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Easy Payout, Advanced shopping, and Security in Super Market

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Abstract*: Nowadays there is a very common issue among the general public that is lack of time. This lack of time has let the consumers to be impatient. Another most important threat to the shop or supermarket owners are theft. Many cases persist in robbery or theft in this modern era. Despite having security systems, alarms and security guards there exists the cases of theft. This leads to a huge loss to the market as well as the shop owners. They face a great challenge due to this. This idea is capable of reducing or rather preventing these issues to occur. This will provide consumers with an easy and time- efficient way. The idea if the project is to deduce a method for smart super-market stores that operate efficiently by reducing the time a customer spends at the billing desk. The target can be achieved by the use of smart bands designed especially for use by the super-market which will keep accumulating the price of the products taken off the racks by the customer. The total system will work on sensors and cloud monitoring which while the shopping will get updated by the user. When the customer is done with shopping, they can request an electronic bill that will allow payment in any of the available formats and will enable the customer to collect the physical bill after the successful payment of the total bill. This payment will be directly made by scanning the code in the billing counter through the band which will directly reflect the amount from the temporary cart and the payment will be proceeded in anyways according to the shopper.

Keywords-Anti-theft; security systems; supermarkets; IoT; sensors; Proximity Sensor; Ultrasonic Sensor; Smart Band; Digital supermarket; e-billing; Stock Management System; Smart Cart.

I. INTRODUCTION

According to recent researches, it found that people barley find time standing in long queues while shopping and then waiting for payment to be completed. This leads to many issues like less sales and of the supermarket and people don't get what they want at that moment. During rush hours it is very difficult to get fast working. One more major issue that has been found majorly in the supermarkets is that of theft. Many times, people steal the products and couldn't be caught. Within a few years, these kinds of markets have gone through a major loss due to these two problems.

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The basic idea behind this project is to overcome these two major difficulties. This goal can be achieved by combining a few major boons of our Computer Science sector. This project will be working with the Internet Of Things (IoT), Cloud Computing and Sensors. The basic working of the system will be simple and will require basic knowledge of using the sensors and codes with the given band that will be provided by the Super Market at the entrance. Without this shopper will not be able to make any purchase. This device will be a smart band that will be attached with the Infrared sensors which will be used to scan the product unique code and display the details of the product. The band will be available with 2 basic options ADD and REMOVE options which will be used for adding and removing the goods from cart respectively. The add option will ask for the quantity of the product and once the quantity is added that a specific amount of product will be automatically provided to the buyer. If the buyer wants to remove any item from the cart the buyer will be provided with a drop location around the store which will be available in multiple places. Once the scanner scans the code it will ask for the product's code that needs to be removed from the cart. The sensors will sense the product that will be dropped to the drop center. Once the commodity is dropped the cart will automatically remove that quantity from the cart. A Radio Frequency Identification Reader (RFID) Sensor will be used in this. RFID has a tag that consists of a microchip, antenna, and reader to receive and transmit data. It uses radiofrequency to transmit data. The tags are sensed by the sensor and the data is transferred within the system. The present systems are provided with mostly self-scanning using methods using smartphones which needs to have its id and needs perfect internet connectivity. This becomes a very big disadvantage for clients who don't possess a perfect or fast internet connection. This system will lower this issue by removing the usage of personal devices and instead will be provided with their own devices. This will reduce the necessity for the lower category of public to buy high-performance devices. Cloud management will also be included in this idea. The whole system will be directly to the cloud which leads to the on-time updating of data in the server and no data loss will be there. Mostly all the shopping complexes or markets are based on local server storage. The local server storage is most effective but if by any case there occurs any damage to the local server then there will be a huge data loss. This data loss will affect the whole system and market massively. The data that is stored in the server logs are of payment and transaction and stock details. If the stock details are lost then the shop will face a bulk data mismatch and will be forced to manually check for every product.

This is time consuming and hectic work. This even affects the sales of the goods in the shop. For this, if the details are updated every hour then there won't be any issue of data loss since the servers of the cloud are maintained perfectly. Mostly all the cloud providers even provide a special feature for free that is the data recovery, which is not available in the local server. This advantage of data recovery will provide great help to the company. Cloud also provides free maintenance or cheap maintenance. The maintenance is done by professionals. The cloud will be also helpful since it can store details from all the stores of the same company and managed individually by the managers. There is no requirement for multiple store locations. This also provides an easy calculation of overall monthly turnovers. It also maintains data transparency. The racks will be sealed by transparent glass which restricts the shoppers form directly reaching out to the products. This will provide the best way to security. The proper arrangement of the products will also be maintained. When the product is removed from the rack the stock is automatically updated and is directly reflected in the cloud storage. The Cloud also provides a special feature of auto messaging. The AI in the cloud will be configured in such a way that when the stock reaches a particular amount or below the system automatically sends a message to the Managers of the store to update the stock or even can configure to place a new stock order to the particular company itself.

II. EXISTING SYSTEM

A. Locating Products

Some applications provide the users with the exact location of the products that are needed while shopping and provide the shortest path that the user should take to reach the product. The Products can also be added to the cart by scanning the barcodes of the products and storing them in the cart reminder. It directly takes the customer to the products one by one according to the easiest path followed. This application also provides with all the offers that exits in the store. This needs personal devices and not a specific device from the shop. If the customer doesn't possess any such device, he/she will not be able to take advantage of this feature. If the map layout of the store is changed and not updated it will lead to a huge mess and a lot of time will be wasted in finding the products. This will make easy work more difficult. The product may be replaced by the working staff and may not be placed in that same location, which again makes shopping difficult for the purchaser.

B. Self Service Scanning

This application allows the customers to scan the bar code of the product and add the price of the product to the cart and pay online using net banking or cards. This allows the users to save time by checkout by themselves and not to wait in the lengthy queues. It increases the chances of theft. This is because it will not check how many quantities the user is taking and paying. The security is being compromised in this self-service scanning feature.

C. Management Alerts When More Registrars Are Needed

This application uses Infrared sensors to sense how many users are entering the store at a time and going out and calculates how many counters should be open for the payment. This calculates the number based on the 3 persons in a set (father/mother with 2 children). This uses a technique that calculates the number of users entering and exiting the shop at a particular interval of time. The calculated number of counters may be wrong and need more time for checkout. This results in a huge queue in the store and wastage of time. The Infrared sensors may even sense the correct number of counters that need to be open but if the number of counters that are working at present is stuck due to some issue won't exclude it and will count it in. For this reason, a person needs to manually check and maintain the counters.

D. Supermarket Mobile Apps

Many chains have introduced their mobile apps with several useful shopping features. The mobile app, for example, lets you scan a bar code on a product and automatically add it to your shopping list. This kind of mobile app lets the customer view the weekly circular, and create and email a list to someone else. A new mobile app, an enhanced store locator adds GPS technology and driving directions. Shop- pers can view their shopping lists offline. The application even provides text message notification and the ability to pre-order subs and sliced meats and cheeses in select stores.
Example - Aisle411 Website - http://aisle411.com/

E. Automatic Checkouts

This system allows automatic checkout while the customer moves out of the store automatically. The system uses radio tags in the products which will automatically sense the tags and add up all the products to the temporary cart and will automatically deduct the amount from the debit cards added and linked to it. Must include all cards to the system. Information security may be compromised. Theft of products can be easy if the radio tags are damaged. Many bank companies don't accept these kinds of transactions.

F. Observation

According to the conducted Literature Survey on pre- existing Supermarkets, Grocery stores, their functionalities, and technologies that have done before the proposal on our research are some of them.
WE-Safe: A wearable IoT sensor node for safety applications via LoRa (2018) states that A wearable IoT sensor node aimed at monitoring harmful environmental conditions. The drawback is that the solar energy will disappear at night and this should be considered in the power management unit of a sensor node.[1]
A Smart Sensing Architecture for Misalignment Measurements (2018) is used for Smart sensing architecture based on inductive readout are very intriguing solutions. The proposed system is based on a primary coil as a fixed sensing element and in front of it, a movable and battery-less receiving sensor coil. If the coil is damaged the system will be unusable.[2]

Design of Software and Data Analytics for Self-Powered Wireless IoT Devices (2018) presents software architecture, data analytics, and development of an Android application on for the wireless IoT devices deployed in both star and multi-hop topologies. The main[3] Analysis of I/O Performance for Optimizing Software Defined Storage in Cloud Integration (2018) introduces the essentials for implementing software-defined storage using a combination of on-premises and public cloud storage. The Algorithms used were LRFU(Least Recently/Frequently Used) and ADC(Advanced Replacement Cache). The main drawback is the storing time increases due to less number of devices and bulk data combination increases the time.[4] Authentication of IoT Devices and IoT Server Using Secure Vaults (2018) represents the Mutual authentication between IoT devices and IoT servers is an important part of secure IoT systems. The algorithm used here is AES encryption for mutual authentication and HMAC is a key- based hashing algorithm. The drawback is since user consent is not required, it may be used to survey people.[5] Privacy and Security of consumer IoT devices for the pervasive monitoring of vulnerable people (2018) shows the security an privacy requirements for healthcare solutions. The algorithm used is AES-128 and SHA-2. The drawbacks are distribution of cryptographic keys is necessary.[6] Efficient Data Classification for IoT Devices using AWS Kinesis Platform (2018) represents all the devices are connected, providing efficient data classification and security is important for transforming the information from all the connected devices. The main drawback is all the devices are connected, if one device gets damaged then the whole network will be in Deactivated state.[7] Scalable and Configurable End-to-End Collection and Analysis of IoT Security Data: Towards End-to-End Security in IoT Systems (2018) states that there is a surge of interest in approaches about security issues of IoT deployments and applications that leverage machine learning and deep learning techniques. The algorithm used is Hybrid Spectral Clustering and Deep Neural Network Ensemble Algorithm for Intrusion Detection in Sensor Networks.[8] IoT Based Smart Signal (2018) represents a method to build an IoT based automated surveillance system to capture the registration number of vehicles and to alert the nearest traffic police in case of any default. The algorithms used for ESP-8266 built on a RISC(Reduced Intrusion Set Computer) based platform and ESP-8266 even has a software development kit that allowed the users to program the device rather than using a different micro-controller altogether.[9] A V-Band Transceiver With Integrated Resonator and Receiver/Transmitter Antenna for Near-Field IoT (2018) presents a V-band transceiver for NF-IoT without the conventional low noise amplifier, mixers, power amplifier, and phase-locked loop building blocks. Also, there are no external components except a battery or energy scavenger.[10] Privacy and Security in the Internet of Things and Wear- able Devices (2015) presents two common practices of privacy and security of IoT and wearable devices. Google Nest Thermostat and the Nike+ Fuel band are the two selected methods discussed in this paper.[11] Signal Quality Assessment and Lightweight QRS Detection for Wearable ECG Smart Vest System (2018) develops a novel IoT-based wearable 12-lead ECG Smart Vest system for early detection of cardiovascular diseases.[12] Using Smart Edge IoT Devices for Safer, Rapid Response with Industry IoT Control Operations (2016) presents a model that combines the capabilities of smart IoT devices with control system gateways using real-time challenge- response for secure control operations.[13] A Secure IoT Service Architecture With an Efficient Balance Dynamics Based on Cloud and Edge Computing (2018) represents a significant security and efficient problems like internal attacks account for a large fraction of security problems.[14] Light-Weight and Privacy-Preserving Authentication Protocol for Mobile Payments in the Context of IoT (2019) shows that the protocol is feasible and efficient for the smart devices in the IoT.[15] A Privacy-Preserving Mobile Payment System for Mass Transit (2017) proposes a privacy-preserving transit payment system based on traceable signatures, identity-based signatures, and anonymous signatures.[16]

III. PROPOSED SYSTEM

A wrist band would be given to all the customers at the entry checkpoint of the supermarkets which would contain few IoT sensors used for scanning the QR code to add, remove the products. This band creates a temporary guest user for one-time shopping which produces an online smart cart. All the racks containing the products would be protected with glass so that the products shouldn't be picked up directly by the user. This concept would be similar to the cold drink vending machines. Each product can only be picked if it's QR code is scanned by the wrist band of the customer, which in turn creates an online e-cart which could be used to add or remove the products while shopping. The digital racks would be installed with few IoT sensors which detect the products that are to be added to the guest's smart cart.

A. Add item to the cart

To add a product the user needs to scan the given QR code placed below the products, which after successful scanning enables an add button beside the QR code. This add button allows us to add several products available. By pressing the add button multiple times the number of products gets added to the customer's temporary e-cart. The products after addition to the cart will be released from the digital racks so that the customer can pick those products.

B. Remove item from the cart

To remove the products user needs to scan the QR code again which shows the list of all the final products added in the cart. The user then needs to select the products that are to be deleted along with the delete button which deletes the particular product from the smart cart. Once the product has been selected for deletion then those products should be dropped in the DROP-OFF points to remove products from the smart cart.

C. Payment

The customer can make the payment anywhere in the whole supermarket and the e-receipt would be generated and will be sent through SMS/email. Once the payment is done, at the exit points the smart bands would be checked for successful payments before leaving.

The payment option would be made for both online, offline. Many screens would be set up which shows all the final products on scanning the temporary QR code through the smart band and also includes all kinds of payment options. Only the cash payment could be done finally at the cash counter. This reduces the long waiting in queues and increases the sales for the supermarket. This would be the simple procedure to add, remove the products from the smart cart. There is no need of installing any kind of mobile application to view the final cart items because this could be done at the exit point where individual customer's smart cart would be displayed on the screen before the final payment option. The Ultrasonic sensors would also be installed in the digital racks to monitor the regular stock management of products in the supermarkets. Once the stock of a particular product is nearly to be finished, notification of new stock
ordering would be sent to the store managers in no time.

D. Advantages

This system would help to reduce the theft of products in the supermarkets and also reduces the long queues for payments. The wrist band would be given in free of cost to all the customers. This system could help in real-time stock management of products. It reduces the manpower in the supermarkets. This idea can increase sales for supermarkets in the future. All the products would be placed in strong glass which can't be directly picked up by the customers.

E. Figures

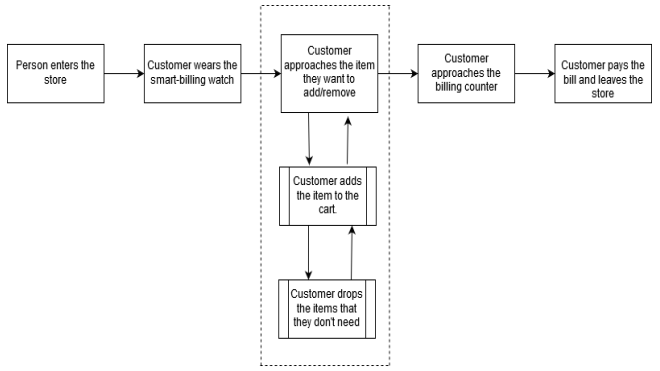

Fig. 1. Workflow Diagram

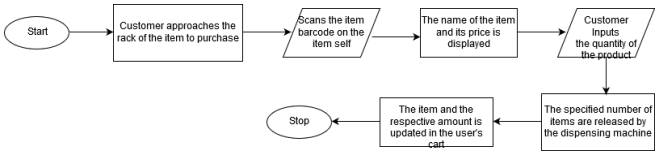

Fig. 2. Add Items To The Cart

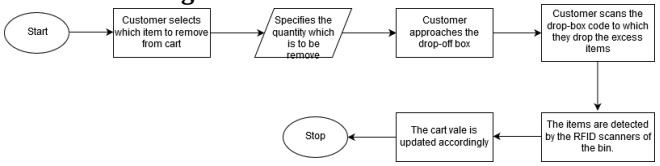

Fig. 3. Remove Items From The Cart

IV. RESULT AND DISCUSSION

The contents of the journal are peer-reviewed and archival. The journal publishes scholarly articles of archival value as well as tutorial expositions and critical reviews of classical subjects and topics of current interest.

Authors should consider the following points:

1) Technical papers submitted for publication must advance the state of knowledge and must cite relevant prior work.
2) The length of a submitted paper should be commensurate with the importance, or appropriate to the complexity, of the work. For example, an obvious extension of previously published work might not be appropriate for publication or might be adequately treated in just a few pages.
3) Authors must convince both peer reviewers and the editors of the scientific and technical merit of a paper; the standards of proof are higher when extraordinary or unexpected results are reported.
4) Because replication is required for scientific progress, papers submitted for publication must provide sufficient information to allow readers to perform similar experiments or calculations and use the reported results. Although not everything need be disclosed, a paper must contain new, useable, and fully described information. For example, a specimen's chemical composition need not be reported if the main purpose of a paper is to introduce a new measurement technique. Authors should expect to be challenged by reviewers if the results are not supported by adequate data and critical details.

V. CONCLUSION

This paper provides an insight to a smart supermarket system for current society. This system includes IoT sensors along with wearable wrist bands that would be used to purchase products at supermarkets and other grocery stores in current society.

Further it reduces the long queues at billing counters along with the anti-theft of products from crowded supermarkets. It also provides real-time stock management in the particular store and notifies the managers about the new wanted stock as per the public demand. This research work has been done mainly to make day-to-day life of people much easier.

The future work includes - The Advancement of algorithms for IoT sensors. Applying AI systems to provide a smoother shopping experience. Prevent hackers from exploiting loopholes.

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