IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

AMAZON GO – JUST WALKOUT TECHNOLOGY

Mr. Prakash Hongal
Dept of CSE
SKSVMACET
Laxmeshwar, India

Mr. Shrikanta Jogar
Dept of CSE
SKSVMACET
Laxmeshwar, India

Tejashwini Patil
Dept of CSE
SKSVMACET
Laxmeshwar, India

ABSTRACT

Amazon Go's "Just Walk Out" technology revolutionizes the retail experience by eliminating traditional checkout lines and offering a seamless shopping experience. Leveraging a combination of computer vision, sensor fusion, and deep learning algorithms, this innovative system tracks items as customers pick them up and automatically charges their Amazon account upon exiting the store. The technology enhances convenience, reduces friction in the shopping process, and exemplifies the future of retail automation. By combining sophisticated computer vision, sensor fusion, and machine learning algorithms, this system enables customers to enter a store, select items, and simply walk out without the need for traditional checkout processes. As customers navigate the store, sensors and cameras track their movements and interactions with products, accurately detecting items taken or returned to shelves. This data is seamlessly processed to generate a virtual cart for each customer, ensuring accurate billing through their Amazon account upon exiting the store. The technology not only streamlines the shopping experience by eliminating checkout queues but also minimizes human error and theft concerns. Amazon Go's "Just Walk Out" technology represents a paradigm shift in retail, setting new standards for convenience, efficiency, and customer satisfaction.

This abstract explores the key components and functionalities of Amazon Go's Just Walkout Technology, highlighting its impact on customer experience, operational efficiency, and the retail landscape as a whole. It delves into the underlying technologies such as computer vision, sensor fusion, and machine learning algorithms that power this seamless shopping experience.

Furthermore, the abstract discusses the benefits and challenges associated with implementing such technology, including enhanced customer satisfaction, reduced labor costs, and data privacy considerations. It also examines the potential implications for brick-and-mortar retailers and the evolution of consumer behavior in an increasingly digitized world.

Overall, Amazon Go's Just Walkout Technology represents a transformative shift in retail operations, offering a glimpse into the future of frictionless shopping and prompting industry-wide discussions on the convergence of physical and digital retail experiences

INTRODUCTION

T visionary concept has redefined the very essence of retail, eliminating the checkout process altogether and ushering in a new era of frictionless shopping. At its core, Amazon Go represents a convergence of cutting-edge technologies that seamlessly blend the physical and digital realms. Gone are the days of waiting in line or fumbling with cashiers – instead, customers are empowered to enter a store, select their desired items, and simply walk out, with their purchases automatically tallied and charged to their Amazon account. Amazon Go revolutionizes the shopping experience through its groundbreaking "Just Walk Out" technology. At the core of this innovation lies a sophisticated system of sensors, cameras, and machine learning algorithms meticulously integrated into the store environment. Upon entering, customers use the Amazon Go app to scan a QR code, linking their account and payment information. They then proceed to browse the store, selecting items they wish to purchase without the need for traditional checkout lines or registers. As shoppers pick up items, the technology automatically detects and adds them to their virtual cart. When they exit the store, their Amazon account is promptly charged, and a digital receipt is issued. This seamless process not only saves time but also enhances convenience, offering a glimpse into the future of retail where frictionless transactions redefine the shopping landscape. With its emphasis on efficiency and customer-centric design,

Amazon Go sets a new standard for retail innovation Amazon Go revolutionizes shopping with its advanced "Just Walk Out" technology. This technology combines sensors, cameras, and machine learning algorithms to create a seamless shopping experience. When customers enter the store, they scan a QR code in the Amazon Go app, linking their account and payment details. Upon entering an Amazon Go location, customers utilize the Amazon Go app to scan a unique QR code, which links their account and payment information to the store visit. This initial step ensures a personalized and frictionless shopping experience from the outset. As customers navigate the store and pick up items, the technology springs into action. High-tech sensors and cameras strategically placed throughout the store detect the items customers take from the shelves. Simultaneously, machine learning algorithms work in real-time to accurately identify and add these items to the customer's virtual cart. There are no traditional checkout counters or lines in Amazon Go stores. Instead, customers can simply exit the store once they have completed their shopping. The "Just Walk Out" technology automatically tallies up the items taken and charges the customer's Amazon account accordingly. Behind the scenes, Amazon's system continuously monitors the store environment, ensuring accuracy and security at all times. Any discrepancies or anomalies are quickly identified and addressed, maintaining the integrity of the shopping experience. Amazon Go sets a new standard for frictionless retail experiences, showcasing the power of advanced technology in enhancing customer satisfaction.

II.METHODOLOGY

The architecture of Amazon Go represents a complex ecosystem of interconnected hardware and software components.

Hardware Components:

Sensors: Amazon Go stores are equipped with an array of sensors placed strategically throughout the premises. These sensors detect when items are taken from or returned to the shelves, allowing the system to track inventory in real-time.

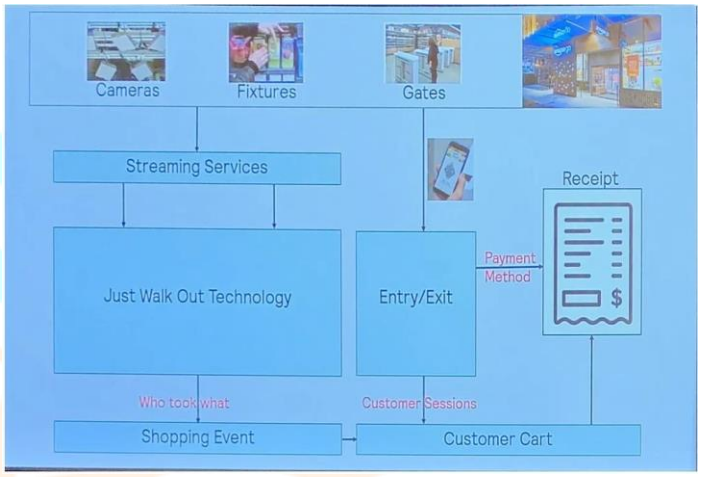
Cameras: High-resolution cameras are installed in the ceiling of the store, continuously capturing footage of the shopping area. Computer vision algorithms analyze this footage to identify customers and the items they interact with.

Software Components:

Computer Vision: Advanced computer vision algorithms process the video feed from the cameras to recognize and track customers as they move through the store. These algorithms can identify individuals, their movements, and the items they pick up.

Machine Learning: Machine learning algorithms play a crucial role in analyzing the data collected by sensors and cameras. These algorithms learn patterns of behavior, enabling the system to accurately predict and update a customer's virtual cart in real-time.

Data Processing: The data collected from sensors, cameras, other sources are processed in real-time to ensure accuracy anefficiency. This involves complex data processing pipelines that handle large volumes of data and extract meaningful insights.
Integration with Amazon Account: The Amazon Go app integrates seamlessly with customers' Amazon accounts. When customers enter the store and scan the QR code in the app, their account information is linked to the shopping session, allowing for automatic payment processing.



Working:

Technologies such as computer vision, sensor fusion and deep learning underlines Amazon Go. Amazon Go stores use cameras to track a user's action in the store. This is where computer vision plays a crucial role, allowing computers to process visual information and generate appropriate algorithms based on the data that is gathered, to generate relevant results. It would use a system of cameras, sensors and/or RFID readers to identify shoppers and the items they've chosen. It also suggests that from the time a buyer enters into the store to the time he checks out, cameras take photos of various actions—essentially when they enter store, while removing items and while keeping the items back in shelf. This data along with facial recognition and other user information like height, weight, user biometrics, purchase history etc., is being reportedly used to sketch the final iteration of these stores, and this is where AI play comes into picture.

Based on the data collected, they are trained to identify the user and activities they carry out inside the store with the items on display. The second important part of the overall working is the Sensor Fusion, which is essentially an amalgamation of sensor data from a number of inputs, such as weight and motion sensors. When paired with computer vision, it helps in determining if someone has picked an item or placed it back. The final part comes in the form of deep learning a part of machine learning that enables computers to learn by continuously collecting and analysing digital data.Portability:

Go store is a "Computer Vision Complete" Computer Vision -Machine that sees like a human, means the technology needs to replicate the brain, eyes and visual cortex. Not simply recording images and videos but also to recognize, identify, understand the object it tracks. To have all these features it requires Machine Learning.The computer is trained with a multi-layered convolutional neural network..

To know who takes what, there are 6 core problems:

1. Sensor Fusion
2. Calibration
3. Person detection
4. Object recognition
5. Pose estimation
6. Activity analysis

The heart of the Go Store is the Computer Vision based Machine Learning that is used to seamlessly track and estimate the intention of everyone in the store. Amazon went into a surprising level of detail on their implementation of this technology.

Sensor Fusion: Aggregate signals across different sensors (or cameras because this was solved using nothing but computer vision)

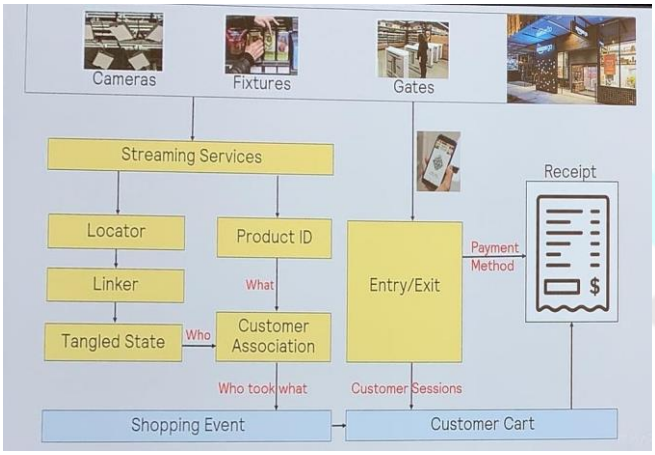
Calibration: Have each camera know its location in the store very accurately

Person detection: Continuously identify and track each person in the store

Object Recognition: distinguish the different items being sold

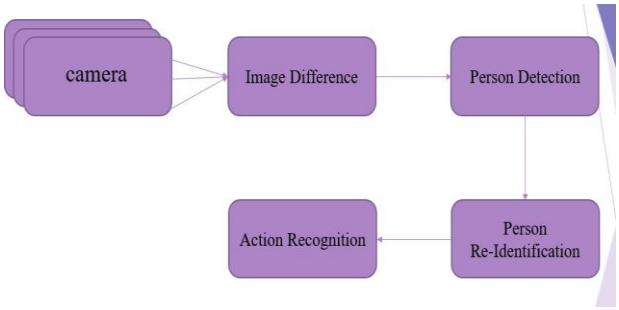
Pose estimation: detect what exactly each person near a shelf is doing with their arms

Activity Analysis: Determine whether a person has picked up vs. returned an item..



Person Identification

Locator: The question "Who took What?" could not be solved as a series of independent picks. Amazon had to track each person the whole time they were in the store, from the moment they walk in until they leave. Some of the difficult problems that had to be solved by the Locator component were:



• Occlusion, where a person is blocked from view by something in the store

• Tangled State, where people are very close to each other

To address these problems, Amazon uses custom camera hardware that does both RGB video and distance calculation. From there, they segment the images into pixels, group pixels into blobs, and label each blob as person/not-person. Finally, they build a location map from the frame using triangulation of each person across multiple cameras.

Linker:

The next task was to ensure the labels are preserved across frames in the video, moving from locating to tracking the customers in the store. The problems experienced in this phase were:

Disambiguating Tangled States:

When 2 people get very close together, this lowers confidence of who's who. The go store technology handles this by marking these customers as low confidence, so they get scheduled to be re-identified over time. There is a follow up phase for distinguishing Amazon Associates, who likely perform different behavior than customers (for example, they likely put items on shelves rather than take them off). Item identification.

Product ID detection:

The key question to answer here is: which specific items are off of the shelf and in someone's hand. Some of the problems faced and solutions in this phase were: Items that are very similar, like 2 different flavors of the same brand of drink, were distinguished using residual neural networks that do refined product recognition after the CNN layer identifies the item class Lighting and deformation changes the items, which was solved using a lot of training set data generation for these specific challenges.

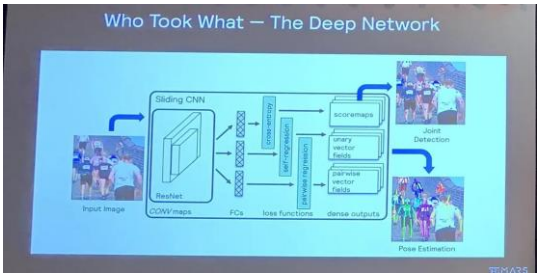
Customer association:

Probably the most challenging problem is combining all of the information from the above steps to finally answer the "Who took what?" question.

Pose Estimation:

The Location tracking Go store cameras look from the top down, not from an isometric view, so they need to trace a path through the pixels representing the arm between the items and a

customer. A simple top down model did not work well enough to solve this problem, so the team set out to build a stick-figure like model of the customer from the video.



REFERENCES

[1]. L International Journal of Creative Research Thoughts, Amazon Go!!! Just Walk Out (2023). ISSN 2320 – 2882

[2]. Shekokar, N., Kasat, A., Jain, S., Naringrekar, P., & Shah, M. (2020). Shop and Go: An innovative approach towards shopping using Deep Learning and Computer Vision. 2020 (ICSSIT). doi:10.1109/icssit48917.2020.9214256

[3]. International Journal of Innovative Science and Research Technology. Just Walk Out Technology in Hypermarkets (2023). ISSN No:-2456-2165

https://www.youtube.com/watch?v=NrmMk1Myrxc

Tangled states
https://www.youtube.com/watch?v=uy3cEl37T4c&t=1s

In action -
https://www.youtube.com/watch?v=KnTGFWthufc

Stick figure model -
https://www.youtube.com/watch?v=9LTHGgYBs8U