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Logistics companies have experienced a tremendous amount of growth over the years and it is poised to continue. Finding ways to make supply chains run smoother is a crucial step. This paper discusses the origins of the Internet of Things and its current challenges, its evolution into what it is today, and what it's set to become in the future. It provides a brief overview of the technologies that made it possible, are currently used, and are expected to be used.

This paper also goes into some current implementations that logistics companies use.

1 Introduction

A study from The Bureau of Infrastructure, Transport and Regional Economics shows that the amount of bulk goods the freighting industry has shipped via rail since 2007 has increased from 642.8 tonnes to 1322.1 tonnes (BITRE, 2019) demonstrating a need for greater organization in order to ensure people get their deliveries on time. This is the role of logistics. A logistics company will facilitate the movement and storage of goods. The question is, does having accurate and up to date figures allow logistics companies to make informed choices? If so, the Internet of Things (IoT) may provide the solution.

Gold (2017) defines the IoT, which is also called 'Internet 4.0', as smart devices that are able to share data they collect. The kind of data gathered and shared varies depending on the application.

2 Timeline – Past and future

IoT has come a long way from its origins. The earliest example was a Coca-Cola vending machine located in Carnegie Mellon University's computer science department in 1970 as published

in Browning's (2018) article "IoT Started with a Vending Machine". It was fitted with switches that would count when a drink gets dispensed and when the machine was last refilled. Computers with the software installed would be able to access the device and have it return the values using the command "finger coke@cmua".

Radovan (2017) describes how things changed since this time, starting with a commercial internet, known as 'The Internet', which provides a global network enabling more device interconnectivity. Stephen Mraz (2016) published a panel of experts discussing the current state of IoT. Some businesses are still looking for ways that they can incorporate IoT devices into their supply chains, but a lot of businesses have already succeeded.

Ploennigs (2018) shows some issues that will need to be overcome and highlights some advances that are expected to have some impact, such as the development of Artificial Intelligence, Blockchain, and 5G.

3 Technology

IoT devices that are particularly useful to the logistics industry share two key features - a way to gather data, and a way to share it.

Technology has changed since its first implementation. It has evolved from switches (as seen in the Coke vending machine) to barcodes and radio frequencies.

Suresh et al. (2014) has a non-exhaustive list of technologies that are used to enable the collection and sharing of data:

- Radio Frequency Identification (RFID) – Utilizes an RFID chip and reader. Goods will have a chip placed in them (or in the packaging).

- IEEE 802.11 (better known as Wi-Fi) – Enables IoT devices to connect to networks wirelessly allowing them to share data.
- Barcode/QR – Goods will have a barcode or QR code printed on them. An IoT device fitted with a scanner can scan the barcode/QR code and gather data.
- Bluetooth – Similar to Wi-fi, allows IoT devices to connect to networks wirelessly.
- GPS (Global Positioning System) – Enables the collection of location data.

4 IoT in industry

Just-in-time (JIT) manufacturing is where a manufacturer will only have the goods on premises that are currently being worked on, it is employed in areas that have lower space, or by businesses that are unable to afford a high level of stock. This requires a deal of coordination as you don't want any downtime. IoT offers a solution to this, Caballero-Gil et al. (2013) provides an overview of how technology (including IoT) impacts complete supply chain process – up to delivery to the consumer. In their proposed solution, IoT is used to compare the delivery note with transported goods, determine their origin and destination, and monitor their location. This pairs well with JIT as it allows manufacturers to have accurate data of their stock levels at all stages of manufacturing.

Tadejko (2015) highlights some challenges that the manufacturing industry faces implementing IoT devices. Because many devices are connected to the internet, and they use many different operating systems, businesses need to be confident that the data security practices are followed. It is kept private (unread and unaltered by unauthorized parties), the data's integrity is maintained (all data is read and sent correctly), and data is available. These are fundamental data security concepts backed up by the Open Information Security Management Maturity Model (O-ISM3) (Aceituno, 2017).

5 Conclusion

In conclusion, the IoT is an inevitable evolution since the introduction of the internet. Starting with a coke machine and developing into its current form and beyond.

The technologies that are available have changed throughout the years and more are expected to be developed with some breakthrough in AI, blockchain technology and 5G paving the way for greater things.

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