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Supermarket Companion - Connecting Hypermarkets via Cloud Computing

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Abstract
The development of the project proposes an all-in-one platform that fills the missing link between supermarket systems and the consumers. This is a platform that makes use of cloud technology to provide consumers with features necessary for grocery shopping to be done in a more efficient way. Such features as recipe databases will benefit customers in terms of revealing ingredients and viewing their real-time availability across existing supermarkets. The need for unnecessary trips to supermarkets is eliminated. For example, this platform uses computer vision technologies to carry out crowd detection which gives information on how busy or congested a supermarket is. Consequently, it can help consumers choose where they are going, saving them time and helping reduce their stress levels. Cloud computing makes communication simpler among supermarkets, manages the data of recipe databases, inventory information, crowd detection data as well as user interface design enabling customers interact with the platform. In addition, barcode scanning has been used both for giving complex product information quickly and creating a more effective checkout system through "Scan and Checkout" system; other features incorporated include "AI chef" which is chatbot system. Also, customers accessing the website will input their allergies to foods, their health requirements, and additional details about foods they prefer.: Every time a customer selects a product for addition to the cart, if, for the product, there is an ingredient the customer is allergic to, then on the screen there will appear an alert informing the customer of the product. This makes the shopping less dangerous than before and according to the health requirements of individual shoppers, as well as their dietary habits. All in all, it is the governmental supermarket's project which aims to change the grocery environment and provide complex and individually tailored information to improve the offline grocery shopping and provide useful insights for the participating supermarkets.
Keywords: *Cloud-based platform enhancing grocery shopping efficiency with real-time data, AI, and personalized health insights.*

1. Introduction
A truly profound adage of today's retail structure can be summed best in saying that it is all about the customer. Consumers want to be addressed individually; their business done quickly and in a clean environment that meets or recognizes their comfort. In fulfilling these needs, this project conjugates the positives of technology to build an efficient shopping environment. We focus on two key areas: improving customers' satisfaction aspects such as easier and more efficient billing, the usage of AI chatbots, coping with customers' health problems while browsing products, and the individual approach to the products' choice. [1] Grocery shopping can be very much a time controlling issue because of the kind of searches, lack of immediate information feedback as well as crowded stores which results into futile shopping trips and shelves. Lack of crowd level information makes it difficult to select the perfect supermarket and make the right decision concerning consumption, especially for people with special medical conditions. These challenges help to reveal the urgency of the properly connected shopping. But in the context of the present-day environment where time is of the essence, improvement on grocery shopping cannot be overemphasized. [2] People face rather tight work schedules today, and consumers want everything to be as convenient as possible, including food shopping. Having to maneuver the

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trolleys through congested pathways, search and find products and finding that shelves are empty is a nuisance to the shopping experience. Another aspect of people's health and wellness increases the need for providing sufficient and detailed information about products suitable for people with special dietary needs or health restrictions. If the above-mentioned pain points are managed and technology is harnessed, then this project is relevant to consumers' demands and expectations of today to provided improved quality of life. Grocery shopping is today characterized by information inadequacy and huge numbers of people in the stores. The "The Connecting Super Wal Mart through Cloud Computing" project is a proactive measure that seeks to resolve these problems by designing a platform that links supermarkets and consumers. The platform connects to the recipe databases and employs the concept of cloud to show inventory and crowd data live. This helps with locating an ingredient, buying foods without having to go to the physical store and saves on avoiding crowds. For the self-cart system, a barcode scanner should be incorporated, while a virtual assistant in the form of an AI chatbot to help answer customers' questions about products should be considered essential features. This project aims to transform grocery shopping into a seamless and stress-free journey. One could easily picture the process of shopping for groceries in the future. Supermarkets are linked by a single interface fuelled by a cloud-computing system. It means that the store offers the ingredients for the recipes, display of the real stock, self-scan, and an automation bot. based on works in computer vision, it supplies a means of knowing the number of people in a supermarket, so that you can select the most effective one. This project aims at saving customers' time, and this simplifies the process of shopping for groceries. Another is the customization of its health and dietary profiles on the member's end. Customers provide details regarding foods that they are allergic to, their health state and their choose diets. When a specific product with allergens is placed in a cart an alert guarantees a safer shopping for a particular user or group of users. It indeed makes shopping wise and assured, which is the element of meeting customer needs in a proactive way. This report is divided into the following parts: problem statement, why the project is needed, the project goals, what the project does, project purpose and specifications, how it works and is implemented and conclusion. Under the system architecture portion of the paper, the author explains the designed layout and structure of the system. Implementation details refer to who, what, where, when why and how of the system. In the concluding part, the idea is highlighted about grocery shopping revolution and further developments of the project. [3]

2. Related Works

2.1 Future Supermarket: Overcoming Food Awareness Challenges

Author: Sergio González-Miranda, Ramón Alcarria, Tomás Robles, Augusto Morales, Ignacio Gonzalez [1] (2013). This paper by González-Miranda et al. (2013) proposes an IoT-based system to improve food awareness in supermarkets. They highlight the limitations of traditional labelling, which often lacks detailed and personalized information. The new system uses cloud-hosted modules and consumer profiles to provide real-time, tailored product information via QR code scans. A pilot implementation demonstrated the system's effectiveness, enhancing the shopping experience by helping consumers find products that meet their specific needs. User feedback confirmed its potential to significantly improve consumer satisfaction and supermarket competitiveness. [4]

2.2 A Fast Cloud Based Pervasive Method of Cart Billing System for Supermarket Using Real Time Technology

Author: M. Jothibasu, S. Boopathy (2017). This paper introduces an innovative approach to supermarket billing using IoT technology to streamline the shopping experience [2]. The proposed system integrates various components such as RFID smart cards, GSM modules, barcode readers, weight sensors, Wi-Fi modules, and Arduino UNO boards to automate the billing process [2]. By enabling customers to measure the weight of products and pay bills online, the system aims to reduce the time spent in queues and improve overall efficiency [2]. The background study highlights the limitations of

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current self-checkout systems, such as the need for employees to assist and prevent shoplifting, and proposes a smarter, more automated solution [2].

2.3 Barcode Reader Application to Enhance the Level of Trust and Safety of Customers

Author: Adnan Ahmed; Samer Ahmad Abi Sen **Year:** March 2021. The paper "Barcode Reader Application to Enhance the Level of Trust and Safety of Customers" by Adnan Ahmed Abi Sen and colleagues (2021) presents a mobile application designed to improve customer trust and safety during the COVID-19 pandemic [3]. The application transforms smartphones into barcode readers, allowing customers to access product information without physical contact. This contactless approach aims to reduce the risk of virus transmission, streamline the shopping process, and improve the overall shopping experience [3]. The application also provides real-time data from store databases, electronic shopping lists, and virtual cart management, enhancing convenience and reducing errors [3]. This innovation supports precautionary measures and addresses customer concerns about safety and efficiency in physical retail environments [3].

2.4 Wi-Fi Cloud Server-Based User Operated Billing System In Mall

Author: Shilpa D. Pawar,Abhishek Kushwaha, Deepak Kumar, Nawab Alam ,**Year:** June 2020. The proposed "User Operated Billing System in Malls" aims to reduce checkout time and improve the shopping experience by utilizing barcode scanning, RFID technology, and cloud computing. Customers use their smartphones to scan product barcodes, which are processed by a cloud server to calculate the total bill. Payments are made online, and RFID tags on products ensure security by triggering alarms if unpaid items are detected at the exit. This system streamlines the billing process, minimizes queues, and enhances security, leveraging technologies like Raspberry Pi, AWS, and mobile applications for efficient and automated shopping.

2.5 Barcode Fingerprinting: Unique Identification of Commercial Products With Their JAN/EAN/UCC Barcode

Author: Rina Ueno, Jin Mitsugi, **Year:** Feb 2018. The paper "Barcode Fingerprinting: Unique Identification of Commercial Products with their JAN/EAN/UCC Barcode" by Rina Ueno and Jin Mitsugi (2018) [5] introduces a cost-effective method for uniquely identifying individual commercial products using item-level barcodes. This approach, known as Barcode Fingerprinting, leverages the microscopic deviations in barcode stripes, captured and analysed using the SURF and RANSAC algorithms [5]. Tested on PET bottle barcodes, the method successfully distinguished each item uniquely, demonstrating its potential for improving inventory management through precise first-in-first-out operations without the need for expensive serial-level barcodes or RFID tags [5]. This innovative technique offers a practical solution for industries seeking better inventory control at a lower cost [5].

2.6 An Adaptive Implantation Case Study of Apriori Algorithm For A Retail Scenario In A Cloud Environment

Author: Mahesh Balaji, G Subrahmanya VRK Rao, **Year:** May 2013. This study focuses on the implementation of the Apriori algorithm in a cloud environment to optimize retail scenarios [6]. The Apriori algorithm, widely used for mining frequent item sets and discovering association rules, is adapted to handle large datasets in the cloud. The research aims to enhance the efficiency and scalability of data mining processes in retail, providing insights that can improve inventory management, sales strategies, and customer satisfaction. The paper by Balaji et al. (2013) [6] discusses the technical aspects of integrating the Apriori algorithm with cloud services and presents a case study demonstrating its application in a real-world retail setting.

2.7 Computer Vision-Based Crowd Disaster Avoidance System: A Survey

Author: B. Yogameena, C. Nagananthini. **Year:** June 2017. The paper "Computer Vision Techniques for Crowd Density and Motion Direction Analysis" by Apeksha Chipade et al. [7] presents a system for monitoring and analysing crowd behaviours using Optical Flow and Motion History Image (MHI) techniques. The system calculates Optical Flow vectors with the Lucas-Kanade method and uses directional histograms to assess crowd density and

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motion direction. This approach aims to improve the accuracy and speed of detecting congested areas, which can help prevent hazardous situations in crowded environments. Validated with datasets like Agoraset and PETS Benchmark, the system shows promise for real-time crowd monitoring and safety management.

3. Limitations

1) **High Infrastructure and Implementation Costs:** Many of the proposed systems require significant initial investment in hardware and software, such as RFID tags, specialized scanners, and cloud services. This can be a barrier to adoption, especially for smaller retailers.
2) **Technical and Maintenance Challenges:** The complexity of integrating various technologies (IoT, cloud computing, RFID, barcode scanning) and maintaining them can be resource intensive. Regular updates and technical support are necessary to ensure smooth operation, which can be costly and require specialized knowledge. [8]
3) **User Adoption and Training:** Systems relying on consumer interaction with new technologies (e.g., smartphone apps, QR code scanning) face challenges in user adoption. Customers may need training and time to adjust, and there may be resistance from less tech-savvy individuals.
4) **Security and Privacy Concerns:** Several systems involve the collection and processing of consumer data, raising privacy issues. Additionally, technologies like RFID and cloud-based solutions can be vulnerable to security breaches, posing risks to both consumers and retailers.
5) **Reliance on Robust Connectivity and Accurate Data:** Many solutions depend on stable internet connections and accurate, up-to-date data from store databases. Any disruption in connectivity or data inaccuracies can significantly impact the effectiveness and reliability of these systems.

4. Proposed System

The proposed system focuses on providing consumers with convenient access to the project's features. Through our application, consumers can seamlessly browse recipes, check product availability, and assess crowd levels at supermarkets. Moreover, the inclusion of a barcode scanning feature facilitates efficient "Scan and Checkout" functionality, enhancing the overall shopping experience. The backend operates on a cloud-based server infrastructure, ensuring scalability and reliability. These services include API endpoints that facilitate communication between the frontend and backend components. Through integration with supermarket inventory data, users can access real-time ingredient availability. Algorithms help produce personalized recipe and product recommendations based on individual preferences and past purchases.
Crowd Detection technology uses computer vision capabilities, provides information about supermarket congestion levels. Advanced data processing algorithms analyse crowd data, enabling the platform to offer users informed decisions about less crowded supermarkets nearby. The AI Chef, a chatbot system, generates relevant recipe suggestions and ingredients based on consumers queries and preferences. "Scan and Checkout" functionality uses the barcode scanning technology to make the checkout process more efficient and easier. Additionally, the platform includes a personalized health and dietary management feature. Customers logging into the website will specify their food allergies, health concerns, and food preferences. Whenever a customer adds an item to the cart, the system cross-checks the product's ingredients against the user's specified allergies and health concerns. If the product contains any ingredients that the customer is allergic to, an alert message pops up on the screen to reconfirm the product. This proactive approach ensures a safer and more informed shopping experience tailored to individual health needs and dietary preferences. Figure 1 shows the Flow Chart of Cloud Storage Figure 2 shows the Flow Chart of Cloud Creation.

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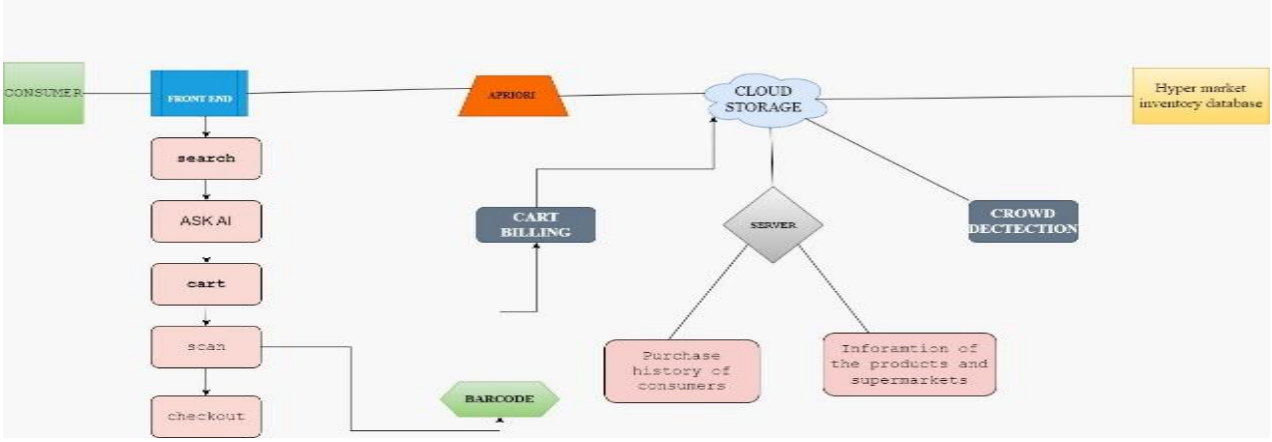

Figure 1 Flow Chart of Cloud Storage

5. Modules Implemented

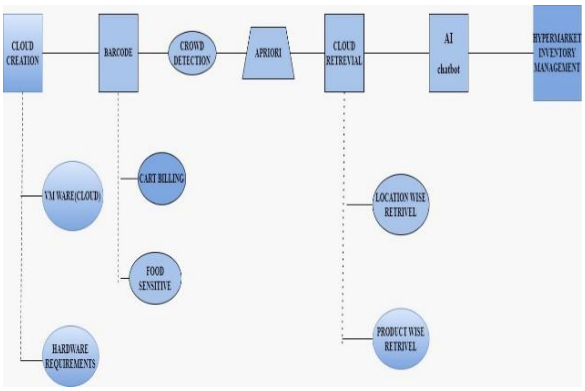

Figure 2 Flow chart of Cloud Creation

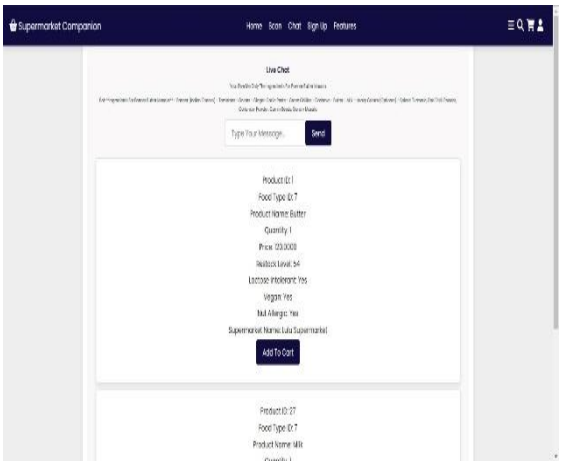

Figure 3 Home Page of Chatbot

5.1 Chat bot: AI CHEF

In today's competitive online grocery industry, providing a smooth and enjoyable customer experience is crucial. This paper examines the potential of AI chatbots integrated into supermarket websites to improve customer interaction, simplify online shopping, and increase customer satisfaction. Supermarkets are increasingly using online platforms to reach more customers and serve to the growing demand for online grocery shopping. However, directing a website filled with products can be overwhelming for customers. AI chatbots provide a promising solution to connect the gap between traditional in-store service and online shopping convenience. They provide intricate details about the product. Figure 3 shows the Home page of Chatbot. Figure 4 shows the Search products.

Figure 4 Search Products

5.2 Benefits of Chatbot

- Chatbots can offer 24/7 assistance, answering customer queries about product availability,

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promotions, store locations, and order tracking.

- It can learn customer preferences based on past purchases and suggest relevant products, creating a more tailored shopping experience.
- It can guide customers through the website, helping them find specific items or navigate product categories.
- It can assist with order placement, modification, and even address order-related issues, reducing customer frustration and provide a more interactive and engaging experience, leading to better customer satisfaction and loyalty. [9]

5.3 Crowd Management

Efficient crowd management is important for a great customer experience in supermarkets. This paper explores the use of advanced computer vision for detecting and analysing crowds in supermarkets. By using modern techniques in image processing and machine learning, supermarkets can gain valuable insights into customer behaviour and optimize their operations.

5.4 How Crowd Detection Works

1. Background Subtraction: This technique identifies objects (people) in the foreground by comparing the current image to a background image without people.
2. Density Estimation: Algorithms estimate the number of people in a specific area of the supermarket.
3. Object Detection and Tracking: Advanced algorithms can detect and track individual people, providing data on their movement patterns and dwell times in specific areas.

5.5 Benefits of Crowd Detection in Supermarkets

1) **Improved Resource Allocation:** Real-time crowd data can help allocate staff efficiently to manage queues and prevent congestion at checkout counters. [10]
2) **Dynamic Signage:** Information displays can be adjusted based on crowd density, directing customers to less crowded areas or informing them of wait times.
3) **Space Optimization:** Analysis of customer flow patterns can inform store layout improvements and optimize product placement based on customer behaviour.
4) **Enhanced Security:** Crowd detection systems can be integrated with security features to identify potential security risks or unusual crowd movement patterns.
5) Computer vision provides a powerful tool for detecting and analysing crowds in supermarkets. By leveraging this technology, supermarkets can gain valuable insights into customer behaviour, optimize their operations, and enhance the overall shopping experience. Addressing privacy concerns, ensuring cost-effectiveness, and constantly improving the technology will be crucial for maximizing the potential of computer vision in the future of supermarket management. Figure 5 shows the Real time monitoring

Figure 5 Real Time Monitoring

The significance of crowd management using computer vision is further highlighted in the survey by Yogameena and Nagananthini [7], which focuses on the development of a Crowd Disaster Avoidance System (CDAS). Their work emphasizes the importance of analyzing crowd behavior, density estimation, and the integration of multiple factors such as crowd motion and people count to enhance public safety in crowded scenes.

6. Barcode Scanner

6.1 Introduction

Supermarkets face ongoing pressure to improve operations and enhance customer satisfaction. Efficient inventory management and streamlined

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checkout processes are key to achieving these goals. Barcode technology and scanning play a vital role in achieving these objectives. This paper examines relevant IEEE papers to explore the latest innovations and applications of barcode technology in supermarket management, while also considering potential future directions for research. [11]

6.2 Barcode Technology in Supermarkets

Barcodes are machine-readable representations of product information, typically consisting of a series of parallel lines and spaces. They offer a fast, accurate, and reliable method for tracking and managing supermarket inventory.

6.3 Applications in Inventory Management

Product Identification and Tracking: Barcodes uniquely identify each product, enabling real-time tracking throughout the supply chain. This facilitates inventory control, minimizes stockouts, and optimizes ordering processes. One of the key advantages of barcodes is their ability to automate data capture. Barcode scanners swiftly and accurately capture product information, eliminating manual data entry and reducing errors. This automation streamlines various processes such as product receiving, shelf stocking, and inventory audits, aligning with the findings of Abi Sen [3], who emphasizes the role of mobile applications equipped with barcode readers in promoting contactless shopping during the COVID-19 pandemic.

Improved Stock Control: Real-time inventory data allows for better forecasting of demand and replenishment, preventing overstocking and minimizing waste. Supermarkets can optimize shelf space allocation based on sales data and identify slow-moving products for potential removal. [12]

6.4 Applications in Checkout Processes

Faster Checkout Speeds: At checkout, barcode scanners expedite product identification, significantly reducing waiting times and improving customer experience, particularly during peak hours. This aligns with the research of Abi Sen [3], who proposes the use of barcode technology to facilitate faster and more efficient checkout processes, thereby enhancing customer satisfaction and loyalty.

Reduced Cashier Errors: Automatic data capture minimizes human error in price calculation, leading to accurate billing. This reduces customer frustration and disputes over pricing inconsistencies.

Self-Checkout Systems: Barcodes facilitate the implementation of self-checkout systems, empowering customers and reducing reliance on cashiers. This provides customers with a faster and more convenient checkout option, especially for smaller purchases. Figure 6 Super Market Companion.

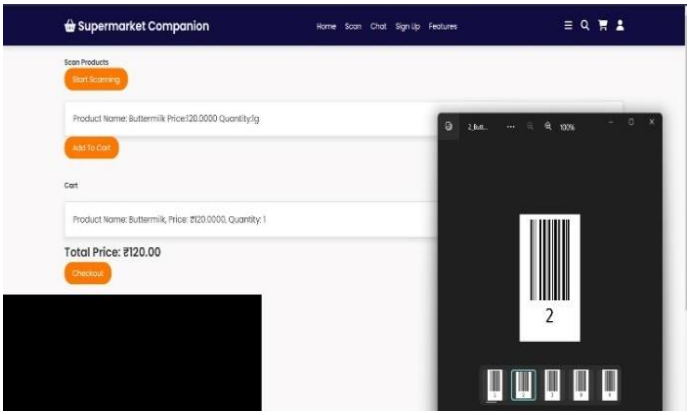

Figure 6 Super Market Companion

Conclusion

The proposed project presents a comprehensive solution to enhance the grocery shopping experience by leveraging advanced technologies. Through the integration of cloud computing, computer vision, and barcode scanning, the platform aims to address common pain points such as inefficient shopping trips, lack of real-time information, and overcrowded stores. The system's modules, including the AI Chef chatbot, crowd management, and barcode scanner, are designed to streamline various aspects of the shopping process. The AI Chef provides personalized recommendations and product information, improving customer engagement and satisfaction. Crowd management utilizes computer vision to analyse crowd levels in supermarkets, allowing users to make informed decisions and avoid congested stores. The barcode scanner facilitates efficient checkout and inventory management, enhancing operational efficiency for both consumers and supermarkets. In conclusion, the proposed project offers a promising solution to revolutionize the grocery shopping experience. By harnessing the

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power of technology, the platform addresses key challenges faced by both consumers and supermarkets, ultimately aiming to make grocery shopping more convenient, efficient, and enjoyable. However, successful implementation will require careful consideration of factors such as data privacy, security, and user adoption. Further research and development are necessary to refine the system and ensure its scalability, reliability, and usability in real-world scenarios. Overall, the project holds great potential to transform the way people shop for groceries, contributing to improved customer satisfaction and operational efficiency in the retail sector.

References

[1]. Sergio González-Miranda, Ramón Alcarria, Tomás Robles, Augusto Morales, “Future Supermarket: overcoming Food Awareness challenges”, IEEE Xplore, Sep 2013.
[2]. M. Jothibasu, S. Boopathy, “A Fast Cloud Based Pervasive Method of Cart Billing System for Supermarket Using Real Time Technology”,
[3]. International Journal of Advanced Research in Computer Science, Apr 2017.
[4]. Adnan Ahmed Abi Sen, “Barcode Reader Application to Enhance the Level of Trust and Safety of Customers”, IEEE Xplore, Jun 2021.
[5]. Shilpa D. Pawar, Abhishek Kushwaha, Deepak Kumar, Nawab Alam,
[6]. “Wi-Fi Cloud server-based User Operated Billing System in Mall”, IEEE Xplore, July2020.
[7]. Rina Ueno and Jin Mitsugi, “Barcode Fingerprinting: Unique Identification of Commercial Products with their JAN/EAN/UCC Barcode”, IEEE Xplore, May 2018.
[8]. Mahesh Balaji, G Subrahmanya VRK Rao, “An Adaptive Implementation Case Study Of Apriori Algorithm Fora Retail Scenario In A Cloud Environment”, Ieee Xplore, May 2013
[9]. B. Yogameena, “Computer vision-based crowd disaster avoidance system: A survey”, Science Direct Volume 22, June 2017, Pages 95-129.
[10]. Rishabh Tripathi, Abhishek Shukla, and Subhas Chandra Misra,
[11]. “Inventory and Supply Chain Management for E-Commerce based Supermarkets Enabled by Cloud Services with Actor Dependency Models”, Industrial Engineering and Operations Management, 2021
[12]. J. C. Silveira Jacques Junior, S. R. Musse and C. R. Jung,"Crowd Analysis Using Computer Vision Techniques", in IEEE Signal Processing Magazine, vol. 27, no. 5, pp. 66-77, Sept. 2010, doi: 10.1109/MSP.2010.937394. keywords: {Computational modelling Computer vision Pixel Cameras Analytical models; Feature extraction; Humans}