**Emerging Technologies on the role of Digital Transformation**

**Executive Summary**

Giant organizations are more focusing on less human interaction based services, so that their services can get rid of human dependencies and facilitate their customers more frequently. Recently e-Commerce Giant Amazon is introducing cashier-less grocery stores throughout the United States where people can simply come, pick their items and walk away from the store, payment is charged digitally (Amazon Go Editorial Staff, 2017). To give a new grocery shopping experience, it incorporates emerging technologies like computer vision, deep learning algorithms, and sensor fusion to automate the purchase, checkout, and payment steps associated with a retail transaction which can be tiring and time consuming for both customers and employees. It has also trimmed the business cost for hiring employees for the stores.

**Introduction**

In the era of modern technology, the world is emerging to automate and replace monotonous works for human beings with robots or computers to comfort themselves and also to do things more efficiently. From driver-less cars to cashier-less stores, automated systems are getting rid of human dependencies in every way possible. In this report, we will discuss about emerging technologies used by organization “Amazon”, taking their part on digital transformation of retail stores.

Amazon is one of the biggest online retail store in recent times, along with its many other services (Nida Turegun, 2019). From online, Amazon is emerging to the physical retail market to show its dominance over retail industry, also to introduce a new shopping experience which will automate and replace retail store processes with advanced technologies (Nick Wingfield et al., 2018). They are also referring it as “Just Walk-Out Technology” (Kirti Wankhede, 2018).

Providing best services to the customers with minimal production cost is the most common business aspect of every company. In this era, a best service is be a combination of service quality, user comfort and service delivery time. Less human interaction based services can reduce the bottlenecks for providing a service to customers as well as cost for human resources. Cashier-less Amazon Go Store is a perfect example for this aspect where they showed a way to reduce human intervention in a retail store. And it has influential future for both customers and retail companies.

**Discussion**

In this section, we will discuss more deeply on the emerging technologies that Amazon used to replace the cashier and automate the grocery store experience for the user. Amazon claims they have used the same technologies as a driverless car use like constant monitoring with cameras and sensors (Amazon Go Editorial Staff, 2017). It also incorporates technologies like block-chain, user personalizing etc. in the mobile application.

**How It Works**

The first step is opening an Amazon account, downloading the Amazon Go application on smart phone and signing in. The Amazon Go mobile application is linked to Amazon account for user verification and actions. A user enters a store by scanning QR code from the store. The application immediately recognize and response with the particular store information, also initializes shopping session for the time being. User can then only pick up the items and walk out of the store, no actions are required. Behind the scenes, the Amazon Go stores have cameras which can identify any action from the user and weight sensors on the shelves to detect which items are removed from or added to the shelve. When a user picks an item, it automatically added to a virtual cart which can be found in the user's mobile application. For checking out, user has to confirm items and proceed to payment through the application. Payment is also integrated with the Amazon account. (Amazon Go Editorial Staff, 2017).

**Technologies Used**

The stores have multiple cameras, microphones, different sensors to monitor activities continuously and again without any human interactions. To do that, advanced computer vision, deep learning algorithms are used such as facial recognition, object detection, anomaly or abnormal behavior detection (Alex Polacco and Kayla Backes, 2018). It also uses advanced technologies on the mobile application such as secured online transaction, user personalizing, authentication and many more. Technologies are discussed briefly below.

* **Facial Recognition**

Video surveillance or monitoring systems are in practice in the retail industry since 15th century (Nada Elnahla, 2019). For constant monitoring, face recognition added a new metric because it can provide the information who is responsible for certain action. Amazon Go uses advanced facial recognition technology to identify each customers by linking their images to their user profile in Amazon account. It helps to spot purchase, checkout process, creating user’s session by recording their entering and exiting actions.

* **Anomaly or abnormal Behavior Detection**

With the help of deep learning algorithms, the field of computer vision has shown promise in recent years (Huimin Lu et al., 2018). Computers can adapt human surrounded environments and identify any abnormal activity as well. 3D Computer vision software has already been developed that scans the subject animal’s behavior in order to try and measure the quality of life of the animal (Alex Polacco and Kayla Backes, 2018). It can differentiate abnormal or unusual activities from normal activities. It prevents occurrences like shoplifting, fight, robbery or any chaos in the shops.

* **Fusion Sensors**

Hardware sensors are primitive and one of the most efficient technologies for monitoring. Amazon uses fusion of sensors (Kirti Wankhede, 2018), meaning, sets of sensors such as pressure detector/ sensor, weight sensors, unique identifier through radio-frequency identification (RFID) tags, distance and dimension measurement sensors. The sensors are placed mostly on the aisles or shelves to identify what’s being picked and whenever any item is removed.

* **Virtual Cart and Self-checkout**

Virtual cart in the mobile application helps user to keep track of their purchases, product details and proceed to checkout. It also incorporates self-checkout technology. Self-checkout technology has been already introduced by other competitors in retail industry, such as Kroger, the grocery chain (Nick Wingfield et al., 2018).

* **Cashless Payment**

Amazon uses its own payment platform, where users buy credits in their online wallets and spend from there. The idea of cashless payments are not new, but it was mostly associated with banks or financial organizations (Alex Polacco and Kayla Backes, 2018). But more secured payment can be done through these online platforms, using technologies like block-chain. Where transactions can be grouped into blocks and written to the database by cryptographic verification, and which makes it almost impossible to change the original state of the transaction by any fraud (Nida Turegun, 2019). Amazon Go also wants to transform traditional payment method to their platform by using block-chain technology. Which will eradicate dependencies on the banks or financial organizations.

* **User Verification and Personalizing**

The mobile application enables user verification using face recognition and personalizing all in one device which makes the shopping experience more user friendly. As it stores actions from the user, it can identify and analyze user’s data and personalize according to user’s liking. This feature is already done in their website (amazon.com), where they analyze data from the user for their recommendation system. Behind the scene, machine learning algorithms analyze the data and build a predictive model for the user profile.

**Before And After Effect**

Amazon first introduced its Go stores in early 2018. In this section we will discuss about its impact over the retail industry, also the before scenario of retail stores.

* **Before Scenario:**

In the traditional retail stores, the customers have to line-up in a queue for checkout and carry cash in hand for payment which can be time consuming as well as tiring at some point for the customers. From the cashier side, it is a relentless task do make the payment for every customer and the company has to spend a decent wage for cashiers. Other competitors of Amazon were also trying to introduce technological revolution like secured cashless payment methods, self-checkout, user personalizing. But Amazon is the first to draw attention to the retail industry by accumulating all the necessary features for a completely new shopping experience.

* **After Impact:**

With this revolutionary concept of cashier-less store, Amazon shows the world that people are going to be more reliable and dependent on technologies, less on humans in the future. Though it seems retailers will not need cashiers, but human interaction will be needed in different capacities. It appears to ease retail shopping experience. It saves time and hustle for customers as well as the company. It is more secured and handy. That’s why it caught general people’s attention very quickly. And it surely will create more competitions, not only in the retail industry, but also in the technology (both hardware and software), warehouse and financial industry. Despite of all the promising sides, there are issues that users pointed such as privacy. Many of the users don’t like to be continuously monitored and recorded by cameras while they are shopping.

**Conclusion:**

Amazon basically accumulates several advanced emerging technologies to prove a concept that a complex environment like retail grocery shop can be managed without or with less human interactions and it can run as smooth as before. With this concept, it also proved that humans will be required in more innovative works rather than simple and monotonous jobs in the future. And emerging technologies will keep easing people’s lives day by day with digital transformations like this.

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**Appendices:**

Table I summarizes overall impact of Amazon Go in digital transformation.

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| --- | --- | --- | --- |
| Technologies used | Created Competition in | Pros | Cons |
| 1. Computer Software using advanced Computer Vision, Deep Learning, Machine Learning Algorithms. 2. Advanced Hardware, fusion of sensors such as, RFIDs, weight, distance, dimension sensors. 3. Secured online transaction with Block-chain technology. 4. User friendly mobile application. | 1. Retail Industry. 2. Bank or Financial Industry. 3. Technology; Software and Hardware Industry. 4. Warehouse Industry. | 1. Less time consuming and hustle free shopping experience. 2. Cost efficient for business purpose. 3. Less dependency on humans. 4. Ease of life for humans. 5. Secured online transaction, cashless payment. 6. User friendly application enables assistance in their shopping. | 1. More dependency on technology. 2. Privacy issues. Users are constantly being monitored and recorded by cameras. 3. Cashiers will lose their jobs. More likely people will be unemployed due to advancement of these technologies in different industries. |