. The concept was simple but powerful. If all objects in daily life were equipped with identifiers and wireless connectivity, these objects could communicate with each other and be managed by computers. In a 1999 article for the RFID Journal Ashton wrote, "If we had computers that knew everything there was to know about things—using data they gathered without any help from us -- we would be able to track and count everything, and greatly reduce waste, loss and cost.

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We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best. We need to empower computers with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory. RFID and sensor technology enable computers to observe, identify and understand the world—without the limitations of human-entered data." At the time, this vision required major technology improvements. After all, how would we connect everything on the planet? What type of wireless communications could be built into devices? What changes would need to be made to the existing Internet infrastructure to support billions of new devices communicating? What would power these devices? What must be developed to make the solutions cost effective? There were more questions than answers to the IoT concepts in 1999. Today, many of these obstacles have been solved. The size and cost of wireless radios has dropped tremendously. IPv6 allows us to assign a communications address to billions of devices. Electronics companies are building Wi-Fi and cellular wireless connectivity into a wide range of devices.

ABI Research estimates over five billion wireless chips will ship in 2013. Mobile data coverage has improved significantly with many networks offering broadband speeds. While not perfect, battery technology has improved and solar recharging has been built into numerous devices. There will be billions of objects connecting to the network within the next several years. By connecting apps with their integrated systems, businesses are able to transform their industry significantly: today almost 90% of all data generated by tablets, smartphones or connected appliances is never acted upon. Imagine you could change that. Image you could use that data to create intelligent tools and interconnected systems or services that will allow you to optimize and accelerate your business processes. It seems safe to say that we have never encountered a single technological platform that combines this much complexity, global reach, and novelty. IoT is able to do just that, and more. Restaurants can use the IoT to monitor the equipment that cooks, cleans or stores food. Currently, there is smart kitchen equipment that measures cooking equipment such as fryers, grills, ovens, etc., whereby circuit boards provide prompts to take action (e.g., filter cooking oil) or to closely monitor temperature. IoT becomes important if restaurant owners or managers wish to see "above the store" or, in other words, export data outside the restaurant to monitor remotely or to compare one restaurant to another. Operationally, by utilizing technologies like routing software and IoT sensors, food service businesses can enable dynamic scheduling of deliveries that boost the bottom line. For example, receiving deliveries only when needed, which eliminates administrative costs and management concerns while helping drive efficiencies for all involved.

Purpose and Contribution of the study

The purpose of this study to examine how IoT in the restaurant and food service industry has evolved so far; what are the ways in which IoT can be implemented in this sector; what are its pros and cons (if any); how its implementation will affect the different variables involved; and what the future holds for this technology in the food serviceindustry.

Research objectives

This whitepaper aims to examine

- The growth of IoT worldwide
- Why it should be implemented in the food service industry
- How it can be implemented in this industry
- What are the future trends in IoT

ANALYSES AND RESULTS

Much has been written about how the Internet of Things (IoT) is rapidly transforming manufacturing and other asset-heavy industries. That's understandable, because those sectors have been at the forefront of IoT adoption and are further along in realizing its potential. But the IoT can be just as important to the food service industry. Recent research has uncovered many ways the IoT can benefit companies that operate a commercial kitchen—whether it's a standalone full-service restaurant, a restaurant chain, a commissary or catering business, or a retail restaurant with a prepared-foods section. To illustrate the promise that IoT holds, let us look at its effect on the restaurant sector.

As consumer demands and tastes change, the market share of these establishments is rapidly expanding. This trend is expected to continue, as the global QSR market is forecasted to grow at Compound Annual Growth Rates (CAGRs) of 5.54% and 5.22%, in terms of revenue and volume, respectively, for the period of 2015-2019[1]. While this growth is a huge opportunity, the industry has challenges. Arguably, the biggest one is managing operational costs. QSR chains face a constant struggle to control a wide range of cost centers—including those related to food and material purchases, food preparation, food waste, energy, and labor. Left unchecked, these can erode the operator's already thin margins. Consider the restaurant manager, who is on the front line of the business and is responsible for the restaurant's performance. One of the restaurant manager's biggest—and most important—challenges is ensuring all the food the restaurant serves is safe. Yet the processes used to make certain the restaurant complies with all relevant food safety regulations are far from optimal. They're manual and paper based and, subsequently, are inefficient and time consuming. Furthermore, the processes suffer from a distinct lack of transparency: The manager has little visibility into food safety beyond the checks and balances currently in place. This could make the restaurant vulnerable to failing a food safety audit or, worse, serving customers unsafe food. Another challenge involves restaurant operations supervision. Because operations aren't automated, the manager typically doesn't have oversight to ensure all employees execute their various tasks consistently.

And most outlets also lack integration among various back-of-the-house systems, which makes it difficult to streamline restaurant management and reporting procedures. Regional managers, who oversee groups of restaurants, face their own set of challenges in restaurant supervision and employee coaching. They typically have limited visibility into how consistently restaurants apply the operational guidelines corporate puts in place. As a result, regional managers are generally forced to react to operational issues when they arise rather than identifying and dealing with them before they become a problem. Those at the highest level—the franchise owner and corporate management accountable for all aspects of restaurant operations—also lack information that can help them proactively manage individual restaurants on a real-time basis. Most of their decision making is based primarily on backward-looking financial metrics. Thus, they can't continually monitor restaurant performance and identify ways to improve it—by, for instance, addressing customer service issues as they happen or reducing energy consumption across multiple restaurants. By implementing IoT technology in its restaurants' kitchens, an operator can take major strides toward addressing these, and other vexing operational challenges. At a high level, the IoT can automate and standardize several key restaurant processes, as well as provide far greater visibility into restaurants' operations—especially, the condition and status of kitchen equipment. At its essence, it encompasses four fundamental elements (Figure 1). Sensors are attached to the two main types of equipment in the back of a restaurant: refrigeration units that keep food cold and heating equipment that cooks and keeps food warm. Sensors that measure both temperature and humidity, and the power or energy drawn, are affixed to each piece of equipment.

[1]http://www.refrigeratedfrozenfood. com/articles/90070-qsr-marketgrowing-6-cagr-by-2019

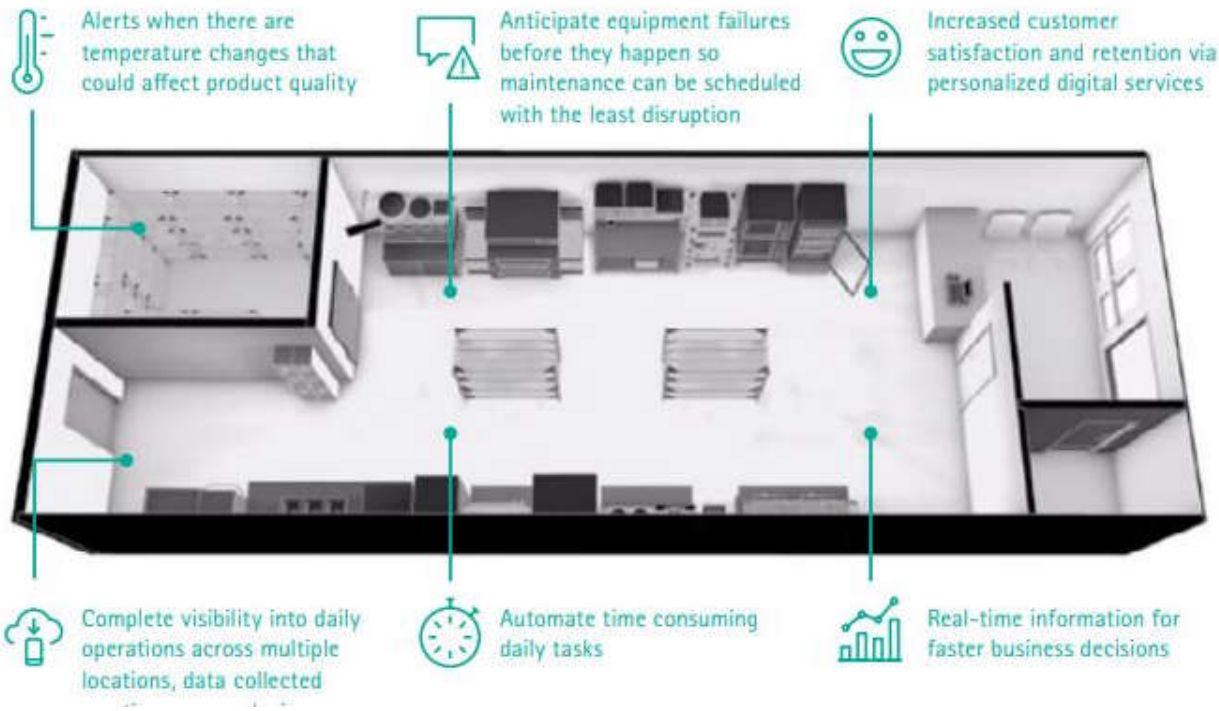

Figure 1. Key elements of the IoT-enabled kitchen

In the case of refrigeration equipment, a sensor attached to the door detects whether the door is open or closed, while other sensors determine whether ovens and fryers are turned on or off. Additional sensors keep tabs on the functioning of key mechanisms within each piece of equipment, such as an oven's heating unit and a refrigerator's compressor. At predetermined, regular intervals (e.g., every 30 or 60 seconds), these sensors send data to a central "gateway" placed in the restaurant. This gateway, in turn, aggregates the data and sends it to a secure, cloud-based platform. Here, business logic and rules are applied to turn the raw data into actionable information that decision makers can access via dashboards through a mobile app. Doing so enables them to see, at a glance and in real time, the status of all the equipment in the restaurant. The app also automatically sends an alert to the restaurant manager when the business rules identify a potential problem or when a particular piece of equipment is operating beyond established limits. With this IoT infrastructure in place, a company can gain visibility into its operations the company never had before—which can help it make faster, more informed decisions to improve the business. The company also can standardize and automate manual and time-consuming tasks—such as safety and compliance checks and inventory management—thus boosting employee productivity and efficiency. Several scenarios illustrate how the connected commercial kitchen could deliver such benefits.

Ensuring food quality and safety

Sensors that regularly monitor the status and temperature of equipment provide accurate real-time information that restaurant managers can use to mitigate changes that could affect product quality or result in violations of food safety regulations. Think about the all-important cooler door. The aggregated data collected by the sensors can be analyzed to determine if the cooler door was open for longer than the established operational best practices. If it was, an alert is flagged in the mobile app, based on the business rules. This tells the restaurant manager that the items in the cooler may be at risk. The platform also can send automated alerts to the manager's mobile device when he's out of the restaurant (for example, at night) if it detects the door is open so the manager can take appropriate action before the cooler's contents spoil. Similar business rules can be used to detect when the temperature inside a cold-temperature equipment is no longer within the established acceptable range. The mobile app dashboard may also be used to view temperature history for any connected equipment. This solution allows near-real-time insight into the operational status of all connected equipment, thus enabling a higher degree of food safety and compliance as well as helping to reduce spoilage.

Reducing energy consumption

Real-time monitoring of all connected equipment also enables granular measurement of energy consumption. While there may be standard operating procedures in place to ensure optimal energy consumption, verifying those processes is currently done via spot checks and manual audits. Sensors that measure power draw may be used to monitor power consumption in real time, which enables restaurant managers and leadership above them to also identify and correct sub-optimal behavior in real time. Over a long period of time, continuous monitoring of all restaurants' energy consumption, combined with analytics and predictive capabilities, could allow management to further identify potential green initiatives and energy-saving measures to reduce operational costs.

Keeping equipment running well

With real-time monitoring of assets and the ability to use analytics tools, the connected commercial kitchen solution can anticipate the failure of key equipment components before it happens. Consider a refrigerator's compressor. Sensors on compressors can continually monitor key metrics—such as vibration and operating temperature—and send that data to the

platform. Predictive analytics can help determine the overall health of the compressor and, if any of the data is running outside of the desired range, generate an alert on the app—much like the "check engine" light on a car. This alert gives the manager time to have the compressor checked out and repaired or replaced when the restaurant isn't open—and before it fails in the middle of the lunch rush. Such proactive maintenance also extends the life of the refrigerator, ultimately reducing the total cost of ownership for that equipment. Over time, this asset-monitoring capability may also extend the life of an asset and reduce its total cost of ownership.

Standardizing Compliance Management

One area in which the IoT can provide considerable value is management of food safety and compliance processes. Restaurants want to avoid running afoul of food safety regulations at all costs, and for good reason: If they're found to be non-compliant, they'll suffer from negative publicity that can drive customers away (some for good) and lost sales from being shut down until they fix the problem. However, the processes to ensure a restaurant complies with all relevant regulations are manual and paper based. Subsequently, they are inefficient, require a lot of labor hours to execute, and introduce the opportunity for errors. By using the IoT to automate daily tasks, such as completing compliance reports, a QSR can standardize how employees execute those tasks across restaurants. This helps reduce labor costs and frees up the restaurant manager's time to focus on higher-value tasks.

Enabling better decisions through real-time insights

The IoT extends visibility into restaurant operations beyond the immediate restaurant manager. It enables regional managers, franchise owners and corporate decision makers to, in real time, monitor key data on multiple restaurants from anywhere, anytime. Such visibility gives them greater control over how the restaurants perform and helps them make faster, more fact-based decisions.

Conclusion

It's clear that the IoT can dramatically improve several key dimensions of a kitchen's operations.

These improvements include

- Enhanced food quality and compliance with food safety regulations
- Lower energy costs and reduced food waste
- Reduced total cost of ownership for key assets such as refrigeration units, ovens, and fryers
- Lower labor costs and greater employee efficiency and productivity

Such benefits are not insignificant. Given the high costs and inefficiencies of the typical QSR business model—and the resulting low margins—any kind of operational improvement or cost reduction can have a big impact on the business and its bottom line. But that's only the beginning. While initial adoption of this solution will lead to better line of sight into day-to-day kitchen operations that result in greater efficiency and lower operating costs, more significant benefits will likely accrue over the longer term as kitchen operators add greater functionality and other offerings. For instance, adding self-diagnosis and predictive maintenance capabilities to equipment can further minimize downtime and service disruption. Advanced levels of automation in restaurant operations can drive even greater standardization and consistency across restaurants, which can spur more rapid adoption of new product lines across the board. And by connecting cameras and motion sensors to a connected kitchen solution, a QSR could monitor food preparation equipment to gain more insights on how to boost product quality and training, as well as improve workplace safety and get real-time alerts of accidents. Eventually, enhancements to the same solution could even unlock new ways to increase customer satisfaction and retention, as well as create new revenue streams, by offering personalized, value-added digital services. For instance, customers may be willing to pay a small additional fee to watch, via a mobile app from their home, their specific order being made. While this may seem far-fetched today, it's only one example of how the connected commercial kitchen solution could boost the top line as well as the bottom line.

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