Case Study

4.0

INTERNET OF THINGS IN INDUSTRY 4.0 – A CASE OF GERMANY

Keywords: *Internet of Things, Manufacturing, Interconnectivity, Automotive, Industry 4.0.*

Background to Case Study

The Internet of Things (IoT) has become an important part of our daily lives. It surrounds us wherever we go: connected cars, home automation, smart office sensors and fitness trackers. But the world was not always like that. There have been visions of machines communicating with one another since the early 1800s. Machines have been providing direct communications since the telegraph (the first landline) was developed in the 1830s and 1840s. However, until 1999, the term "Internet of Things" did not even exist.

The first connected device was a Coca-Cola vending machine that used an early form of the Internet to see if the cooler kept drinks cool enough and if coke cans were available. This invention was a decisive factor for the development of interconnected machines all over the world. A decade later interconnectivity started to rise tremendously.

In 1990, John Romkey was the first to connect a toaster to the internet using a TCP / IP protocol. In 1991, at the University of Cambridge, scientists came up with the idea of using the first prototype webcam to track the amount of coffee available in their lab's coffee pot. 1999 was easily one of the most important years in the history of the IoT, as Kevin Ashton coined the term "Internet of Things". In 2000, LG Electronics introduced an Internet-connected refrigerator, which allowed its users to shop online and make video calls. All these important developments fostered the evolution of the IoT. (Khvoynitskaya, 2019)

Introduction to the Case Study and it's growth within Industry 4.0.

IoT-enabled management systems can be extremely beneficial for small business owners. With many small and medium-sized enterprises (SMEs) struggling to stay afloat, those who have integrated advanced IoT systems into their day-to-day operations have seen great benefits.

The Internet of Things will play a key role in the development of Industry 4.0 with its ability to connect physical devices to digital platforms creating a more conducive environment for manufacturing and management.

IoT systems consist of a set of sensors and "smart" devices that, in a sense, communicate with each other via the cloud. The sensors and devices detect changes in the state of their environment or collect the requested data from their designated target for the software to process and then decide on an automated response, such as issuing a notification to responsible parties.

In short, IoT is about gathering information and using accumulative data to improve existing business practices and promote communication between devices. (Saribardak, 2020).

This connectivity of devices (smartphones and automobiles) is crucial for the mobility sector, which is one of the main problems of large cities. The application of Internet of Things and Big Data to the world of carsharing *offers us a way to improve urban traffic. Together with the massive data processing, connectivity allows users to be in contact with companies and calculate the most efficient routes to minimize the travel time.*

The Case Study and Industry 4.0 Elements: A Pictorial Overview

In the following graph we can see the monitoring and control system model of IoT. IoT devices are pieces of hardware, such as actuators, gadgets, appliances, sensors or machines, that are programmed for certain applications and can transmit data over the internet or other networks. IoT devices connect to the network through the router and have the ability to send data to the remote server over the Internet or to the Cloud services. Sensor data collected by IoT devices is stored in the Cloud database in order to be available to users. This information is accessed by users from any location using desktops, tablets or smartphones.
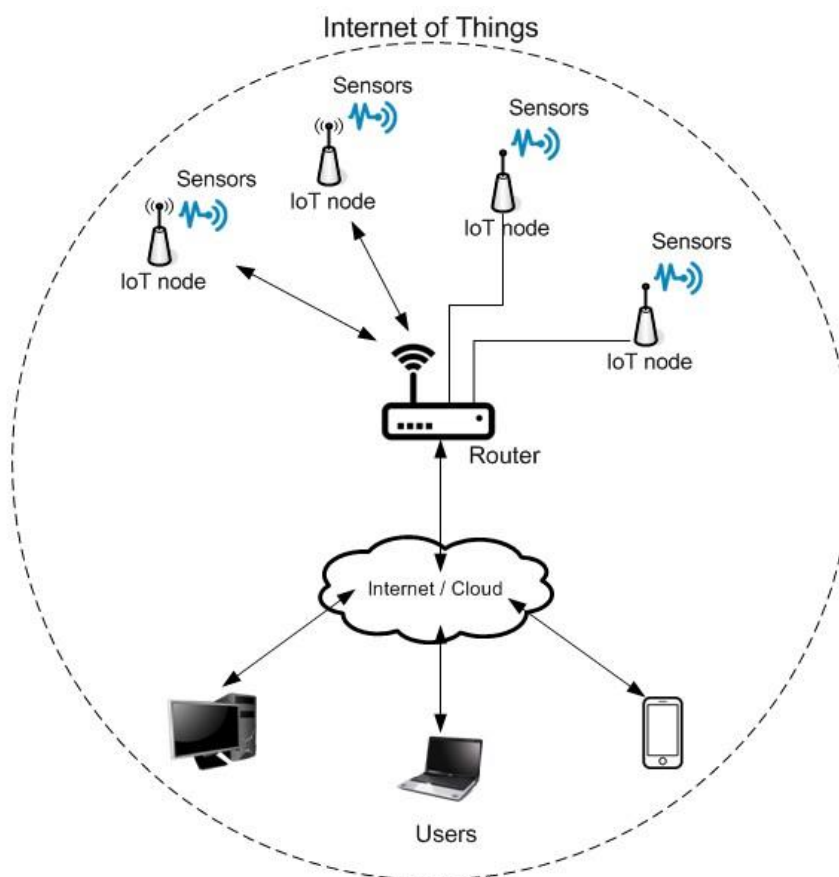
©Source: Markovic, 2015

IoT Technology has led to a disruptive evolution of the rent a car model towards carsharing. The concept refers to the loan or temporary use of vehicles made available to users in exchange for a specific tariff, generally for short periods of time and in limited geographical areas.

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| The Element Explored within Industry 4.0 Application.

DAIMLER

CAR 2GO | *Since its founding in 1924, in the southern German city of Ulm, Daimler has become one of the world's leading automobile companies, producing highly recognizable brands such as Mercedes, Maybach, Smart and Freightliner. With a vision to revolutionize internal operations, Daimler turned to IBM to help launch car2go, a company providing on-demand eco-friendly smart cars that users could book through an app from their cell phones. Car2go represents a bold redefinition of the automotive industry's role in the wider transportation industry and none of that would have been possible without the IoT.*

Sensors and wireless communications allow the company to monitor individual vehicle performance, analyze data to increase efficiency, and provide its customers with an accessible vehicle network. A smart mobile app allows members to pick up any of the car2go vehicles distributed around them or book a vehicle for future use. This gives customers easy access to a vehicle when they need it, without having to buy a vehicle or pay for a car park, which can be very expensive in the big cities. (Schimek, 2015)

Furthermore, the use of Daimler's IoT technology enables creative collaboration with neighboring industries. For example, user-specific data makes it possible to offer customized and travel insurance policies instead of traditional aggregate data policies for all users. Today, car2go is used in 23 towns and cities by 450,000 customers having 8800 vehicles in operation.

Robert Henrich, Managing Director of Daimler Mobility Services GmbH, says: "We grew considerably in the first eight months and are well on the way to achieving our ambitious targets." (Daimler, 2020) |
| **Application Target Audience** | *The results of the case-study are intended for use by SMEs, Enterprises and Entrepreneurs.* |
| **Resources Used:** | *- "The history and future of the internet of things", by S. Khvoynitskaya. (2019) Available here.*
- "How IoT Reshapes Industry 4.0 and the Effects of IoT on SMEs", by E. Saribardak. (2020) Available here. |

	-"Application of IoT in monitoring and controlling agricultural production." By Markovic, D., Koprivica, R., Pesovic, U., & Randic, S (2015). Available here. *-"IoT Case Studies: Companies Leading the Connected Economy", by R. S Schimek. (2015) Available here.* *-"Car2go on the road to success", by Daimler. (2020) Available here.* *-"car2go: Daimler's new concept for individual urban mobility" by Daimler. (2021) Available here.* *-"A Brief History Of the Internet of Things". By Keith D.Foote. (2016) Available here.*
Further Reading:	*- "Guide to IoT Innovation (SME focus)", by IoT Analytics Available here.*

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