1. INTRODUCTION

1.1 Technology Enhancement

The Advancements in technology have inspired new developments in the industry, enabling end-users to reap the most benefits from it. The word smart is trending lately in the field of IoT. Also, numerous security and protection issues have risen and lightweight cryptographic techniques are in high demand to fit in with IoT applications. Every object around us is being made smart so as to make our work easier. With the increase in internet technology, food items are available at our door steps whenever needed. But the experience of going to a mall and shopping the things all by ourself has its own advantages and disadvantages as well. The advantage is that we can carefully select the best product according to our choice and judge the product by seeing, touching and feeling it. The major drawback of this is standing in stretched out line of customers for paying off the bill. Technology has kept its approach always towards the betterment of humans, by providing a number of ways to develop lives. Mobile development technology has added more compact, reliable and easy to carry solutions regarding the incomplete information about the product on sale and waste of time at billing counters. Today's users are more active and social on the internet. Supermarkets and malls are a one-stop place offering all food and household products under one roof. According to research today's customers are surfing more, shopping more in absentia that is shopping in numerous ways including online shopping, teleshopping, etc. However, the fact identified is that customers avoid going to shopping in-person that is it involves a personal visit to the place to shop necessary products due to long queues at billing counters.

1.2 Offline Shopping

One has to leave home, either walk or take a ride to the store or shopping centre in order to buy what one wants. It enables one to see the actual product before paying the money. One could get the actual product that he or she likes with the money. Some of the benefits of traditional shopping includes: shopping malls are centre of attraction because of discounts in products, cashless transaction, variety of products like household, decorative, kitchen, sports, education, stationeries which are all available under one roof. Traditional way of shopping in the locals or showrooms gives the happiness that online shopping can never give, one can try the dresses in the trial room and this gives immense happiness, one can actually feel the dress, see the dress material, quality and texture and see if it meets the expectation and then can decide whether to buy or not, one can also check whether the dress fits properly or not. While traditional shopping, the shop's staff gives personalized attention and keeps asking what one likes. And love the way they show the dress. When

one gets confused, they recommend which dress will look good and which dress will not. In traditional shopping, one can shop the product quickly and can bring home that time only and then can show it to the family and friends. Nowadays, consumers are very much possessive about oneself. Most of them need to try on the clothes which they buy and this is only possible in traditional shopping.

1.3 Online Shopping

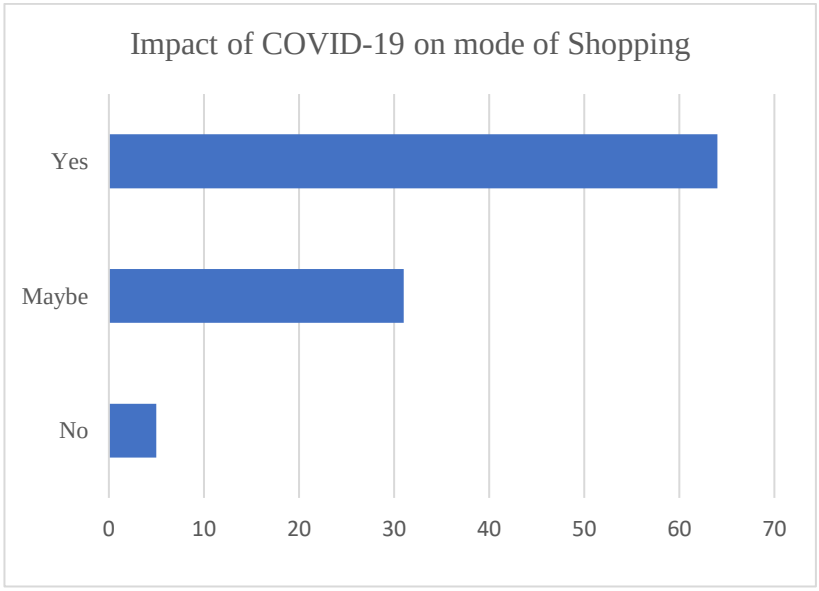
It means a process of buying and selling of products and services through the Internet. Online shopping has become the fastest-growing industry and Internet users have reported that online shopping is one of their primary uses of the Internet. With the help of online shopping, the consumers can purchase clothes, shoes, books, airline and event tickets, foods, computer hardware and so on. Majority of the time it is assumed that transaction security, personal privacy, product price, product quality, convenience, accessibility, promotions and advertisement, delivery time, quality comparison and reputation of the company are the important variables in online shopping. With the growth of online shopping, there are various opportunities and challenges to online business retailers and consumers. Instead of having to physically visit different stores to compare prices or rely on circular pamphlets in newspapers, a consumer is able to search and retrieve needed information through the internet. The development of the internet has created a paradigm shift of the traditional way people shop. A consumer is no longer bound to opening times for specific locations; he can become active virtually any time and place and purchase products or services. The number of internet users is constantly increasing which also signifies that online purchasing is increasing.

1.4 Impact of COVID-19 on Offline shopping

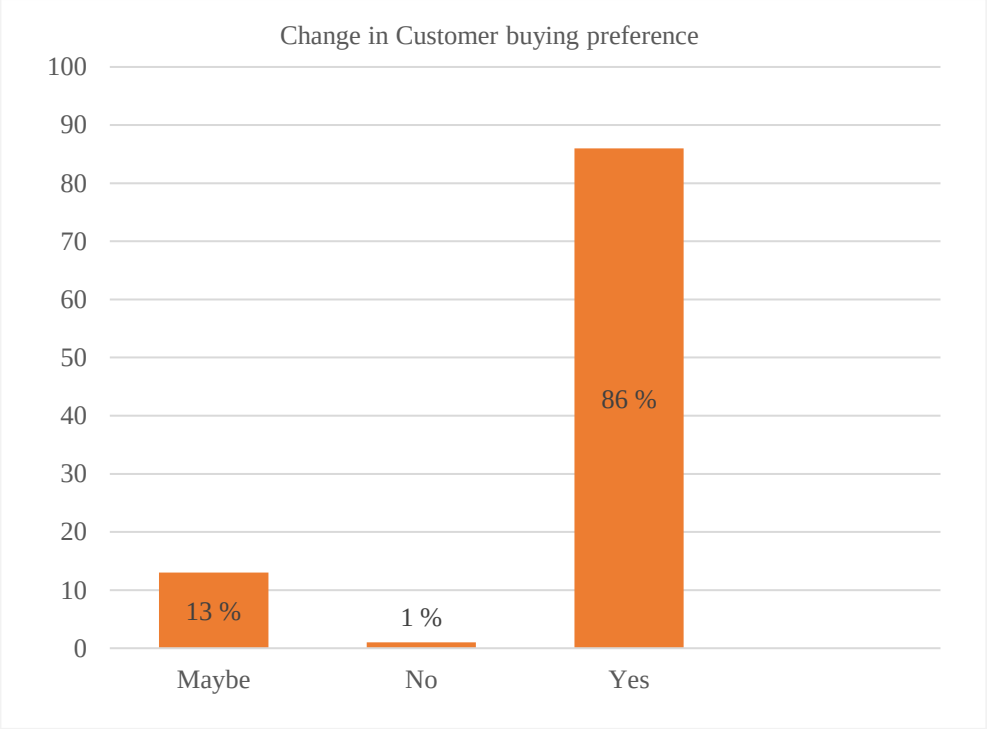
The e-commerce sector with other sectors was on good place and growing at rapid rate with usual ups and downs, before pandemic entered India. But the lockdown had changed the market trend a lot and especially affected the buying behaviour of consumers. Customer are preferring to but online rather than offline due to Covid 19 pandemic, it is very much risky to try on clothes and the shops usually are closed so there are less chances of opting for traditional shopping.

On the one hand, the pandemic boosted up the online sales and led to rapid growth in online shopping, on the other hand it hindered the offline sales. In fact success of online shopping became the drawback for the offline shopping somewhere. Shutting down of brick and mortar stores was the cautionary measure taken by the Government for the safety of the people but it hindered their

earning and affected their livelihood too. This pandemic destroyed the offline sellers in two ways i.e., by restricting their earning and hampering their livelihood and health.



From the above Chart, it can be observed that during the pandemic, 64 percent of the respondents agreed that COVID 19 had a deep impact on the mode of shopping, 31 percent respondents felt that COVID did have a little effect on mode of shopping and only 5 percent respondents did not think COVID had any impact on mode of shopping.



The above chart shows that 86 percent of people preferred to buy via offline shopping, whereas 13 percent of the respondents buying preferences were both -online and offline whereas there were other 1 percent of the respondents who did not prefer buying offline at all.

1.5 Problems faced in the present shopping system

a) Customer has to wait for long hours for billing at counters.

b) More manpower is needed.

c) Demonetisation.

d) Products need to be checked manually at checkouts.

e) Social Distancing during COVID-19.

The main aim of the project is to satisfy the customer and to reduce the time spent on the billing process which is to complete the billing process in the trolley rather than waiting in a queue even for one or two products. In order to solve the problems previously identified and save consumers time, money and help the retailers to win loyal clients, So, we are designing an application in which the barcodes of the products are scanned then the products which are scanned can be added to the shopping cart in the application and the payment is made online automatically through the application that we are going to design. Once the customer scanned the product, the weight of the trolley will be measured by using the load cell which is attached to the trolley, if the weight of product and weight in trolley matches then the product details are fetched to the application, after that the total amount will be displayed then the customer can go for next product or remove the product based on customer budget and settle the bill. The billing will be done based on the customer requirements either online or offline. The solution is to reduce the queue at the billing counters including a mechanism to bill conveniently by creating an easy environment between customer and store-owner. This will turn out to be very beneficial for the retail stores as more people will enjoy the shopping experience and come more often to shop.

2. LITERATURE REVIEW

Mr. P. Chandrasekhar Assistant Professor, proposed the "**RFID based Smart Shopping Cart**" that uses the concept of RFID Reader is stand by Radio- frequency identification. It is use of radio wave to read and capture information store on a tag attached to micro-controller. When the shopper drops any product s in the card then the RFID Reader reads the tag. Shopping trolley is equipped with proposed model with RFID Reader on front panel. An RFID tag is attached to each product in shopping centre. After selecting a product, person has to drop the product in trolley. When the product is dropped the RFID Reader scan the RFID tag on product without requirement of line of sight communication [1].

In 2014, **Sainath, Surender and Vikram Arvind** has proposed a "**Smart Trolley System**" which integrated Raspberry Pi, Embedded Chip with two barcode scanner and battery kit to allow user to self-checkout at the shopping market. This system exploited barcode technology for billing products where the customer can be self-scan the product using the barcode scanner on the shopping trolley. Meanwhile, barcode values are preloaded into database and coded application can access these values using wireless network. After that, all of the product details will be sending to the server at the checkout counter where user able to pay instantly at the counter. Furthermore, there is a keypad in this system whereby allow user to changes the amount of the product due to wrongful entries. A smart devices with a GUI based android application will be attached on the trolley where it uses for communicate between the server and the android application [2].

Aboli Hanwate and Poonam Thakare (2015), introduced the system "**RFID based Smart Trolley**" using Radio-Frequency Identification technology that uses radio waves to transfer data from an electronic tag, called RFID tag or label, attached to an object, through a reader for the purpose of identifying and tracking the object. RFID Tag is a special type wireless card which has inbuilt the embedded chip along with loop antenna. The inbuilt embedded chip represents the 12 digit card number. The RFID reader is the circuit which generates 125KHZ magnetic signal. This magnetic signal is transmitted by the loop antenna connected along with this circuit which is used to read the RFID card number. In this project, RFID card is used as a security access card. The RFID reader is interfaced with microcontroller. Here the microcontroller is the flash type programmable microcontroller in which we already programmed with the card number. It is a small electronic device which reads the radio frequency and transfer the information to the device. The RFID device serves the same purpose as a bar code or a magnetic stick on the back of a credit card or debit card, ATM card etc [3].

Sagar Sojitra et al. (2016) proposed the idea to decoding the "**QR codes, thereby launching a URL in the web browser**". This is because in today's retail environment, products come with label tags for unique identification and theft protection. Novelty underlies in the idea of linking retail item identifiers to network application. This also helps in exposing the customers to rather detailed information regarding the product to be purchased. This in turn gives rise to in-store marketing and access to information. The impact of IOT comes in the case of mobile payment where by enabling NFC, one may get access to systems and virtual wallets. From a retailer's point of view this increases the convenience and simplicity these kinds of transactions are beneficial in providing opportunities for personal interaction with the customers [4].

Another system proposed by **Kamble, Meshram, Thokal and Gakre** in 2014 had focused on the scalability, affordable, and "**Multitasking Shopping Trolley System**". In this system, it consists of three mains part. Firstly, Server Communication component (SCC) maintained the connectivity between the cart and server. This component offers a more security way during transferring the data between the cart and the server. For example, when customer finish shopping, the purchasing list will be transfer under a secure method to shopping list database. User Interface and display component (UIDC) provide a user-friendly interface for customer to review the status of the items in the trolley. Whereas Automatic billing component (ABC) handles the billing where associates with SCC components. All of these components have to working together in order to perform some associated task [5].

Suraj.S, Vishal Guruprasad, Udayagiri R Pranava and Preetham S Nag have conduct a project to build an "**Intelligent cart using ARM7 and RFID technology**". They have explore an automatic identification by using RFID that help to benefits the quality of service provided by the retailers. Besides, they use modernized equipment for shopping cart that will help to reduce the time at the billing counter. This system will implemented in each of the shopping cart where it will attach with a RFID reader. All the items will be equipped with a unique RFID tags. Therefore, when the customer put the desired products in the trolley, the RFID tag will scan by the reader and the product name and prices will display on the LCD screen. Furthermore, this system manage to calculate the total cost automatically. Besides, ZigBee module will be use to transfer the billing data to the counter computer. This system also included an IR sensor that used for detecting a select light wavelength in the infrared spectrum. In addition, this sensor is aims to counting the total items in the trolley [6].

Awati.J.S, S.B.Awati, proposed the "**Smart Trolley in Mega Mall**" They Developed microcontroller based design for users who wait in a queue so avoid the crowd at the billing counter and headache like pulling a trolley. They used LCD display, Max 232, Barcode scanner; RF module, RF transmitter & RF receiver, & Object counter [7].

Dhavale Shraddha introduced an "**Intelligent Trolley for Shopping Mall**" based on Internet of things by used the concept of RFID for billing in shopping malls and utilized the feature of ESP module which comes is an IOT device. But the drawback of using ESP module is that it has short distance range and long range communication is not possible. Another drawback is interference. Server will be busy during huge crowds and internet connection should be made available for finishing the process of billing and also server maintenance is not an easy task and it should be maintained efficiently. Smart shopping trolley using RFID and zigbee, in this bill is generated by scan of products in the reader and bill is transmitted to central billing unit. The drawback of using zigbee is it is having low range connectivity [8].

Gourav Bidkar, Deepali Doddabhamannavar, Priyanka D. Deshmukh Published in 2021. A "**Smart Trolley**" is mandatory tool for shopping in supermarkets or grocery stores. We've been pushing the shopping trolley since 1937, cities expanded people multiplied but the trolley still unchanged. In this busy world waiting in long queue during shopping it is extremely irritating and this consumes lots of time of customers in the malls and shops. Introducing the smart shopping Trolley using NodeMCU, LCD, RFID reader, LCD & motor driver. The smart Trolley is self-service payment terminal just shop, pay and pass the queues. RFID reader reads the product information and sends to webserver created using NodeMCU. The trolley is controlled by joystick created using Blynk app over Wi-Fi. NodeMCU read the signals and send commands to driver circuit to drive the motor in forward, left, right and reverse direction. IndexTerms RFID reader, NodeMCU, Motor Driver, LCD, Trolley, Webserver [9].

T. Sarala, Y. Sudha, B. N. Nithin proposed an innovative concept of "**Smart Electronic shopping Trolley used in commercial complex which many individual retail stores**" Published in 1 May 2018. The main purpose here is to assist a person in shopping to reduce time while purchasing a products. Electronic trolley is fitted out with Barcode reader that scans the identification of outcome and internet connection with shop's server. It is also consists of LCD exhibits that notify the number of items and total amount to customers and Barcode scanner identifies the outcome and updates the bill. Swiping machine will be provided to recompense the bill through credit/debit cards [10].

S. Shankar, S. Balasubramani, N. S. Kumar Reddy Published in 8 April 2022, this research work proposes a "**Smart trolley based on Internet of Things [IoT] with an advanced billing system**" that makes shopping easier and secured and also avoids standing in long queue. The proposed system consists of a smart trolley attached with LCD display, barcode scanner and a raspberry-pi. This exploratory model is intended to completely eradicate the tedious shopping interaction and administration-related issues. The proposed framework can be undoubtedly implemented at a business scale under the genuine situation [11].

S. Mekruksavanich Published in 1 March 2020. The objective of this research was to present the proposed design and use of an "**RFID technology-based Smart Shopping System**". In this system, smart shopping carts that the consumers can navigate in their search for their desired items are used, while promotional items are also recommended, and the billing information will be calculated during the customer's shopping activity. The smart shopping cart will automatically identify the items placed inside and add them to the bill. Use of this method will allow shoppers to save time by avoiding the long lines at the check-out points, and the supervision of the supermarket will be more efficient [12].

D. Sinha, Karthik Cottur, Badari Nath K has proposed a the idea of "**Automated Billing System using RFID and Cloud**" Published in 1 March 2019. This system discusses the design of a shopping system where the customers drop products into a trolley which has an RFID reader to scan the RFID tags associated with products. After completion of shopping, customers can exit the shop with their bills deducted automatically from their e-Wallet. RFID technology has been incorporated with IR sensors to be able to accurately detect and determine whether a product has entered the cart or not. A Django Web Application is hosted on an AWS EC2 instance to allow customers to keep track of their transactions. The RFID system is connected to a Raspberry Pi with inbuilt Wi-Fi to communicate with an Amazon RDS MySQL instance which stores the inventory of the retail store along with the prices of the products [13].

Akshay Kumar, Abhinav Gupta has designed a "**Smart Shopping Cart**". The system does the same by displaying the total price of the product kept inside the cart. In this way the customer can directly pay the amount at the billing counter and leave with the commodities he/she has bought. It eliminates the traditional scanning of products at the counter and in turn speeds up the entire process of shopping, also with this system the customer shall know the total amount to be paid and hence can accordingly plan his shopping only buying the essential commodities resulting in enhanced savings [14].

Dr.N. Palanivel, S. Francis has proposed the system "**Recommendation System Based Smart Shopping Cart**". It begins with object detection using YOLO algorithm with the camera module mounted within the shopping cart. The similar recommendations for the chosen product is displayed through the touch screen display. The customers can view the description, cost, quantity of the product and the total cost of the products from the bill generated within the Web Interface. Then the customers can get through the bill counters only to perform payments [15].

Yerlan Berdaliyev, A.P. James has proposed the idea of "**RFID Cloud Smart Cart System**". Smart Cart System is a cooperative performance of three separate systems: a website developed for the shopping market, electronic smart cart device and anti-theft RFID gates. This project focuses on developing the electronic smart cart device itself. It involves an embedded electronic hardware that consists of an OLED display, Arduino Mega 2560 board, a PCB, a Wi-Fi module, 13.56 MHz HF RFID reader, a power supply and a shopping cart [16].

Murari Kumar and Rachana has designed the solution "**Smart basket design using arduino and rfid module**". The trolleys in the shopping malls are enabled with a device consisting of Arduino board which can identify the products by communicating with the racks which in turn consists of an arduino board which is programmed with the details of the product in the rack [17].

Zubin Thomas, N. Kumar, D. J. Preshiya introduced the "**Automatic billing system using Li-Fi module**". In this project data transfer is processed between products and the mobile phone. Each and every product is having LIFI transmitter and it store the encoded data similar to the product id, cost of product and quantity. Here the mobile is integrated with LIFI receiver via OTG communication in the shopping cart. It can read the commodities' information when the LIFI transmitter holding goods are chosen by the customers, each information of the goods can be entered by using the mobile LIFI and when the product is kept into the trolley, which also contains the LIFI module, double check the product identity. After completing the purchase, the payment is processed in mobile itself via mobile banking system [18].

Sonali S. Dhokte and **Bhagyashree S. Patere** has discussed the "**Smart shopping trolley using rechargeable smart card**" is being developed to help a person in everyday shopping in terms of reduced time spent while purchasing. The main objective of proposed system is to provide a technology oriented, low-cost, easily handled, and efficient system for assisting shopping in person. The main facility that the proposed model provides is the user only needs to carry a smart RFID card, which can be recharged from time to time [19].

J. C. Narayana Swamy, D. Seshachalam, and **Saleem Ulla Shariff** has proposed an "**Interactive Kiosk based cart**" which uses the RFID technology to identify the products details which is already available in the database. We propose to have facility to browse the available products list onscreen in the display connected to beagle bone black cart. The cart is interacting with the Main Server and it will have the facility to generate the bill for all the products added into the cart [20].

B. Bhattacharyya, Shilpa Sarkar and **Shubham Goyal** proposed a system "**An Android App Based Autonomous Shopping Cart**". It consists of three NodeMCU boards, RFID module, Motor driver, Chassis, a centralized Database and an Android app "EaseShop". The customers can add products into the cart using the app. During shopping, the customer can scan the required products using RFID and the details will be displayed on the LCD and will be updated in the centralized database. The payment can be done through the app [21].

T. Hanooja, C. G. Raji, M. Sreelekha and **Jemsheer Koniyath** has designed the "**Human Friendly Smart Trolley with Automatic Billing System**". An customer following trolley was implemented which calculates the total sum of grocery items carried in the trolley by the customers. This reduces the customer's effort to pull the trolley and keep the line for the payment of the grocery products. The customer who has a specific tag and a web camera installed in front of the trolley will recognize the tag and move the trolley to the customer. Using the RFID tag and the Raspberry Pi receiver, the item bill inserted has been obtained in the trolley [22].

V. Nandini, N. Shree and S. **Kulkarni** has proposed "**Smart Shopping System Using IOT**". The core objective of this paper is to improve the shopping experience of customers by reducing the time consumption during the checkout process. In this system, every product will be incorporated with RFID tag and every cart is attached with RFID reader and Zigbee. When product is placed in cart it reads the RFID tag and price, name of the products will be displayed on the LCD screen. Total items and Total cost will be displayed on LCD as well as s sent to billing counter and android application in mobile [23].

T. Sheltami, E. Shakshuki has proposed the "**An efficient RFID solution to expedite services**". Radio Frequency Identification (RFID) is becoming attractive technology as an alternative to barcode systems. RFID systems provide an automatic identification method, relying on storing and remotely retrieving data using RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Chip-based RFID tags contain silicon chips and antennae. In this

paper, we develop a smart shopping system that allows customers to manage their shopping list while shopping and only pay the bill at the checkout counter. The shopping cart has the ability to automatically calculate and display the total prices of all the products inside it. This makes it easy for the customer to know how much he or she has to pay while shopping and not at the checkout counter. This way the customer can also control his or her budget and receive faster service at the checkout [24].

George Roussos an "**Enabling RFID in retail**". The past two years have witnessed an explosion of interest in radio-frequency identification and supporting technologies, due primarily to their rapidly expanding use in tracking grocery products through the supply chain. Currently such applications monitor store-keeping units (SKUs) rather than individual goods, as the relatively high cost of RFID deployment and the very low profit margin of supermarket products make item-level tagging impractical. Yet, economic and technical concerns aside, it is easy to envision a supermarket in which each item is tagged with an RFID label and all shopping carts feature RFID readers. The carts could potentially include onboard computers that recognize products placed inside and that display information and promotions retrieved wirelessly from the system back end. RFID-enabled smart phones, which are commercially available today and becoming increasingly popular, could carry out the same function [25].

Pushkar Saraf, Arati D. Khanolkar the "**D2D (Day to Day) Smart Billing System**" is developed that abets a person in everyday shopping in malls involving some automation in customarily practiced process. Malls and supermarkets are self-service shops offering a wide variety of food and household products. This system helps the customer in everyday shopping by minimizing the time required and increase the shop productivity. The main objective is to provide a robust techno-savvy trolley with low-cost, high efficiency and easily adaptable system. Each techno-trolley is set up with a Raspberry Pi that is a unique identification device for that trolley. The camera scanner on the trolley will scan the purchased product and display it on LCD that is interfaced to the raspberry pi. The web-based application for trolleys and mobile-based application for baskets are designed to minimize the waiting time in "Queue" at the billing counters [26].

J. Suryaprasad, B. Kumar, D. Roopa, A. Arjun has discussed a novel product "**A Novel Low-Cost Intelligent Shopping Cart (NLISC)**" being developed to assist a person in everyday shopping in terms of reduced time spent while purchasing a product at the best price available. The main objective of NLISC is to provide a technology oriented, low-cost, easily scalable, and rugged system for assisting shopping in-person. The developed system consists of 4 key components or modules (a) Location detection component (LDC) (b) Server Communication component (SCC) (c)

User Interface and display component (UIDC), and (d) Automatic billing and Inventory management component (ABIMC). LDC is used to dynamically locate the shopping cart inside the shopping arena to facilitate providing relevant product information. SCC establishes and maintains the connection of the shopping cart with the main server. UIDC provides the user interface and ABIMC handles the billing and inventory management in association with the SCC [27].

Subhanvali Shaik, Mohammad Jabirullah has proposed the "**Advancement of Shopping Handcart for Supermarket**". To conquer all the difficulties of present systems, they have proposed the ARM-7 microcontroller-based smart shopping handcart for supermarkets to make the shopping experience very convenient for customers. This work can potentially reduce the human efforts and manpower requirement at the billing desk. Radio frequency identification (RFID) reader helps to scan through the tag and display the product information on LCD screen. ZigBee serves as the transceiver. All the components are interfaced with microcontroller which has database of the particular product in its memory. So whenever a tag is swiped the microcontroller checks the database and displays the details of the product. At the final stage, the list of details of the products is maintained and convenient payment solution is provided when shopping is finished [28].

Ankush Yewatkar, Faiz Inamdar, Raj Singh, Ayushya, A. Bandal has proposed the "**Smart Cart with Automatic Billing, Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft**". To develop a smart shopping cart system that will keep the track of purchased products and also online transaction for billing using RFID and ZigBee. The system will also give suggestions for products to buy based on user purchase history from a centralized system. In this system, every product in Mart will have RFID tag, and every cart will be having RFID Reader and ZigBee attached to it. There will be a centralized system for the recommendation and online transaction. Moreover, also there will be RFID reader at the exit door for anti-theft [29].

A. Narayan, Atheesh Krishnan has developed the "**IOT Based Comprehensive Retail Malpractice Detection and Payment System**". The project aims to develop a system that can be used in supermarkets to automate the billing process and reduce waiting time. All the trolleys will consist of a connection of a barcode scanner, load cell, LCD, and a pi cam, which are integrated by Raspberry Pi and Arduino. To prevent malpractice, once the barcode is scanned by the customer, it is placed on the load cell to verify the weight of the product from the external database. Once the customer is done shopping, he/she can view the products on the display and make the payment using the inbuilt payment mechanisms [30].

B. Arathi, M. Shona has proposed the "**An Elegant Shopping using Smart Trolley**". This system is equipped with microcontroller, ARM processor, Bar code reader, ultrasonic sensors, and android phone. A mobile phone with Wi-Fi connection is required for showing the information about discounts, product prices, and the total updated bill. Findings: When the customer finishes his shopping he/she can just pay the bill and leave, no need to wait in the queue. This smart trolley system will change the way of shopping that people shop in traditional systems. Application/Improvements: This proposed system is mainly to save the time in billing, it improves the operational efficiency of the system and it reduces number of staffs required [31].

M. Dhivyaa, C. Brindha, T. Haritha, S. Gokula Kannan have proposed the system "**A Multifunctional RFID enabled Shopping Tramcar**". The core intent of this project is to develop a robust tool with high efficiency, minimal cost and an accustomated structure for the ease of customers and retailers. The system works with the integration of 7 modules. Firstly, develop a login credentials for each customer to connect the cart with the main server through a website based login and set the budget, if it crosses the limit it notifies the customer. The products are scanned via RFID scanner. Besides, this system is embedded with a technique which intimates the product spot when searched. It also has the anti-theft mechanism feature, enabling automatic bill display and automatic payment. The sales rate could also be predicted to drop down the work of a retailer [32].

Ria Singh, Satyam Verma, Ms. Kriti has developed a prototype "**RFID and IR based Smart Shopping Mart Management System**". That uses an extended shelf system that can be used for on-time shopping at one side and another side for stock filling and takes up for online shopping booking. RFID code system is used to give identity to each product that defines its placement coordinate. Products are placed on a conveyer belt and the three motors get the Cartesian command from the RFID code read and move the product to the defined position. For the on-time shopping, users can use their shopping carts as an smart cart that can automatically calculate their bill and then the customer can select the desired product to add the selected product to the cart, the data from the cart would be saved in EEPROM and communicated wirelessly using Zigbee module to the biller for instant billing [33].

2.1 REVIEW FINDINGS

We have surveyed several smart billing systems. According to the survey the existing systems have their own advantages and disadvantages.

- Based on the existing system, they have used the traditional method of barcode scanning. Using the barcode scanner, we need to scan each product and so this method becomes very slow to be scanned.
- We got to know that the products are checked manually by using the staff at checkouts, this increases the time consumption and also high manpower is needed which increases the cost for the shopping mall management.
- The shopping mall management has to rearrange all the products, once the customer finished his/her shopping.
- In the traditional method the customer has to return the products after billing if there is not available enough cash.
- The RFID systems are also slow procedure in which each are every product is attached with the RFID tags and scanned by the RFID scanners, this also increases the time and cost for buying and attaching the tags to every product.
- Due to COVID-19 the offline shopping of customers has decreased due to the risk of visiting offline stores.
- The Demonetisation has affected offline stores due to offline cash transactions this made the customers reduce visiting offline stores and shifted to online shopping.
- Only the customers, who want to buy all the stationaries, goods, etc., under one roof are visiting the offline stores.
- The customers are shifting from offline shopping to online shopping due to time consumption, home delivery and cashless transactions.
- The customers, who want to try out and check the quality of products are visiting the offline shopping malls.

3. EXISTING SYSTEMS

After reviewing several websites, books and journals we came across the following systems which are existing.

1. Barcode Based System in shopping malls.
2. RFID Based Shopping Trolley for Supermarket.
3. Smart Cart with Automatic Billing, Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft.
4. Effective Methodology for Purchasing in Shopping Marts Using QR Code And Smart Trolley.

3.1 Barcode Based System in shopping malls

The barcode has been introduced in the year 1932 a small group of students from Harvard University, London first developed the concept of Automatic Product identification by passing a high intensity light through Morse code.

Which gradually developed to Bar-coding system from the year,1948 soon the bar-coding technology opened for public use from 1967. In 1967, the first the first bar coding was introduced to the retail world on a packet of Wrigley's Gum. Thirty-eight years later the number of applications bar code technology has exploded, going far beyond.

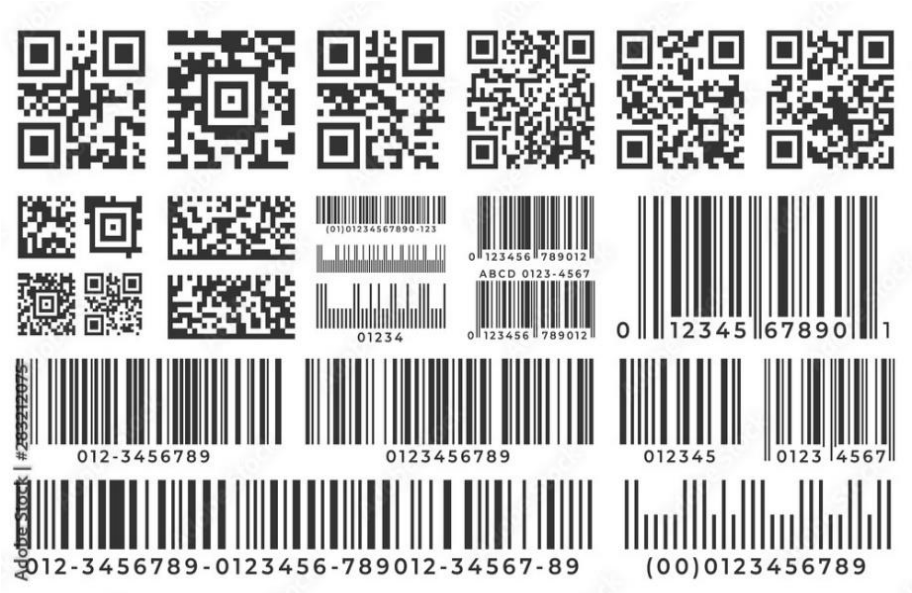


Fig 3.1 Several types of QR/Barcodes

3.1.1 Barcode Based System Working

If you run a busy store, you need to keep track of all the things you sell so you can make sure the ones your customers want to buy are always in stock. The simplest way of doing that is to walk around the shelves looking for empty spaces and simply refilling where you need to. Alternatively, you could write down what people buy at the checkout, compile a list of all the purchases, and then simply use that to reorder your stock. That's fine for a small store, but what if you're running a giant branch of Wal-Mart with thousands of items on sale? There are many other difficulties of running shops smoothly. If you mark all your items with their prices, and you need to change the prices before you sell the goods, you have to reprice everything. And what about shoplifting? If you see a lot of whisky bottles missing from the shelves, can you really be certain you've sold them all? How do you know if some have been stolen?

Using barcode technology in stores can help to solve all these problems. It lets you keep a centralized record on a computer system that tracks products, prices, and stock levels. You can change prices as often as you like, without having to put new price tags on all your bottles and boxes. You can instantly see when stock levels of certain items are running low and reorder. Because barcode technology is so accurate, you can be reasonably confident that any items that are missing (and don't appear to have been sold) have probably been stolen—and maybe move them to a more secure part of your store or protect them with RFID tags.

Fig 3.2 Barcode Scanner

A barcode-based stock system like this has three main parts. First, there's a central computer running a database (record system) that keeps a tally of all the products you're selling, who makes it, what each one costs, and how many you have in stock. Second, there are the barcodes printed on all the products. Finally, there's one or more checkout scanners that can read the barcodes.

Fig 3.3 Barcode Functionality

3.2 RFID Based Shopping Trolley for Supermarket

1940's - Radar technology was used to identify enemy and friendly aircrafts in WWII. Technically this was the first use of RFID

1948 - Scientist and inventor Harry Stockman creates RFID and is credited with the invention.

1963 - Inventor RF Harrington formulates new RFID ideas which include scattering data and information.

1977 - The first RFID transmitting license plate is created.

2000 - By this time over 1000 patents have been submitted using the RFID technology.

Radio frequency identification (RFID) is a general term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object wirelessly, using radio waves. RFID technologies are grouped under the more generic Automatic Identification (Auto ID) technologies.

A feasible solution was putting the data on silicon chips. The ideal situation is contactless transfer of data between the data carrying device and its reader. The power required to operate the electronic

data carrying device would also be transferred from the reader using contactless technology. These procedures give RFID its name.

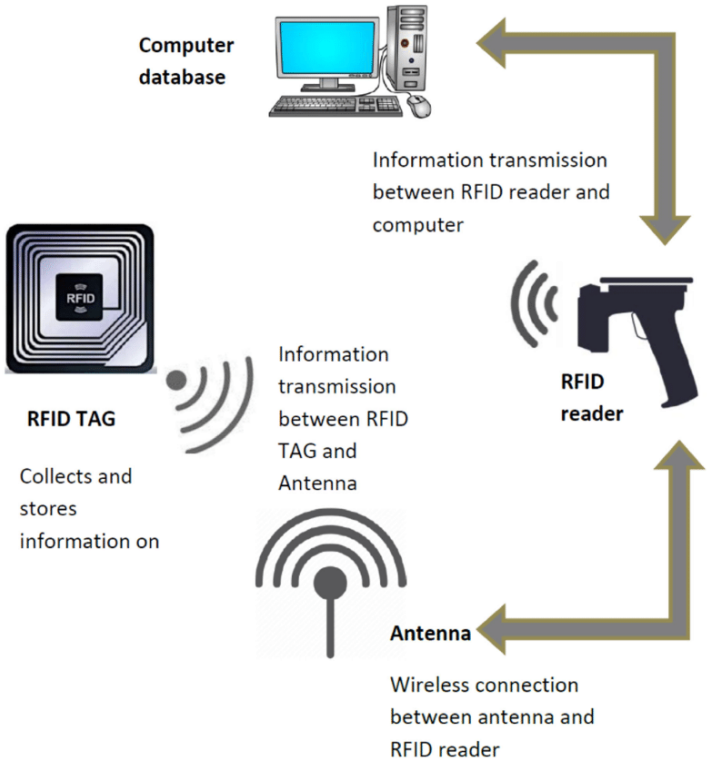


Fig 3.4 RFID System

3.2.1 RFID Based System Working

According to the existing system, the Arduino is interfaced with all the remaining components. Once the microcontroller is powered up with the use of a 9v battery it is initialized and set to the basic settings, now the system is ready to proceed which means the RFID card and the tag can be scanned. Then the RFID card or tag is scanned the RFID reader fetches all the details from the scanned card or tag, and if the scanning process is successful the product details will be transferred to the microcontroller's memory and then will be transferred to the LCD module to be displayed on the LCD screen. Here the RFID module uses the SPI communication technique to transfer or to retrieve the data from the RFID card or tag. After the shopping is completed the entire bill details will be displayed on the LCD screen, each card or tag acts as a product, where the product details are pre early set or dumped into the card. When the bill amount is paid, the shopping details will be sent via the sim900 GSM module to the prescribed customer's mobile number. The entire working process is implemented by the software called Arduino IDE. The Proteus simulation software is used to check the simulation results before the hardware implementations.

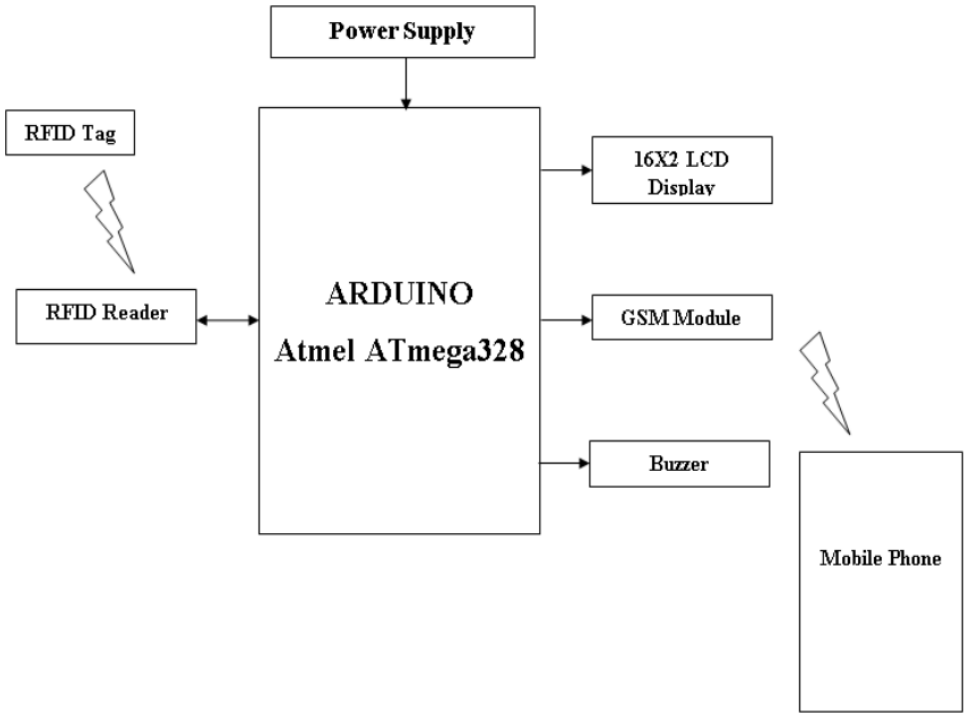


Fig 3.5 RFID System Architecture

A customer enters into a shopping mall. On entering, She/he first picks up a trolley. Each trolley is associated with a RFID reader and a barcode reader.

- When the customer purchases a product, she/he first scans the RF tag of the product using the RFID reader and the places it into the trolley. While the customer is scanning the RF tag of the product, a price of the product is taken and stored in the system's memory.
- Information stored in system's memory is compared with the lookup table. If matches are found then cost, name of respective product gets displayed on the LCD. At the same time ARM processor sends the same information to computer for billing purpose with the help of RS232protocol.
- Here we have used IR sensor for counting purpose. This works as the IR sensor continuously emits IR rays. If we put a product in a trolley ant at that time there is obstacle for IR rays, then it would result in interruption in counting of products in trolley. This recorded data is stored in arm processor.

Fig 3.6 RFID Working

- Counting is mainly done for security purpose. If in case while wandering round the mall someone removes the RFID tag and puts the product in trolley then counting the no of items helps to get information of items purchased. Thus counting is done but there is no addition of cost respective product in bill. This shows the increase in number of products but not increase in bill.
- If an unwanted product is removed from trolley then it decreases the number of products as well as bill. Double entry of product deletes the product name with respective to cost of product.
- After completion of shopping, a key is pressed indicating final billing of all the products. Thus the final information of all products is transmitted to a computer with the help of serial communication & the final billing is done by VBs software on computer.

3.3 Smart Cart with Automatic Billing, Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft

Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network.

The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or more general wireless

networking such as Wi-Fi. Applications include wireless light switches, home energy monitors, traffic management systems, and other consumer and industrial equipment that requires short-range low-rate wireless data transfer.

Fig 3.7 Zigbee Module

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID system consists of a tiny radio transponder, a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. This number can be used to track inventory goods.

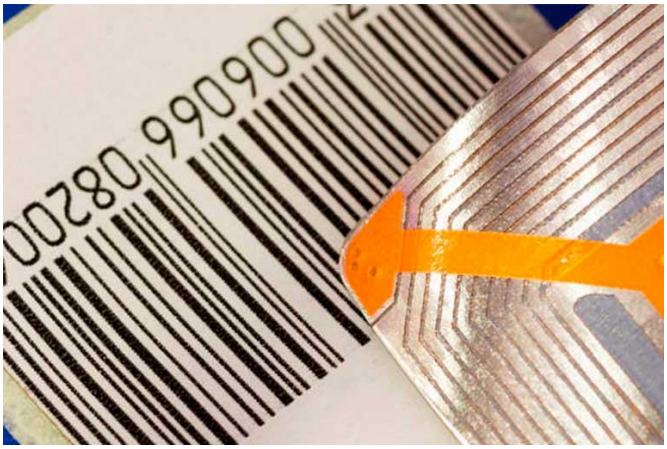


Fig 3.8 RFID Tag

3.3.1 RFID & Zigbee Based System Working

Each product in the shop or a mall will have an RFID tag on it. Each Cart will have an RFID reader and ZigBee Trans receiver implemented on it. There will be online payment procedure for billing. If the product is removed, it must get deleted from bill too. There must be an RFID reader at the exit door for anti-theft. Depending Upon Customer Buying Habits Display Offers/Discount

on screen. Display Product Info, Expiry Date, and Better Alternative. So by making use of this, the super market shopping system will become easier. It will also provide anti- theft system for a supermarket. It will enable online transaction procedure for billing, and it will also give suggestions to the user for buying products, display offers, etc. Constraints: RFID tags and ZigBee should work properly.

1. Every product in the shop or a mall will have an RFID tag on it.
2. Each Cart will have an RFID reader and ZigBee Tran receiver implemented on it1.
3. There will be a Centralized Server System.
4. After the payment of money, the Cart must get reset. There will be online payment procedure for billing.
5. If the product is removed, it must get deleted from bill too.
6. There must be an RFID reader at the exit door for anti-theft.
7. Display Product Info, Expiry Date and Better Alternative.

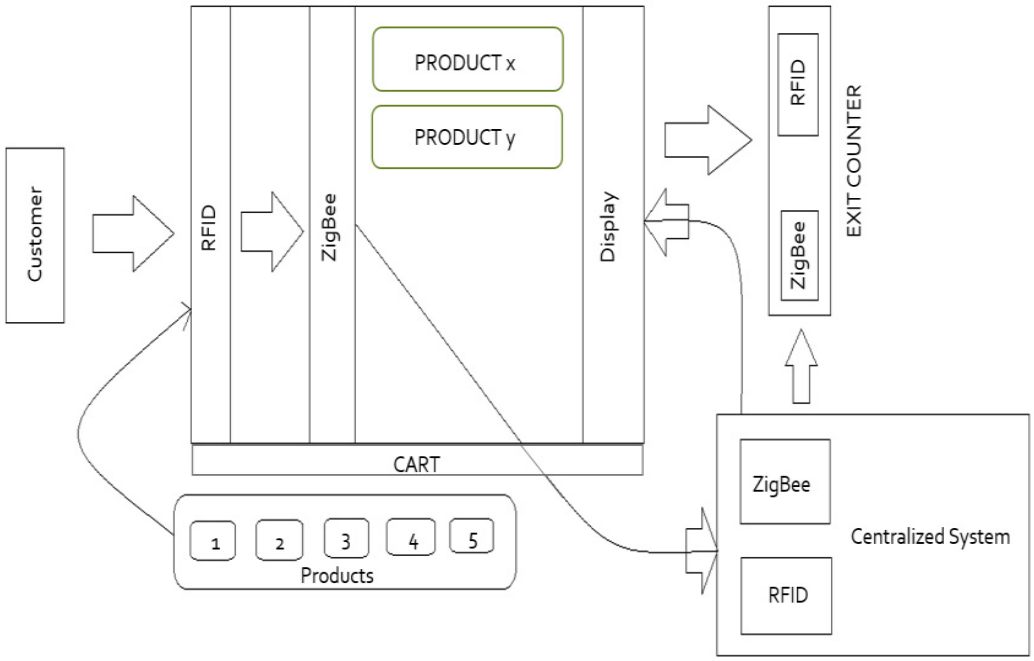


Fig 3.9 RFID & Zigbee Architecture

3.4 Effective Methodology For Purchasing In Shopping Marts Using QR Code And Smart Trolley

On shopping marts purchasing of products and their collection from various blocks is a hectic and tedious task where in today's world time is very precious. Following are the problems which are faced by customers

4 In shopping malls, customers firstly have to look for their required products, secondly they have to manage a cart (trolley) with them in case they have too many products to buy in large shopping area.

5 Customers have to stand in long queues for a longer period of time, which is time consuming.

In this proposed system uses an effective methodology for purchasing on shopping marts using QR-Code and Smart Trolley. This methodology contains the following steps

3.4.1 Algorithm for QR Code and Smart Trolley

Step 1: Customer after entry to the shopping mall and how will open the App on his smartphone.

Step 2: Login into the App.

Step 3: After login user will scan QR code available on the entry door of shopping mart (unique QR code will be assigned to the customer).

Step 4: After the QR code is assigned, customer can purchase the product by just scanning the QR Codes printed on the products, customer can also select the products from the previous ordered list or bill.

Step 5: After the final order of products, customer will click on bill generation and go to bill counter.

Step 6: Each smart trolley will have unique id and as the customer is clicking on bill generation, the unique trolley id will be connected with the customer's QR code id.

Step 7: Then the smart trolley will be moved to each block in the mart and the shop/stall keeper will put the customer's ordered products in the trolley and then trolley goes to the next stall and same process will continue till the order is completed.

Step 8: Then the trolley will be moved to the billing counter by the embedded system and the customer will take the products and pay the bill amount.

3.4.2 Process of Shopping Using QR Code

QR-codes can also be used in shopping malls. Here we are proposing a system (mobile application) where sample product will have a specific QR-code so, the customers have to scan the QR-code of the products they want to purchase. As soon as they complete their shopping, instead of standing in long queues with their products, they just have to collect their bill as well as their products from the cash counter. Customer has to install app before they enter to the mall and as the customer will come for shopping they will open the mobile application and then a unique id will be assigned to each customer. After the unique id is assigned customer can starts canning the QR code for the product he/she wants to purchase.

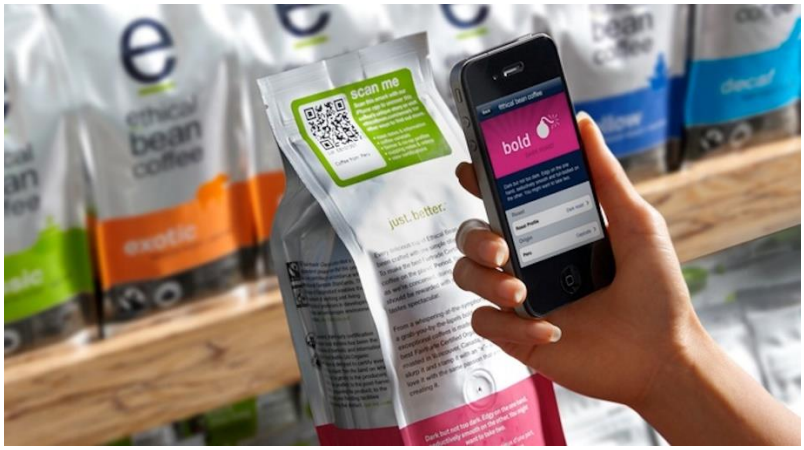


Fig 3.10 Scanning QR Code

Sample Products are displayed with QR code and customer needs to scan product QR code using app, then he will enter quantity of that product. When customer will finish his complete purchasing of products by scanning the QR codes of products a unique smart trolley (unique smart trolley number will be given to the customer) will be assigned to each customer in the mart. Then the trolley will go to each stall one by one, and stall keeper will put products in trolley. In marts shopkeeper and person of the particular block will put the customer ordered products in the smart trolley. The smart trolley will reach to the cash counter block when customer taps on check-out button in the app. The billing amount will be reflected immediately including discount and offers. Until he/she reaches Billing Counter he/she will not have trolley. When he/she reaches at billing counter and do check-out, the trolley will come with all the purchased products from mart and immediately he/she can pay the bill and collect the products.

4. PROPOSED SYSTEM

In the existing system, they have used the traditional method of barcode scanning. Using the barcode scanner, we need to scan each product and so this method becomes very slow to be scanned. A barcode reader is associate in electronic device for reading with the barcodes. In this process we have no automatic billing system and the customer has wait for the billing process in the long queues. Therefore, using the barcode process billing method is slow. This eventually results in the long queues and there also exists the RFID based Smart trolleys that uses RFID technology and RFID based tags to scan and add the products using RFID tags attached to the products and displayed the price in LCD screen are used to make some advantage over barcode billing system. It also becomes difficult to the shopping malls to fix RFID tags to each and every product in the shopping mall and also difficult for customer to scan each product with the RFID Reader.

The main purpose of our project is to overcome the problem of standing in queue and wasting time. In the proposed system, we will design an application in which the barcodes of the products are scanned then the products which are scanned can be added to the shopping cart in the application and the payment is made online automatically through the application that we are going to design. Initially, the customer registers with the mobile application which we designed and gets login. After registration the customer enters the trolley number given in the mobile application. The customer scans the Barcode/QR code attached to the product by using mobile camera in the application which he/she wants and keep the product in the trolley. Once the customer scanned the product, the weight of the trolley will be measured by using the load cell which is attached to the trolley, then the weight is sent to the ESP-32 module and will be sent to the cloud then the weight of the product is matched with the weight which is sent by the ESP-32 module, if the weight matches then the product details are fetched to the application, after that the total amount will be displayed then the customer can go for next product or remove the product based on customer budget and settle the bill. The billing will be done based on the customer requirements either online/offline. This system will be more efficient regarding offering a great deal to eliminate time taken at the billing counter in supermarkets and increasing customer satisfaction.

4.1 OBJECTIVES OF PROPOSED SYSTEM

The main objective of our solution is to overcome all the problems with the existing systems, the objectives include the following

- To overcome the problem of customers from waiting of long hours in the queues for billing.
- To reduce the man power by making the system fully automated, such that the man power for checking and billing the products at the checkout will be reduced.
- To reduce the cost for the management of shopping malls by reducing the staff and billing counters.
- To make customer to easy selection of products by displaying the total price to the customer after each product is scanned in the mobile application, such that the customer no need to return products due to less budget after selecting and billing is done.
- The system will be more efficient regarding offering a great deal to eliminate time taken at the billing counter in supermarkets and increasing customer satisfaction.

4.2 UNIQUENESS OF SOLUTION

All the existing systems are have their own advantages and disadvantages, In the existing system, they have used the traditional method of barcode scanning. Using the barcode scanner, we need to scan each product and so this method becomes very slow to be scanned. A barcode reader is associate in electronic device for reading with the barcodes. In this process we have no automatic billing system and the customer has wait for the billing process in the long queues. Therefore, using the barcode process billing method is slow. This eventually results in the long queues and there also exists the RFID based Smart trolleys that uses RFID technology and RFID based tags to scan and add the products using RFID tags attached to the products and displayed the price in LCD screen are used to make some advantage over barcode billing system. It also becomes difficult to the shopping malls to fix RFID tags to each and every product in the shopping mall and also difficult for customer to scan each product with the RFID Reader.

Uniqueness of solution

- The proposed system uses mobile camera to scan the products that makes the customer to reduce the billing time.
- The system calculates the weight of products in trolley automatically by loadcell which is attached to the trolley.

4.3 CUSTOMERS/USERS OF PROJECT

All the Customers who wants to visits the Offline Store because of discounts in products, cashless transaction, variety of products like household, decorative, kitchen, sports, education, stationeries which are all available under one roof. And the Shopping Mall managements who make use of the mobile application and stores the Customer data which make the management easy use of maintaining the products.

4.4 SOCIETAL USE OF PROJECT

- The time taken for the billing of the products is extremely reduced which makes the customer easy for purchasing products.
- Customers can add or remove items in the cart with ease i.e., they need not depend on bill counter.
- Customers can predict the price of the items in the cart before billing (Cost Estimation).
- Time efficiency and cost efficiency are guaranteed by this smart billing system.

4.5 PROBLEM AREA OF PROJECT

The problem area of the project are the Shopping malls which are the centre of attraction because of discounts in products, cashless transaction, variety of products like household, decorative, kitchen, sports, education, stationeries which are all available under one roof.

This includes all the places where we can purchase products for our needs in physical way (i.e. purchasing at store rather than ordering)

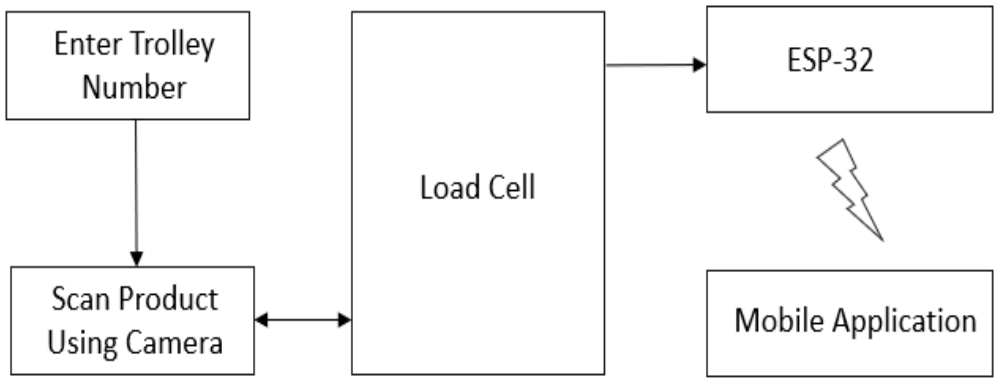
Some examples includes Supermarkets, Shopping malls etc.

5. SYSTEM ARCHITECTURE/DESIGN

5.1 System Architecture

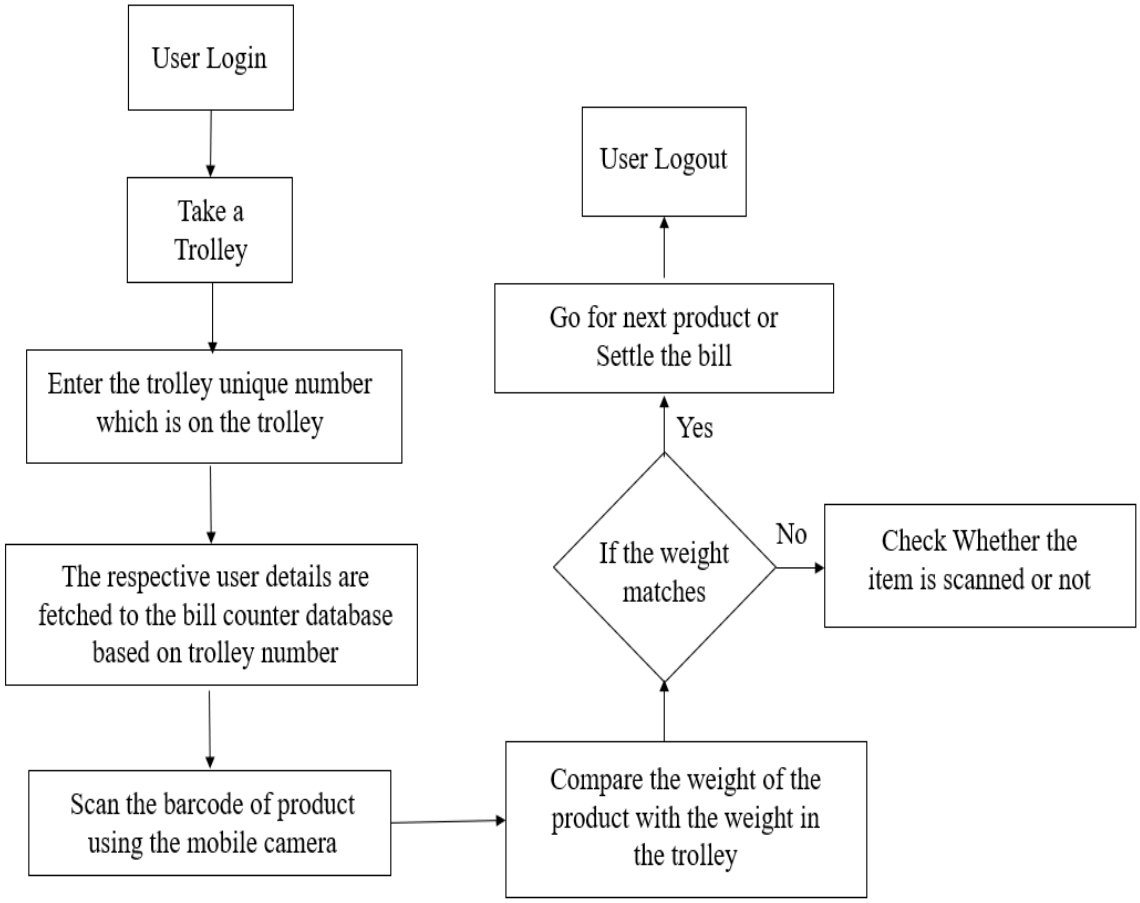
5.1.1 Block Diagram

The following is the Block Diagram of the Proposed System.

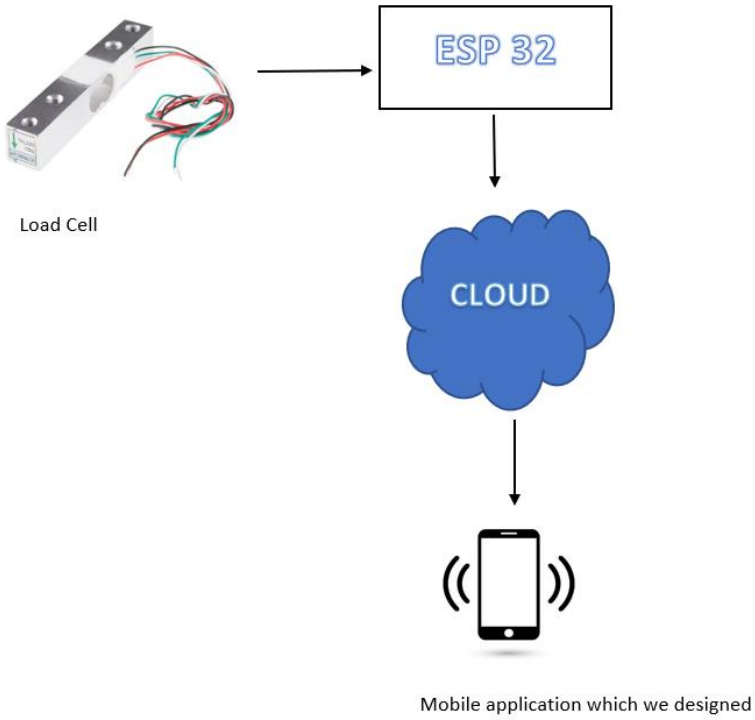


5.1.2 Flow Chart

The step by step procedure of the mobile application



The customer initially registers with the mobile application which we designed and gets login. After, Entering the unique number of trolley by the customer the connection between the mobile application and trolley is established, then the customer scans the product using mobile camera and keeps the product in the trolley, then the Load cell sends the weight of product in the trolley to ESP-32 module and will be sent to the cloud the weight of the product is matched with the weight which is sent by the ESP-32 module, if the weight matches then the product details are fetched to the application, after that the total amount will be displayed then the customer can go for next product or remove the product based on customer budget and settle the bill. The billing will be done based on the customer requirements either online/offline. This system will be more efficient regarding offering a great deal to eliminate time taken at the billing counter in supermarkets and increasing customer satisfaction.



5.2 METHODOLOGY & PROCESS

5.2.1 Algorithm

Step - 1 : Initially the customer takes out the trolley for shopping, the trolley has given an unique number and contain an inbuilt load cell to calculate the weight of products in the trolley.

Step - 2 : The customer initially registers with the mobile application which we designed and gets login.

Step - 3 : After registration the customer enters the trolley number given in the mobile application.

Step - 4: The customer scans the Barcode/QR code attached to the product by using mobile camera in the application which he/she wants and keep the product in the trolley.

Step - 5 : Once the customer scanned the product, the weight of the trolley will be measured by using the load cell which is attached to the trolley, then the weight is sent to the ESP-32 module and will be sent to the cloud then the weight of the product is matched with the weight which is sent by the ESP-32 module, if the weight matches then the product details are fetched to the application and go to step7.

Step - 6 : If the weight of product in trolley and the weight of product does not match, check for unscanned products and go to step8.

Step - 7 : Based on the total price the customer can estimate his budget and decide whether to buy the next products or to remove the products added in the cart.

Step - 8 : After the completion of shopping, the total amount is displayed on the mobile application and billing can be done will be done by the customer requirements (Offline/Online).

5.2.2 Working

Firstly, the customer enters the shopping mall and takes out the trolley for shopping, the trolley has given a unique number and contain an inbuilt load cell and ESP-32 to calculate the weight of products in the trolley. The customer initially registers with the mobile application which we designed and gets login. The data of the customer after registration is stored in the shopping mall database for future reference. The sample screen of register page look like given figure below.

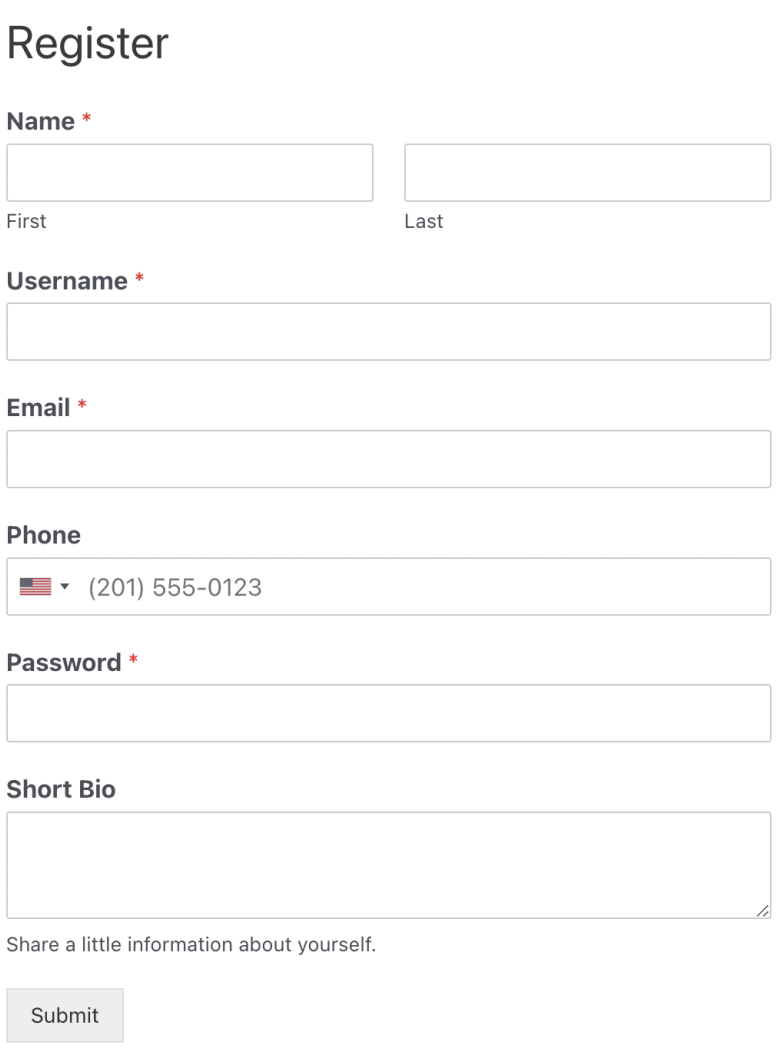


Fig 5.2.1 Registration page

After registration the customer enters the trolley number given, then the connection establishes between the trolley and application. The weight of trolley is calculated by the Load cell then the Load cell sends the weight of product in the trolley to ESP-32 module and will be sent to the cloud, if the weight of the product is matched with the weight which is sent by the ESP-32 module.

After completion of registration the customers gets login and the next screen as given below.

Fig 5.2.2 Trolley Number Entering

The customer is asked to enter the unique number of the trolley, after the trolley number is entered by the customer, the next screen opens the mobile camera and the customer scans the Barcode/QR code attached to the product which he/she wants and keep the product in the trolley.

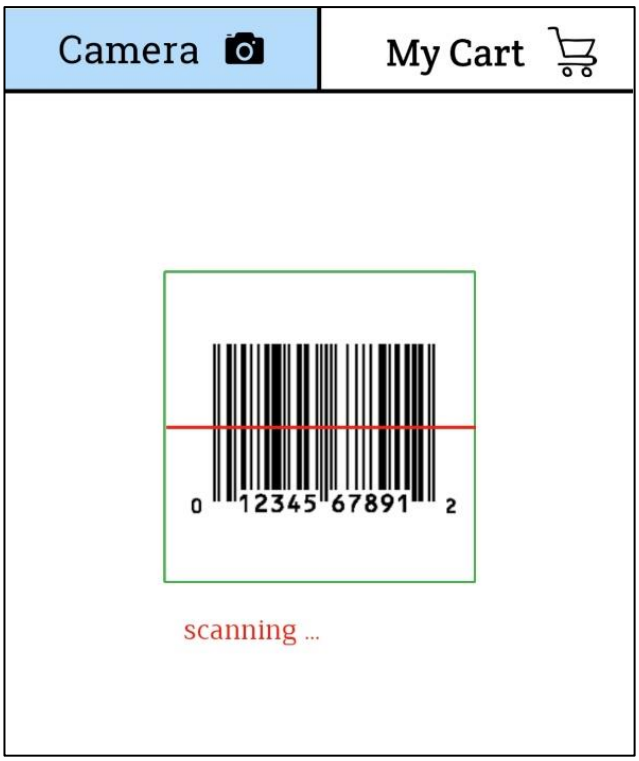


Fig 5.2.3 Barcode Scanner using Camera

Once the customer scanned the product, the load cell attached to the trolley calculates the weight in trolley, if the weight matches then the price and net weight of the product are added to the cart and displayed on the application. As much as the customer can add or remove the products form cart, so that the customer can view the total price of the products scanned. So that the customer no need to return products due to less budget after selecting and billing is done, because the total price is displayed to the customer after each product is scanned in the mobile application.

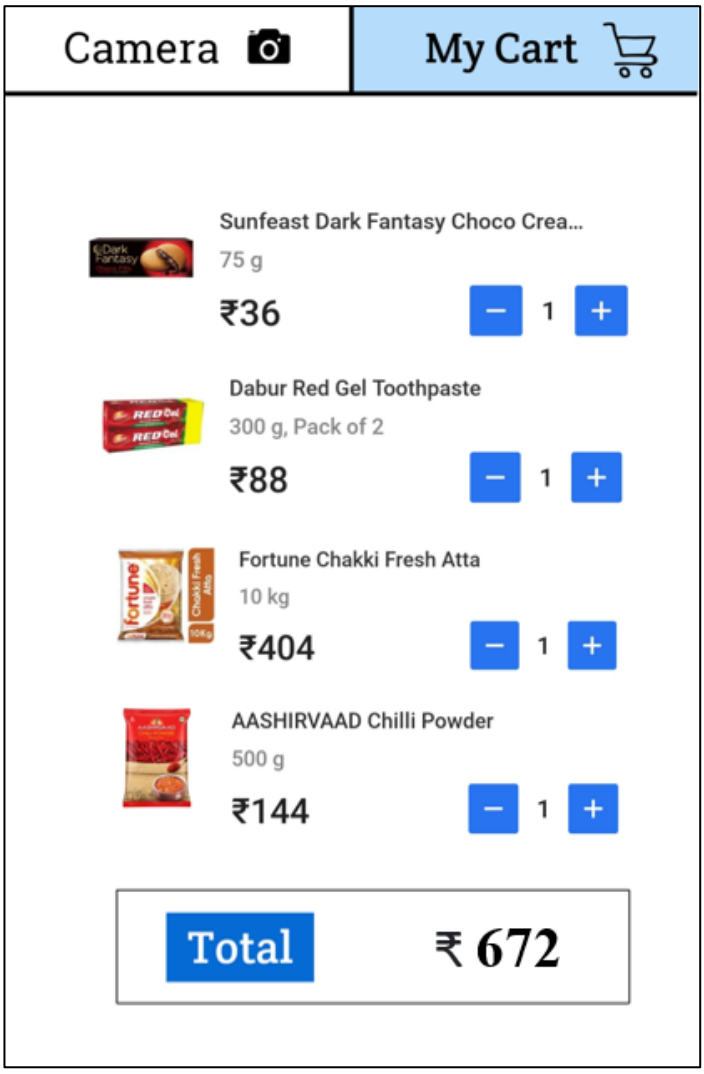


Fig 5.2.4 Shopping Cart

Based on the total price the customer can estimate his budget and decide whether to buy the next products or to remove the products added in the cart. The customer can easily add or remove products from the cart. After the completion of shopping, the billing will be done by the customer requirements (Offline/Online).

5.3 TECHNOLOGIES USED

For the purpose of the project, we are using the following technologies which makes the developer and the customer easy to make and use of the application for doing shopping and maintaining the shopping mall efficiently.

5.3.1 Android Studio

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (E-ADT) as the primary IDE for native Android application development.

1. Android Studio comes with the Gradle build system and many other toolchain elements built-in. This makes it the easiest IDE to set up for Android development.
2. It has an excellent graphic user interface for coders, making the process of creating an app more accessible and enjoyable.
3. It has a built-in emulator to make it easy to test and debug your app. It can also connect to your device for app testing.
4. Android Studio allows you to create many types of apps and use several different programming languages to do so.
5. It allows you to jumpstart your app with built-in templates and extensive full app templates from sites like Code Canyon.

In this system we use Android Studio to develop the mobile application in which the customer enter the trolley number and scans the barcode of the product by using the mobile camera in the application and also the products are displayed in the cart.

By using the mobile application the customer can easily identify and do shopping with out any waiting hours and also makes the customer satisfy by displaying the total bill in the mobile application itself, which helps the customer to easy decision to buy the products or to remove the products.

5.3.2 Cloud Computing

Cloud computing is the on-demand availability of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user. Large clouds often have functions distributed over multiple locations, each of which is a data centre. Cloud computing relies on sharing of resources to achieve coherence and typically uses a "pay-as-you-go" model, which can help in reducing capital expenses but may also lead to unexpected operating expenses for users.

Cloud is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software.

Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it.

Cloud computing is a popular option for people and businesses for a number of reasons including cost savings, increased productivity, speed and efficiency, performance, and security.

Organizations of every type, size, and industry are using the cloud for a wide variety of use cases, such as data backup, disaster recovery, email, virtual desktops, software development and testing, big data analytics, and customer-facing web applications. For example, healthcare companies are using the cloud to develop more personalized treatments for patients. Financial services companies are using the cloud to power real-time fraud detection and prevention. And video game makers are using the cloud to deliver online games to millions of players around the world.

Benefits of cloud computing

- Agility
- Elasticity
- Cost Savings

In this project we will use the cloud for storing the data of the items that are available in the small industry/marts like the prices of the items and their information and to retrieve the data of products to match the weights and get next process done.

We use cloud to store large databases like products, item availability, manufacture details and management of items which helps the customer for easy shopping and for management of shopping mall to easily manage and store the products.

5.3.3 SQL Database

A **database** is an organized collection of data, so that it can be easily accessed and managed. You can organize data into tables, rows, columns, and index it to make it easier to find relevant information.

Database handlers create a database in such a way that only one set of software program provides access of data to all the users.

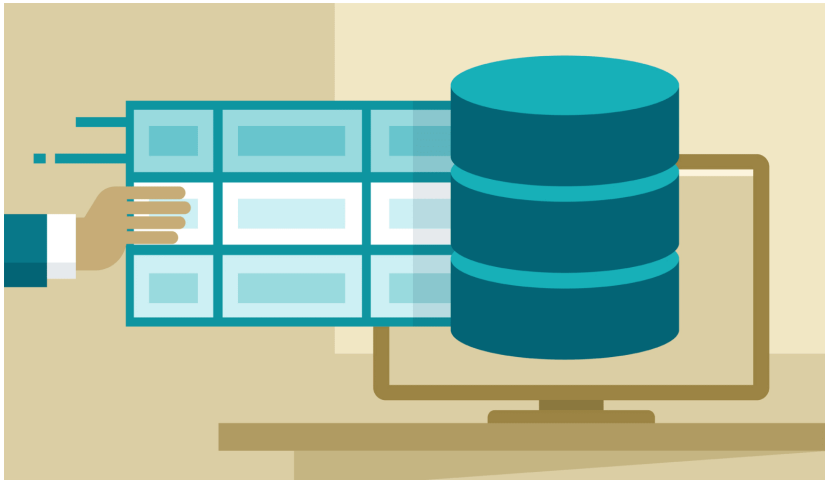
The **main purpose** of the database is to operate a large amount of information by storing, retrieving, and managing data.

There are many **dynamic websites** on the World Wide Web nowadays which are handled through databases. For example, a model that checks the availability of rooms in a hotel. It is an example of a dynamic website that uses a database.

There are many **databases available** like MySQL, Sybase, Oracle, MongoDB, Informix, PostgreSQL, SQL Server, etc.

Modern databases are managed by the database management system (DBMS).

SQL or Structured Query Language is used to operate on the data stored in a database. SQL depends on relational algebra and tuple relational calculus.



We use SQL in the project to create tables of customers and products and to store the customers data in the database and get the required data from the database and send it to the mobile application so that the customer details are saved and used for future reference purpose.

For the local database we use SQL database which is used to store the customers data in the shopping mall.

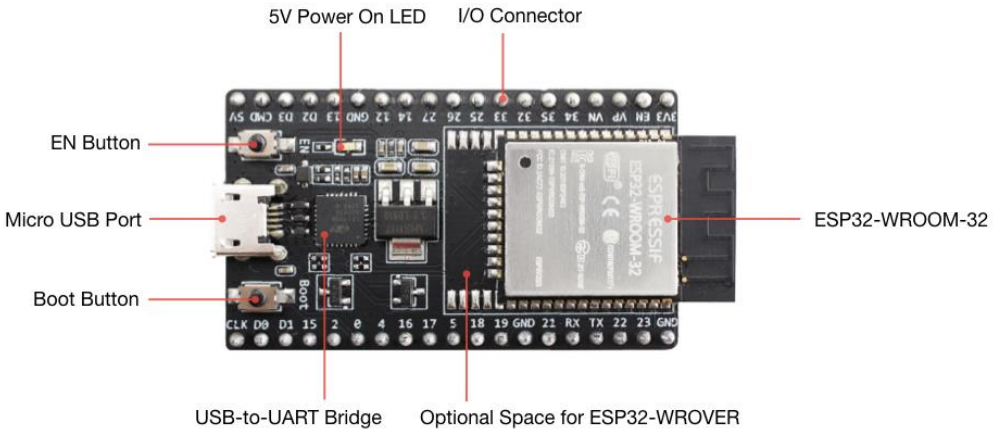
5.3.4 ESP-32

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth.

ESP32 is a system on a chip that integrates the following features:

- Wi-Fi (2.4 GHz band)
- Bluetooth
- Dual high performance Xtensa® 32-bit LX6 CPU cores
- Ultra Low Power co-processor
- Multiple peripherals

The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm processor. It is a successor to the ESP8266 microcontroller.



The ESP 32 is integrated with the load cell which calculates the weight of the product in trolley and gets stored in cloud. Whenever we request the data it will fetch from the cloud storage and the details of the product will fetch to the mobile application and the product displays in the mobile application if the weight matches. By using the ESP-32 we will able to send the signals easily hence it contains inbuilt WiFi module, which helps to send the signals with low latency.

5.3.5 Load Cell

A load cell converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. It is a force transducer. As the force applied to the load cell increases, the electrical signal changes proportionally. The most common types of load cell are pneumatic, hydraulic, and strain gauges.

Load cells are commonly used to measure weight in an industrial environment. They can be installed on hoppers, reactors, etc., to control their weight capacity, which is often of critical importance for

an industrial process. Some performance characteristics of the load cells must be defined and specified to make sure they will cope with the expected service.

Among those design characteristics are:

- Combined error
- Minimum verification interval

We use the Load cell along with the ESP-32 which calculates the weight of product in the trolley and sends the weight to cloud, when the customer scans the product using camera the details of the product like price and weight are fetched in background and the weight is compared with the weight given by the load cell, if it matches the product details are fetched to the mobile application. This makes the system automated which reduces the time consuming for checking the products at the checkouts in shopping malls.

5.4 COMPARISON WITH EXISTING SYSTEMS

Based on the several measures we are going to compare the existing system with our proposed system.

1. Time Consumption.
2. The Weighing of products.
3. Manpower needed.
4. Products inspection.
5. Cost of shopping mall management.
6. Product returns.

Functionality	Existing Systems	Proposed System
Time Consumption	More	Less
The Weighing of products	Manual	Automatic
Manpower needed	More	Less
Product Inspection	Manual	Automatic
Cost of shopping mall management	More	Comparatively Less
Product Returns	After Billing	Before Billing

Table: Comparison between Existing and Proposed Systems

1. Time Consumption

All the existing systems have their own advantages and disadvantages. In the existing system, they have used the traditional method of barcode scanning. Using the barcode scanner, we need to scan each product, and so this method becomes very slow to be scanned. And the customer has to wait for the billing using this barcode system; each and every product is scanned manually, which increases the time consumption at billing counters.

In the proposed system, we are using the camera of the mobile application to scan the barcode of the products by the customer itself, which reduces the time consumption at billing counters and increases customer satisfaction.

2. The Weighing of Products

The products are manually kept and checked from the trolley in the current system, which requires more manpower and takes longer.

In the proposed system, each trolley is given a unique number. After entering the unique number of the trolley in the mobile application by the customer, the connection between the mobile application and trolley is established, then the customer scans the product using the mobile camera and keeps the product in the trolley. The load cell then sends the weight of the product in the trolley to the ESP-32 module and will be sent to the cloud. The weight of the product is matched with the weight that is sent by the ESP-32 module. If the weight matches, then the product details are fetched to the application. This reduces the manpower and calculates the weight automatically.

3. Manpower needed

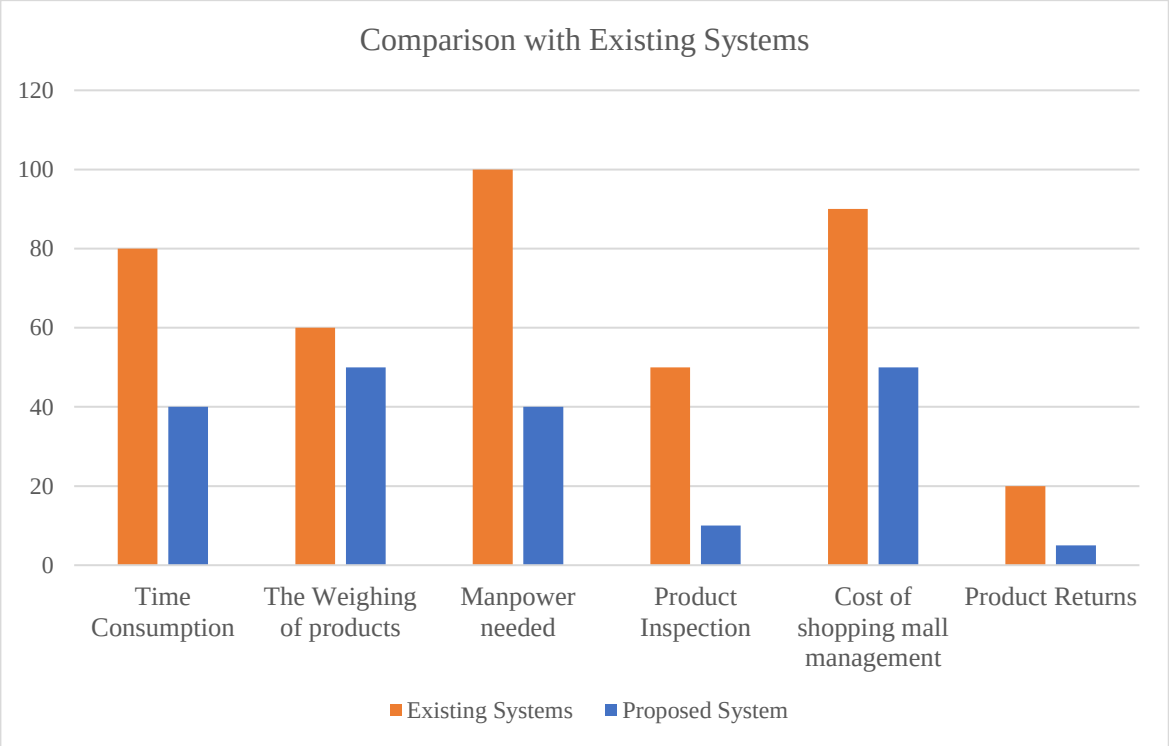
Each and every product is scanned manually by using a barcode scanner, which is a very slow method and requires more manpower to scan the products at billing counters. The products also need to be checked at the checkouts to determine whether they are billed or not.

We use a mobile camera for scanning the barcode by the customer itself, and it also consists of an automatic weighing system that calculates the weight and matches the weight with the products. This reduces the manpower at the billing and checkout counters.

4. Product Inspection

The products must be reviewed at the checkouts to see if they have been properly charged for all the products. Additionally, each and every product must be manually scanned using a barcode scanner at the billing counters, which is a labour-intensive process that takes a lot of time.

There is no need to check the products manually because the proposed system consists of automatic weighing by using the load cell, which gives the weight of the product in the trolley. After the weight matches the product weight, the billing is processed.



5. Cost of shopping mall management

The cost of shopping mall management is high due to the manual process of scanning the barcode at billing counters, which increases the cost of equipment, and checking by the staff at checkouts, which increases the salaries for the staff.

The proposed system reduces the cost by reducing the staff at checkouts and billing counters.

6. Product Returns

In the traditional method, the products are returned by the customer after billing due to insufficient cash.

It displays the total cost in the mobile application, where the customer can choose to go for the next product or remove the products from the cart before billing.

5.5 RESULTS

The proposed model is easily accessible and convenient to use. It does not require special training. The manpower is decreased and will save time that the user spends in billing queue. Many users can be attended in same time which is useful for retailers and customers. Time efficiency and cost efficiency are guaranteed by this smart billing system. This will turn out to be very beneficial for the retail stores as more people will enjoy the shopping experience and come more often to shop. The system will be more efficient regarding offering a great deal to eliminate time taken at the billing counter in supermarkets and increasing customer satisfaction.

6. CONCLUSION

Now a days, shopping has become a daily activity in today's world. Metropolitan cities are crowded with people in shopping malls to buy their daily needs. Though almost everything is available online for purchase, a large number of people still prefer to buy many things by visiting supermarkets and malls. Shopping malls are centre of attraction because of discounts in products, cashless transaction, variety of products like household, decorative, kitchen, sports, education, stationeries which are all available under one roof. The objective of our project is to overcome the problem of standing in queue and wasting time. So, we are designing an application in which the barcodes of the products are scanned then the products which are scanned can be added to the shopping cart in the application and the payment is made online automatically through the application that we are going to design. Initially, the customer registers with the mobile application which we designed and gets login. After registration the customer enters the trolley number given in the mobile application. The customer scans the Barcode/QR code attached to the product by using mobile camera in the application which he/she wants and keep the product in the trolley. Once the customer scanned the product, the weight of the trolley will be measured by using the load cell which is attached to the trolley, if the weight of product and weight in trolley matches then the product details are fetched to the application, after that the total amount will be displayed then the customer can go for next product or remove the product based on customer budget and settle the bill. The billing will be done based on the customer requirements(online/offline). This system will be more efficient regarding offering a great deal to eliminate time taken at the billing counter in supermarkets and increasing customer satisfaction.

We conclude that by making avail of our application, customers can pack and bag their things very fast as they don't need to spare much time at bill counters which will also help speed the end-of-day counting process, reduce errors and saves time. At the end, it will be a win-win situation for both customers and billers. The system will be more efficient regarding offering a great deal to eliminate time taken at the billing counter in supermarkets and increasing customer satisfaction.

6.1 FUTURE SCOPE

The project mainly aims to scan the product within cart and make total billing count at cart side. The main improvement for the future is to develop application for shopping within mall. In that application before going to market user can note the products that he want to buy and make a checklist. Another feature that can be added is that it will give suggestion to buy products based on our daily needs and also based on the previous shopping and can make online transaction through this application.

7. BIBLIOGRAPHY

7.1 Books Referred

For the purpose of the project work, we have referred to the following books.

1. Internet of Things – A Hands on Approach by Arsheep Bahga and Vijay Madisetti.
2. QR Codes: The Technical Guide by Michael M. Stark.
3. Cloud Computing, A Hands on Approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2014.
4. Esp32 Programming for the Internet of Things by Sever Spanulescu.
5. Mastering Cloud Computing, Foundations and Application Programming,1st Edition, Raj
6. Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH,2013.
7. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
8. Rice Lake Load Cell Hand Book by M.C. Schroeder.

7.2 Websites Visited

The following are the websites that we visited for the reference of the project work.

1. https://www.connectedpapers.com/search?q=smart%20billing%20system.
2. https://www.connectedpapers.com/main/bdf1dfea3117a7d5f24601c56161f82090e143a3/Automated-Shopping-Trolley%3A-A-Smart-Billing-System/graph.
3. https://www.academia.edu/28898739/Smart_Trolley_and_Automatic_Billing_pdf.
4. https://www.academia.edu/13619187/IRJET_AUTOMATION_OF_SHOPPING_CART_TO_EASE_QUEUE_IN_MALLS_BY_USING_RFID.
5. https://www.researchgate.net/publication/358744057_Smart_Trolley_with_Automatic_Billing_System_using_Arudino.
6. https://www.ijert.org/smart-shopping-cart-with-automated-billing-system.

7. https://jespublication.com/upload/2019-V10-I11-11.pdf.
8. https://ejmcm.com/article_5801_28575b6031b9f61112e7d631a4824f8d.pdf.
9. http://ece.anits.edu.in/2019-20%20BE%20Project%20REPORTS/GMR_1920_PROJECT_2
10. https://how2electronics.com/smart-shopping-cart-with-automatic-billing-system-using-rfid-arduino/

7.3 REFERENCES

[1] Mr. P. Chandrasekar and Ms. T. Sangeetha "Smart shopping cart with automatic billing system through RFID and transmitter and receiver", IEEE, 2014.

[2] S. Sainath, K. Surender & Arvind, V., 2014. Automated Shopping Trolley for Super Market Billing System. s.l., International Conference on Communication, Computing and Information Technology.

[3] Aboli Hanwate and Poonam Thakare. 2015. Smart Trolley Using RFID, International Journal of Research in Science & Engineering. Volume: 1, Special Issue: 1.

[4] Sagar Sojitra et al. the "QR code, there by launching a URL in the web browser" in 2016.

[5] Kamble, S., Meshram, S., Thoka, R. & Gakre, R., 2014. Developing a Multitasking Shopping Trolley Based On RFID Technology. International Journal of Soft Computing and Engineering, 3(6).

[6] Suraj.S, Guruprasad, V., Pranava, U. R. & Nag, P. S., 2016. RFID Based Wireless Intelligent Cart Using ARM7. International Journal of Innovative Research in Science, Engineering and Technology, V(8)

[7] J.S.Awati , S.B.Awati, et al, "Smart Trolley in Mega Mall", International Journal of Emerging Technology and Advanced Engineering,, Volume 2, Issue 3, March 2012.

[8] Dhavale Shraddha D,DhokaneTrupti J,Shinde Priyanka S "IOT based intelligent trolley for shopping mall",IJEDR,2016.

[9] Gourav Bidkar, Deepali Doddabhamannavar, Priyanka D. Deshmukh "A Smart Trolley is mandatory tool for shopping in supermarkets or grocery stores" has Published on 2021.

[10] T. Sarala, Y. Sudha and B. N. Nithin a "Smart Shopping trolley using Rechargeable Smart Card" Published on 1st May 2018 in 3rd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT).

[11] S. Shankar, S. Balasubramani, N. S. Kumar Reddy a "Smart trolley based on Internet of Things [IoT] with an advanced billing system" Published on 8th April 2021 in 5th International Conference on Computing Methodologies and Communication (ICCMC).

[12] S. Mekruksavanich the "RFID technology-based Smart Shopping System" Published on 1st March 2020 in Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT & NCON).

[13] D. Sinha, Karthik Cottur, Badari Nath K the "Automated Billing System using RFID and Cloud" Published on 1st March 2019, in Innovations in Power and Advanced Computing Technologies (i-PACT).

[14] Akshay Kumar, Abhinav Gupta a "Smart Shopping Cart" Published on 1st August 2017 at the International conference on Microelectronic Devices, Circuits and Systems (ICMDCS).

[15] Dr.N. Palanivel, S. Francis the "Recommendation System Based Smart Shopping Cart" is Published on 1 May 2020 in Journal of emerging technologies and innovative research.

[16] Yerlan Berdaliyev, A. P. James a "RFID-Cloud smart cart system" is Published on 12 August 2016 in International Conference on Advances in Computing, Communications and Informatics (ICACCI).

[17] Murari Kumar, Rachana the "Smart basket design using arduino and rfid module" is Published on 28 March 2017 in International journal of recent scientific research.

[18] Zubin Thomas, N. Kumar, D. J. Preshiya the "Automatic billing system using Li-Fi module" is Published on 6 April 2016 in International Conference on Communication and Signal Processing (ICCSP).

[19] Sonali S. Dhokte, Bhagyashree S. Patere "Smart Shopping Trolley Using Rechargeable Smart Card" Published on 2015.

[20] J. C. Narayana Swamy, D. Seshachalam, Saleem Ulla Shariff the "Smart RFID based Interactive Kiosk cart using wireless sensor node" Published on 1 October 2016 in International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS).

[21] B. Bhattacharyya, Shilpa Sarkar, Shubham Goyal "An Android App Based Autonomous Shopping Cart".

[22] T. Hanooja, C. G. Raji, M. Sreelekha, Jemsheer Koniyath the "Human Friendly Smart Trolley with Automatic Billing System" is Published on 5th November 2020 in 4th International Conference on Electronics, Communication and Aerospace Technology (ICECA).

[23] V. Nandini, N. Shree and S. Kulkarni a "Smart Shopping System Using IOT" Published in 2021.

[24] T. Sheltami, E. Shakshuki "An efficient RFID solution to expedite services" Published in MoMM on 14 December 2009.

[25] George Roussos an “Enabling RFID in Retail” Published on 1 March 2006.

[26] Pushkar Saraf, Arati D. Khanolkar the "D2D Smart Billing System" Published on 4 June 2019 in International Journal of Advance Research, Ideas and Innovations in Technology.

[27] J. Suryaprasad, B. Kumar, D. Roopa, A. Arjun “A Novel Low-Cost Intelligent Shopping Cart” published at 011 IEEE 2nd International Conference on Networked Embedded Systems for Enterprise Applications on 8 December 2011.

[28] Subhanvali Shaik, Mohammad Jabirullah the “Advancement of Shopping Handcart for Supermarket” was published at the 2020 Sixth International Conference on Parallel, Distributed and Grid Computing (PDGC) on 6 November 2020.

[29] Ankush Yewatkar, Faiz Inamdar, Raj Singh, Ayushya, A. Bandal a “Smart Cart with Automatic Billing, Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft”.

[30] A. Narayan, Atheesh Krishnan the “IOT Based Comprehensive Retail Malpractice Detection and Payment System” was published at the 2020 IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT) on 1 July 2020.

[31] B. Arathi, M. Shona “An Elegant Shopping using Smart Trolley” was published at the Indian journal of science and technology on 23 January 2017.

[32] M. Dhivyaa, C. Brindha, T. Haritha, S. Gokula Kannan “A Multifunctional RFID enabled Shopping Tramcar” was published at Journal of Physics: Conference Series 2021.

[33] Ria Singh, Satyam Verma, Ms. Kriti “RFID and IR based Smart Shopping Mart Management System” was published at 2018 International Conference on Advances in Computing, Communication Control and Networking (ICACCCN) on 1 October 2018.