Original Article

IOT APPLICATIONS IN BUSINESS: EXEMPLAR WAY OF MAKING A SMART BUSINESS

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Abstract

In coherence with the progressive digitalization of all areas of life, the Internet of Things (IoT) is a flourishing concept in both research and practice. The rapid growth and accomplishment of emerging and IoT (Internet of Things) based technologies have allowed for various possibilities in technological advancements for different aspects of life. The foremost objective of IoT technologies is to simplify processes in different fields, to ensure a better efficiency of systems and finally to improve life quality. Internet of things (IoT) is the new paradigm, has a great impact on different areas like industry, health, education, agriculture, farming and many others and its main functions are to make our life easier and more comfortable. This conceptual paper aims to understand the real applications of IoT in various sectors of the business. Various application areas of IoT technologies were discussed as well as the progress made in this research article. Energy, Transportation, Healthcare, Logistics and Retails sectors are selected for analysing the real application areas of IoT in Business. Also significant research efforts are made carefully to investigate the pros and cons of using the IoT technologies by using the various secondary sources. This study stress that an clearer understanding is needed of how the IoT will impact on the ways that organizations go about their business at all levels. Finally this study profoundly reveals that the IoT technology helps to understand the various key elements, operational domains, and various cases of applying these technologies in the business. And also proves that IoT in business is essential from the back end to the front end, creating smart products and campaigning for customers, etc.

Keywords: IoT, Smart Business, Technologies, Privacy, Security, etc.

1. Introduction:

With rising technological developments in society, new possibilities have occurred and that could simplify our daily life and provide more efficient services or production processes. IoT technologies are nowadays assumed to be one of the key pillars of the fourth industrial revolution due to significant potential in innovations and useful benefits for the population. Thirty years ago, the first known Internet of Things device a vending machine at the Carnegie Mellon University in the US with remote temperature monitoring kept Coke cans cool in the summer heat. Today, the Internet of Things is everywhere. From connected cars, fridges and virtual assistants to applications in healthcare, logistics and retail that are keeping supply chains and hospitals running during the COVID-19 pandemic, the Internet of Things (IoT) is a technology that is transforming business operations and

creating new revenue streams. However, adoption rates are currently lower than expected, given the gains businesses could realise.

In the last two decades, the Internet of Things (IoT) has become a hot topic of discussion in various fields of life, defining objects that can connect and transfer data through the Internet. IoT is a new technology paradigm that aims to connect anything and anyone at anytime and anywhere, giving rise to new innovative applications and services. This technology enables physical devices to connect and exchange data through the Internet by gathering strategic information, thus creating opportunities for companies to be more efficient and responsive to market changes. The Internet of Things is a network of physical objects or devices that communicate and interact with each other via an internet connection.

IoT can revolutionize the business and consumer landscape by bridging digital and material worlds. Any industry reliant on making, moving or selling objects that were previously not connected to the internet stands to benefit. The specific benefits IoT can bring to a business depend on how the technology is used. For example, sensors can be used to reduce waste by optimizing lighting or heating based on occupancy levels, or reduce spoilage of products in transit by monitoring temperatures. IoT can also generate revenue and increase productivity, such as acoustic offshore oilfield sensors that analyse activity through pipelines to maximize output and help identify new resource pools.

2. Objectives of the Study:

- To understand the role of IoT in various sectors of the business.
- To investigate the pros and cons of using the IoT technologies in making the smart business.

3. Making Smart Business through IoT

The digital upsurge has given businesses an opportunity to adopt IoT to gain competitive advantage and provide better customer experience. But, IoT benefits can go deeper than revenue and profit growth. IoT will have a particular impact on sectors that are focused on the making, moving or selling of physical objects; from drugs to electric vehicles. Here are the 10 ways that IoT is transforming the business in success path and they hold common across all sectors:

- **Asset Tracking and Inventory Management**

IoT applications can enable you to manage your inventory by granting some automatic control options. Similarly, tracking asset in the supply chain with IoT can be an ideal solution to catch the assets that went missing in transit. Installing IoT products and software in your warehouses and storage units can aid you to manage inventory changes. Moreover, embedding surveillance systems with IoT and analytics can prevent theft before it takes place.

For example, Amazon increases its shipping capacity by engaging WiFi robots that scan QR codes on its products and track its order.

- **Data Sharing & Perception**

Almost all businesses function with the assistance of data collection and transmission, and the IoT adoption has completely revolutionized how data is processed. Apart from allowing greater access to user data, IoT applications can track the patterns in which a user connects with the device. By learning from the patterns, the application becomes smarter and offers a better user experience. Simultaneously, IoT products support businesses in deciphering that data for company growth. You can use the data to study consumer requirements, buyer cycle, the scope for enhancement & inventions and approaches for marketing & advertising.

For example, wearable devices like Fitbits and smart watches communicate data through sensors and offer the most precise information on our needs.

- **Forming New Business Lines**

Companies not only develop products but also monitor their product's performance, all thanks to the predictive maintenance algorithm embedded in the IoT platform. The feasibility to transfer the IoT data across the organization's ecosystem of customers and partners enables new paths of innovation in the form of continuous engagement and value-added services.

For example, John Deere, a farm equipment manufacturer employs the IoT in various ways to provide new as well as innovative products to their customers. These include self-driving tractors, intelligent farming solutions and more where sensors constantly monitor crop levels & soil health and offer farmers advice on what crops to plant and what fertilizer to use.

- **Effective Market Strategizing**

As enterprise can ingest, process, visualize and respond to huge volumes & variety of data they can ultimately build strategies to meet customers' needs. With the internet-connected devices, they are obtaining a 360-degree view of their customers' preferences and building campaigns that drive revenue from the audiences. Further, it helps to segment customer base, generate customized offers for boosting the customer satisfaction rate, and enhance their experience.

For example, Big Ass Fans have created their smart fans with light, speed and temperature sensors. Tailoring fan speed based on the user's comfort preference, this fan stands out from other ceiling fans on the market.

- **Driving Real-Time Insights**

Real-time data from processes, devices and people via sensors is revolutionizing businesses; since visibility into what is really going on can be a game changer. We are already observing innovation across the core sectors, especially in retail. By gaining real-time insights of buyers, retailers can stock products on-shelf and increase their profits with efficient sales and stock management.

The Internet of Things plays a key role in interconnecting devices like systems & smart cameras, to work collaboratively. Thereby, a business can make intelligent decisions, eventually acquiring innovations in business models that help to accomplish its business goals.

For example, Livestock monitoring deals with animal farming. With IoT applications, ranchers can collect data about the well-being of the cattle. By knowing timely about the sick animal, they can whip out and prevent a large multiplicity of sick cattle.

- **Facilitate Omni-channel Services**

Omni-channel approach to sales is highly acceptable today as it streamlines the entire shopping experience. IoT plays a major role in facilitating this service and improves the user experience manifold. Due to the incorporation of sensors on internet-connected devices, the organizations or manufacturers are facilitated to supervise the operations, status and service levels from remote locations and offer prompt support as and when customer demands.

For example, AWM's Smart shelf is equipped with high-def optical sensors and edge displays, which displays product pricing as well as information that send data about actual inventory levels and increases the shopping experience.

- **Accessibility, Efficiency & Productivity**

Beyond everything, customers always demand quick deliveries. Most of the business partners like logistics service providers and suppliers apply IoT technology solutions to ensure faster delivery of orders. Things don't close at processing with a great speed only. Businesses also need high-level efficiency and productivity. With

improved information about the market and consumers, you can increase the productivity of your business. In addition, IoT can support to orchestrate extensive automation and offer a real-time response on operational efficiency. These innovations will lead businesses to run cheaply and consequently, will expand the landscape intensely as insertion will be economical and manufacturing will become more feasible.

For example, IoT powered smart desks offers the ideal workstation for employees. The smart desks learn and adjust based on personal preference to ensure individuals are set up for best comfort as well as productivity.

- **Improve Customer Experience**

If the customers won't be delighted with your product, they will never provide positive feedback, which eventually leads to a decline in your market revenue. The feasible solution is building your product with the Internet of Things. By facilitating the support team with improved tools for monitoring the problems faced by the clients, IoT supports you to address and resolve them easily.

In addition, the mass integration of chatbots and artificial intelligence with IoT, focus on customer satisfaction and offer enterprise owners with a unique gateway into the lives of customers. Chatbots synthesize data as well as spot certain issues with any service or product that can be improved. The inclusion of AI into the IoT operations provides customer relation managers with valuable data and offers customers with instant support; as such, they can use the products in a better way.

Mercedes Benz's Mercedes Me Connect is a perfect example of how the IoT connected cars can deliver top-notch in-car customer experience. This connected car enables customers to connect with the world using modern sensors and technologies like machine learning to complement its IoT features.

- **Generate New Consumer Demands**

As the customers realized the uses of IoT applications, they begin to demand new things. Intelligent refrigerators make grocery lists based on its stock, for example. These would have appeared clueless ten years ago. In the future, this will be a standard feature of refrigerators.

- **Changing the Consumption Model**

The internet of things impact on business drives the changes in the consumption models. There are flexible consumption calls for the new business model that innovates how products are purchased. We have evolved from purchasing a product to pay-per-use. Thanks to IoT, it facilitates to measure the utilization of a product and charge by utilization.

4. Applications of IoT in Various Industries

Industry	Characteristics	Application
Energy	**Connecting**	Create smart home management systems, control home appliances remotely.
	Collecting	Generate real-time power consumption data to match demand-supply.
	Monitoring	Remote monitoring of assets in hard to reach places, e.g. wind turbines and geothermal plants.
	Monetizing	Better distribute investment and R&D by analysing consumer data.
	Optimizing	Alert operators on outages, manage congestion and inform on need for machine upgrades.

Healthcare	**Connecting**	Track own health more effectively and receive real-time feedback using wearable technologies.
	Collecting	Build complete picture of health of patients with historical analysis.
	Monitoring	Reduce need for hospital visits and maintain complete visibility of patient condition.
	Monetizing	Commercial retail opportunities in patient monitoring/wearable devices.
	Optimizing	Minimize waste and reduce error to improve patient care, reduce wait time at emergency room and enhance drug management.
Logistics	**Connecting**	Enhance communication by connecting all elements in a supply chain.
	Collecting	Improve efficiency and accuracy of assets by creation of digital replicas.
	Monitoring	Track and trace inventory and improved monitoring of production flow.
	Monetizing	Utilize logistics data as a market research product.
	Optimizing	Enhance operations through data capture and by mapping supply chains virtually.
Retail	**Connecting**	Location-based beacon technology.
	Collecting	Improve in-store layout, insights on how customers like to shop.
	Monitoring	Operate smart shelves to prevent theft.
	Monetizing	Creation of higher margin products.
	Optimizing	Repurpose existing enterprise technology like security cameras.
Transport	**Connecting**	Allow vehicle-to-vehicle communication for asset sharing schemes.
	Collecting	Use collected data to offer customers better value for money offers, e.g. in insurance industry.
	Monitoring	Engage in preventative maintenance.
	Monetizing	Reduce management and maintenance costs via smart parking solutions.
	Optimizing	Yield operational efficiency in vehicle fleet management.

5. Growing trends/ opportunities in IoT Technology

The Internet of Things (IoT) has been gaining more and more traction over the past few years as connected devices and smart home and office gadgets dominate the market.

- **Voice-Powered Technologies:** With the growing popularity of IoT devices, the interaction of business with customers is also changing. Take for instance Siri, Alexa and Cortana — who are advanced voice technologies — to perform countless searches as the customer orders. This one area of IoT is going to expand gigantically in the future.

- **Retail Data Tracking And Analysis:** Recent technological advancements have opened the door to IoT. Your watch, smart speaker and digital thermostat are all connected and the data they acquire can be used to improve your business. Because of the ubiquity of these devices, they can easily be leveraged to provide data from the world of retail. Tracking customer behavior within brick and mortar establishments can become invaluable for business owners.

- **Cyber security:** Every endpoint that is connected to the internet is exposed to increased risk and vulnerability. There are many new niche cyber companies emerging and they all claim to protect you and your business in the best way. Choosing the right cyber firm is like "merging houses with someone," so finding that right provider within all these emerging new businesses will be key for any business.

- **Internet Telephony:** I work in the office communication space and the office desk telephone has become a super versatile communications hub. To even call some of these devices desk phones or hard phones no longer seems appropriate because making phone calls is only one out of hundreds of features that these phones provide. In the near future, I see even more engagement on that front, where proactive use of social media based on location and proximity will trigger marketers and representatives to engage before there are questions and problems.

- **Real Estate:** With e-commerce booming, there are lots of opportunities to invest in industrial buildings. However, many investors are unaware of what most industrial businesses need. If you want to invest, make sure the building has adequate IoT devices. I own an e-commerce business and my building has automated management of inventory. We have IoT sensors and RFId tags installed in inventory systems. We also have smart shelves and temperature-monitoring sensors. These devices have made a significant difference in streamlining our business infrastructure and in the value of the building itself. Anyone looking for new business opportunities could find many opportunities in the real estate side of the IoT boom.

- **Seasonal Retail:** It wouldn't be surprised if we see more people using their IoT devices to do seasonal shopping this year. More consumers own smart speakers than ever before and most people already use them for shopping. As operating systems refine their voice search software, we will see more people use this technology to shop for loved ones. This will create new jobs for SEO specialists, e-commerce marketing experts and much more.

- **Patient Health Monitoring:** Patient monitoring in healthcare will emerge. The ability to monitor a patient without them having to come into the office or hospital will surely cut down on overall costs and improve quality of care since in most cases, it can be done in real-time.

- **Virtual Medical Care:** The use of IoT in the health sector is worth mentioning because medical services are using it to offer medical care at a distance. So now it's possible to perform operations or monitor the health condition of patients from remote places, even when the doctor isn't present physically with the patient. In a way, the use of IoT in medical services has revolutionized the way the health care system works.

- **Inventory Management:** IoT can play a significant role in improving the inventory management of retail companies. Storing and tracking goods is one of the most expensive tasks there is in running an e-commerce or physical retail store. IoT devices can track when a stock is down and automatically send an order for replacements. This creates efficiency, saves space and also lowers expenses. The savings are reflected in the final price the customer pays without reducing profits.

- **Senior Care:** I think that an important area where IoT can be applied is in looking after the elderly and other people who need care. IoT devices can be used to ensure that they have all their needs related to food and other

articles kept in stock without ever running out. Such devices can also help with security and monitoring the health and wellness of people who struggle to care for themselves.

6. Major key issues and challenges of IoT

The involvement of IoT based systems in all aspects of human lives and various technologies involved in data transfer between embedded devices made it complex and gave rise to several issues and challenges. These issues are also a challenge for the IoT developers in the advanced smart tech society. As technology is growing, challenges and need for advanced IoT system is also growing. Therefore, IoT developers need to think of new issues arising and should provide solutions for them.

IoT key issues	Specific concepts covered
Interoperability	General issues, IoT platforms and architectures, technical and semantic interoperability
Security and privacy	Security and privacy issues, definition and design of secure IoT networks and architecture
Management and control	IoT layer management and control, device, network, application, data and trust management and control
Architecture	Hardware, cloud centric, SOA, process architectures and conceptual models, application frameworks
Quality of Service	Data traffic load, protocols for all layers in IoT architecture, QoS and QoE routine check
Authentication and identification	Addressing issues and solutions, IoT integrations with internet protocols (IPv6), authentication and identification issues
Environment, power and energy	Involvement of green technology in IoT, design of low power consumption devices and chips, pollution control and management
Smart city, healthcare and transportation	Smart traffic management and control, smart devices for healthcare management, smart vehicles, energy management
Data processing and storage	Data analysis, visualization, integration issues and solutions
Reliability	Connectivity, mobility and routing issues, reliability of infrastructure and applications
Scalability	Scaling issues on large platforms and geographical locations, potential discovery services
Standardization	IoT definition, protocols design, architecture standardization, vision and framework design

7. Conclusion:

In this paper, a screening study covering the application areas of the Internet of objects was conducted, such as Energy, Transportation, Healthcare, Logistics and Retails sectors. Due to the technologies and especially the

cheapening and simplification of sensor technologies, it has become necessary to be in touch with all the objects we use in our lives.

Any business leader involved in the making, moving or selling of objects needs to consider if they should be using this technology. Companies need to be aware of the security and privacy risks, the infrastructure and, therefore, investment required and the need to comply with regulation that is sometimes opaque. However, in each of these areas the perceived barriers may be higher than the real ones, and business leaders can do more to educate themselves on the tangible ways these obstacles can be mitigated. Leaders should look to the growing number of experts in the field. This may include the work of groundbreaking companies, such as those profiled in this report, or dedicated internal IoT teams and taskforces. IoT is not a cheap fix and in some cases will require a radical re-think of processes, equipment and personnel. Leaders need to invest upfront, in particular to ensure the most secure components are used throughout the process. Whether any individual company chooses to implement IoT or not, adoption rates are set to rise over the coming years. Sectors that have previously not faced disruption from start-ups in the first phase of the internet may find new tech-enabled companies in their markets. The still limited research related to the role of IoT in business and provides excellent opportunities for subsequent research, especially exploring the connection of IoT with business model innovation; framework; development, dark side behavior; demand service; customer preference, marketer; new-age technology adoption; concept; network; big data. In a new expression defined as the future of the Internet, the IoT directs a new future surrounded by small smart objects that interact with the environment, communicate with each other, and are controlled over the Internet. It is thought that IoT technology will become the third-wave world industry after the computer and the Internet. This proper usage may lead to increase the profitability of the business and makes the customer more comfortable.

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