

## Smart Kart

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### Abstract

Due to demonetization, India suffered from a huge economic loss in various sectors, especially retail. Demonetization has caused a rift in the economy and caused a lot of problems for the common man. The citizens had to deposit the older notes in the bank which in turn resulted in big chaos and queues in front of the banks and ATMs. The main aim of this project is to promote cashless transactions and reduce the loss suffered by the retail and economic sector and problems faced by the common people due to demonetization. In this paper, we demonstrate the implementation of a cost-effective, reliable and fair Smart Kart which can be used in supermarkets and shopping malls where it can help in reducing the man power and can also help us in improving the shopping experience of the user. As our proposed solution works well for all the types of customers and supports all sorts of payment method possible in a smarter way. Now, instead of waiting in a long queue for billing out their shopped items, our system makes the billing system fully automated. Along with this our system has the ability to ensure detection of cases of deception invoked by the dishonest customers, which in turn makes it attractive and fair for both buyers as well as the sellers too. The proposed system design along with the experimental setup are being demonstrated through this paper. Our approach itself proves that our setup is ready for the deployment in the real world for the benefit of every single stake holder out there.

**Keywords:** - Demonetization, Cashless transactions, Load cell, Smart Kart, Raspberry Pi, Smart Card, QR Code, Barcode, E-wallet, etc:

## 1. INTRODUCTION

Innovations and inventions in the field of communications and information technologies have caused a huge revolution in values, knowledge and perceptions in practically all the areas of human understanding, deeply carving the so-called “Age of Information and Knowledge”. Human beings have invented/adopted technology to their needs since their existence. Main purpose of innovation in technology, irrespective of the domain, has been in simplifying life on earth or making every day work easier and faster. There has been an enormous amount of advancements in the field of automation, basically today everything what we do is already automated or has to be automated making it simpler for us.

In today’s scenario, the shopping trolleys are being used frequently for the ease of the customer’s shopping. There exist many systems attached to the trolley to make it ‘smart’. The systems have employed many technologies. In some systems, they have employed RFID (Radio Frequency Identification) and wireless networks for product identification that makes the shopping process faster, transparent and efficient. As the shopping trolley approaches the product, the trolley automatically reads the product by using RFID tag. In our project, we are employing a completely different strategy for the shopping kart.

The challenges here are not only to make the system smart by automation, but also to handle the concerns that are raised due to dishonest customers and various methods of forgery, cost-effectiveness, energy consumption etc: that may create a negative impact on the mindset of certain stakeholders which in turn can prove to be a failure for the system. The proposed system works reliably with minimum energy requirement and is fair as well as cost- effective at the same point of time.

While we were making the proposed system, we came across certain supermarkets and shopping marts, where our smart kart along with smart card shall be used to address the common issues faced by most of the stakeholders. The issues addressed or faced along with our solutions are as follows: -

- **Customers dissatisfaction because of hours and hours of waiting for check-out or billing process-** our smart kart is designed in a way to accept payment in all forms that is Cash, E-wallet or the Smart Card depending upon user’s convenience as soon as it is through with its shopping
- **Involvement of huge man-power, which is expensive-** we have come with a design or a system that automates the checkout procedure by billing the products simultaneously as soon as we add the product in the Smart Kart
- **Dishonest behavior of customers-** we all know that everything has its own advantages as well as disadvantages. Automation has its own worries. Absence

of human operators can lead to forgery. We propose a solution that handles all the cases of deception, if any so that it is an attractive option for both the buyers as well as the sellers too.

This system works well under all the circumstances even if there are lots of customers or buyers present in the shopping mall, there won't be any sort of deterioration or decrease in the service. Every single shopping Kart is in-built with our proposed system with a load cell fitted at the bottom of the Smart Kart, a camera fitted at the top or in the middle edge of the smart kart(which acts as our QR code scanner as well as barcode scanner as well), a servo motor fitted at the two ends of the smart kart in order to close or open the slab placed at the top of the kart on which the product is to be kept for shopping as well as a display which can be a mobile or tablet etc: Every smart kart has a unique barcode or a QR-Code attached at the side of the kart to identify the kart with a unique id for sorts of future references.

## **2. LITERATURE REVIEW**

According to all the research papers reviewed by us, the author in this paper has proposed that the smart shopping trolley is installed with a RFID reader which reads the Smart card which has a RFID tag that allows the customers to pay via this smart card. The bill of the customer is generated when the products are completely scanned and the payment is done with help of the smart card. [1] The authors in this paper have stated a way in which the customer would easily have their billing done. They have proposed a method in which the shopping trolley is installed with a RFID reader. Each product in the market has been installed a RFID tag. The reader reads the tag and that particular item is billed. [2] This paper proposes a system in which the customer has to hold the barcode of the product in front of barcode scanner. Then the data regarding product will be displayed on display and billed automatically. [3] The author has proposed a system in which the trolley follows the customer and it allows the customer to bill the items purchased automatically and pay the bill too. [4]

In this paper the author proposes a system which consists of RFID tags, RFID reader, Zigbee & micro-controller which allows the customers to bill the products automatically with the help of the RFID reader. [5] The author uses the RFID reader to read the products instead of using the barcode scanner & it displays on the in-built LCD display. The bill is automatically generated after it receives from the receiver present in the trolley. [6]

The authors have proposed a system which consists an UNO, IR transmitter and a RFID reader & tags were installed in all the product in the supermarket. The program in the UNO was programmed to read the tags & display it to the customer. [7] The authors in

this paper bases its entire reading on RFID reader which reads the product of the supermarket and helps the customers to locate the product easily. The RFID reader helps in detecting all the products and bills it automatically. [8]

The authors have proposed a system in which the system consists of RFID tags, RFID reader, Zigbee and micro-controller which the allows the customers to bill the products automatically with the help of the RFID reader. The billing starts automatically after a short span of time. [9] This paper proposes a bot which is automatically programmed and follows the person with the help of a simple robotic platform which is powered by a PIC micro-controller.

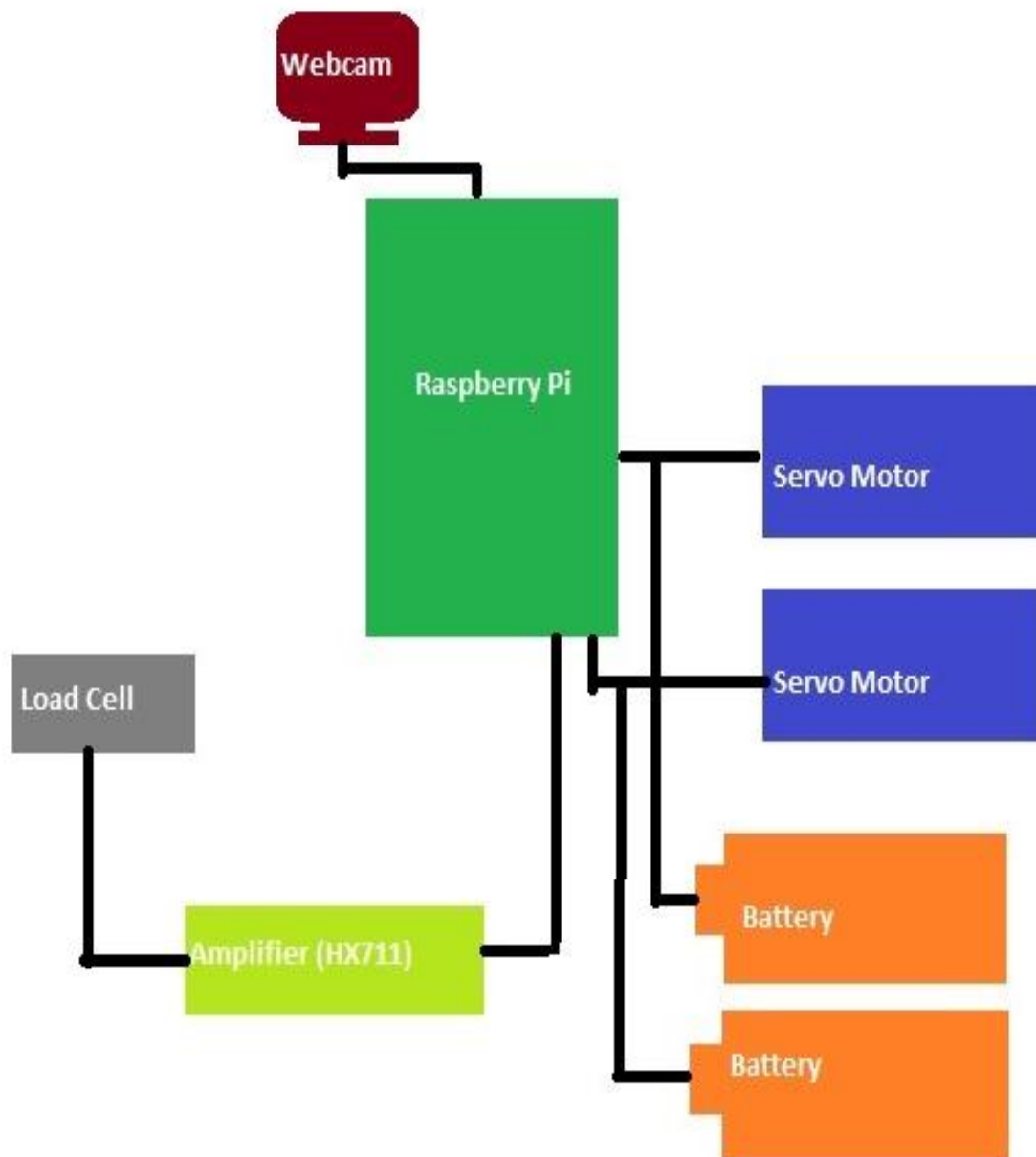
[10] The system is implanted with a PID, LCD, RFID reader and a Bluetooth module. The system reads the products automatically with the help of the RFID reader and it sends it to the Bluetooth module to bill the particular items. [11] The system proposed in this paper by the authors has a load cell and barcode scanner. The load cell in this system calculates the weight obtained by the products and the barcode scanner scans each product. An automatic bill is obtained after all the items are scanned. [12]

In this paper, they have conducted a national survey to examine the conditions of customers in the online and in store environments. They have tabulated many results according the views of the customers. [13] The authors have developed an android app in which they help the customers to identify where the products are in the super market. It provides a real time quick way to track the items which they want to buy. [14] The authors have proposed a unique way which helps to point out products to the customers by helping the customer to calculate shortest path from the location where the customer is in the shop to the target product location. [15]

### **3. SYSTEM ARCHITECTURE**

The Smart Kart is a way to improve the quality of services provided by retailers and to augment the consumer value thus allowing for saving time and money. The proposed system gives the customer an option to generate the bill at the cart itself thus saving their time that usually gets wasted by standing in long queues.

Once the customer enters the Super Market, he/she is required to enter their mobile number and unique security pin that is looked up on the database and if it is an existing customer, their profile is loaded into the cart. If the mobile number is not registered, the user is requested to give their name for registering them temporarily



**Figure 1- Architecture of the Smart Kart**

Once the user is identified, they can proceed to shop. The customer is redirected to the user interface of the shopping complex, the list of products is displayed on the user interface.

If customer has to add a particular product to the bill, the barcode of the product is scanned which is done by bringing the barcode of the product close to the camera installed in the cart. Each detail of the product and the bill is displayed on the

tablet/mobile application. If the customer wants to remove a product, he/she can navigate through the options provided on the touchpad. A load cell installed in the cart that measures the total weight of all items in the cart.

The weight of the product obtained from the database by scanning the barcode and the weight sensed by the sensor is compared to make sure that all products are billed and no extra products have been added to the cart without proper billing. Once the user has completed his/her shopping they can finalize their bill and a list of payment options are displayed on the tablet/mobile application.

If E-wallet is chosen as the mode of payment, a QR code of the corresponding E-wallet is displayed on the touchpad and the customer can complete the payment. If Smart Card is chosen as the mode of payment, scanning the QR code of the user's smart card after which the user is requested to enter a 4-digit security pin to confirm identity identifies the user.

Once the payment is successful, the customer can leave the shopping area and proceed towards exit for the security check. The security guard will get a notification automatically and when the security guard will scan the Smart Kart for the payment confirmation, if yes then only the platform of the kart opens up automatically and the customer is allowed to leave the premises.

The architecture diagram drawn in figure 1 showcases the connections of the smart kart, that how the web camera, the two servo motors , a raspberry pi as well as the external power supply along with the load cell and its amplifier will be configured in the system.

#### **4. METHODOLOGY ADOPTED**

The methodology adopted by us is quite simple. To demonstrate our project and findings, we will be making use of activity diagram as well as sequence diagrams. An activity diagram shown below in figure-1 completely showcases the series of activities to be performed in a proper order which proves this system to be robust, cost-effective, fair and reliable for all the stake holders.

The activity diagram shown in figure 2 clearly explains us the functioning of the Smart shopping system. Here as you can see that when the user visits the supermarket for the very first time, then the user needs to register itself. Now for the registration purpose, the user is provided with two options.

The very first option is that where the user can directly register himself as shown in snapshot1 present below the circuit. In this the customer needs to add his registered mobile number as well as the password which he/she wants to fix for logging in to their account for future references.

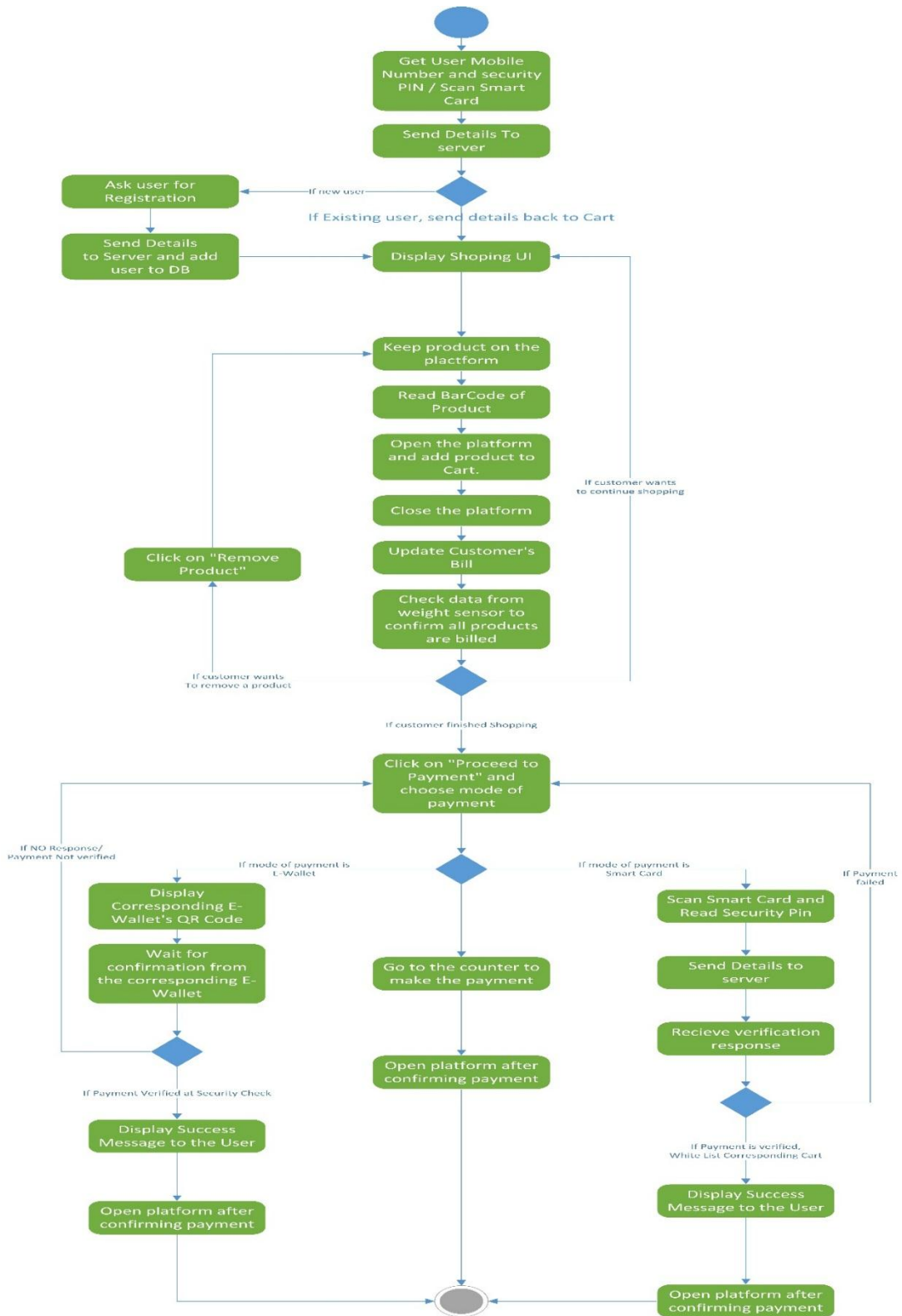


Figure 2- Activity Diagram of the proposed model

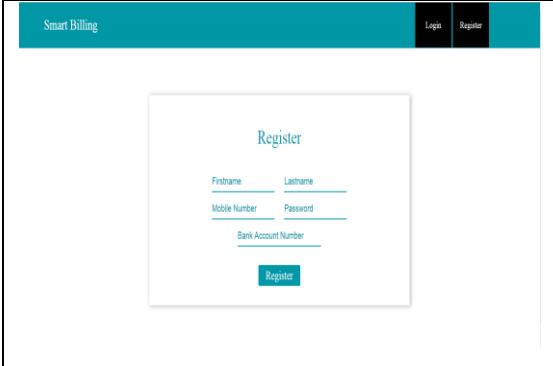
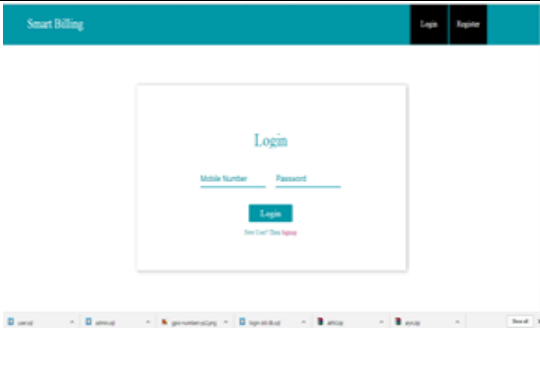
The option for the bank account number is to filled by the user those who wish link their account directly with smart card which is to be used for the shopping. Actually, there are in total of three methods to make the payment that is in cash, smart card or E-wallet. So, for the customers who wish to pay through smart card of the supermarket are required to get the card issued in their name from the customer support help desk.

That smart card can be recharged in two ways. One way out is to get it recharged manually by paying cash but with a maximum amount of Rs. 50,000 to avoid any sorts of misuse. The other way out is that it can be directly linked to the customers' bank account number from where it can be deducted directly as per the bill. The smart cards built by us can only be used in the particular supermarket or the outlet. It is highly secure as it requires a 4-digit PIN for authenticating the payment.

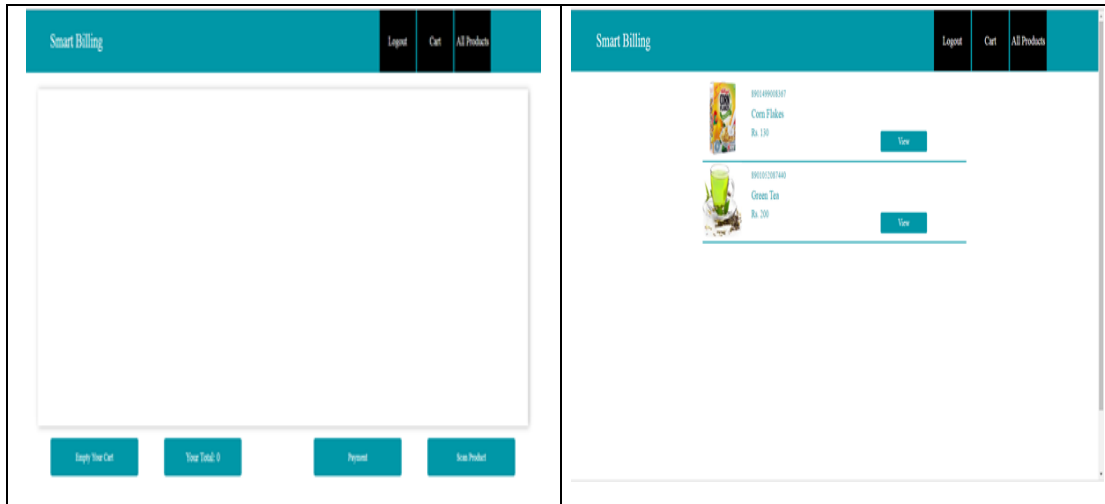
Also, the user can avail cash backs and discounts based upon his history of shopping. So once the user register himself as shown in snapshot-1 after that the user can make use of the login portal for the customers as shown in snapshot-2 to login to his account. After logging in the user has the option the of checking out all the items available in the market as shown in snapshot 3 and snapshot 4 along with its Maximum Retail Price (M.R.P).

In snapshot-5 we can see the payment portal where we have the option of paying via smart card, cash or E-wallet. When we select the cash option then we need to pay the bill at the cash counter, when we select the E-wallet option then we need to scan the QR-Code present on the screen and we will be redirected to the payment gateway. And if we select the third option of the smart card then we need to press the 4-digit pin after scanning the smart card for authenticating the payment.

In snapshot-6, snapshot-7 and snapshot-8 we have the admin portal for the store manager to update the inventory and the stock available as well as to address the customer grievances too. All these snapshots were being captured while testing the prototype which ran successfully and did pass all the tests and safety hazards.

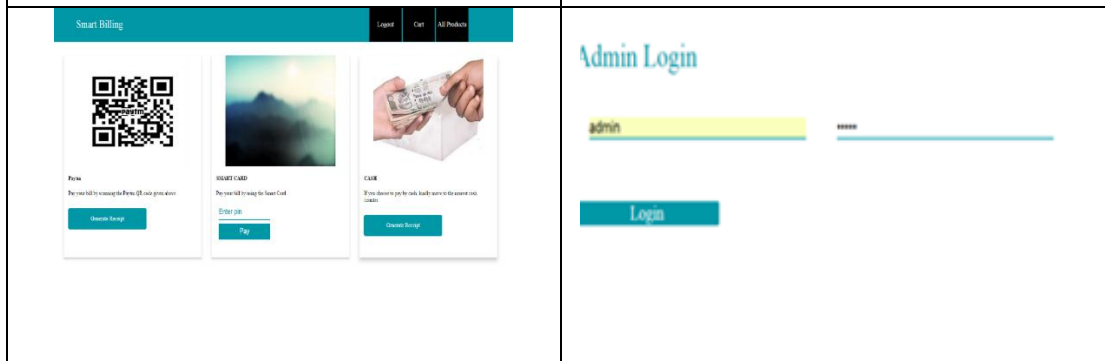
	
<p><b>Snapshot 1- Registration for the new customers</b></p>	<p><b>Snapshot 2- Login portal for the new customers</b></p>





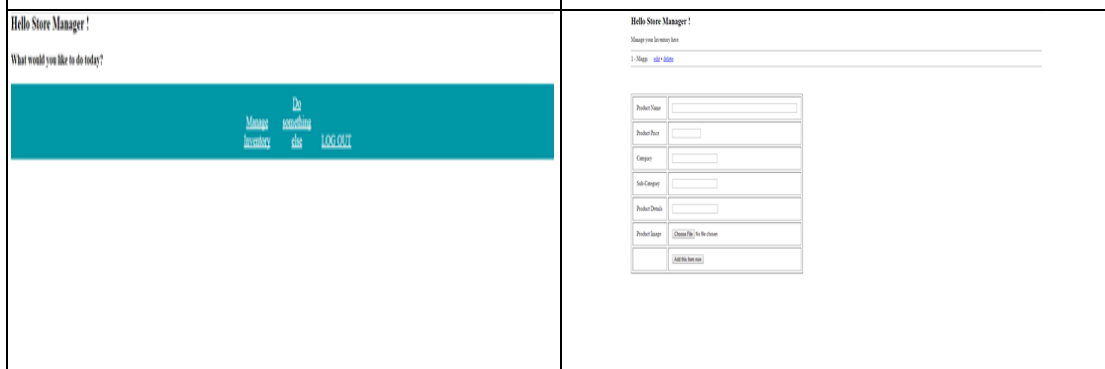
**Snapshot 3- User interface after logging in**

**Snapshot 4- Items available for purchase**



**Snapshot 5- Payment portal**

**Snapshot 6- Admin login portal**

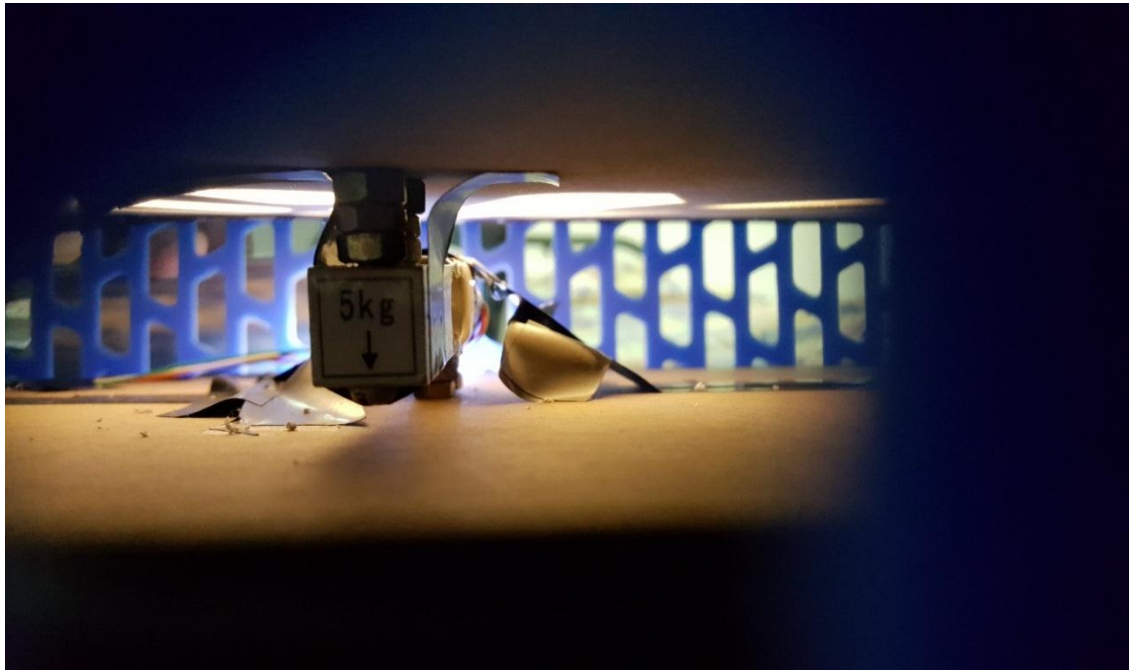


**Snapshot 7- Admin portal for the store manager**

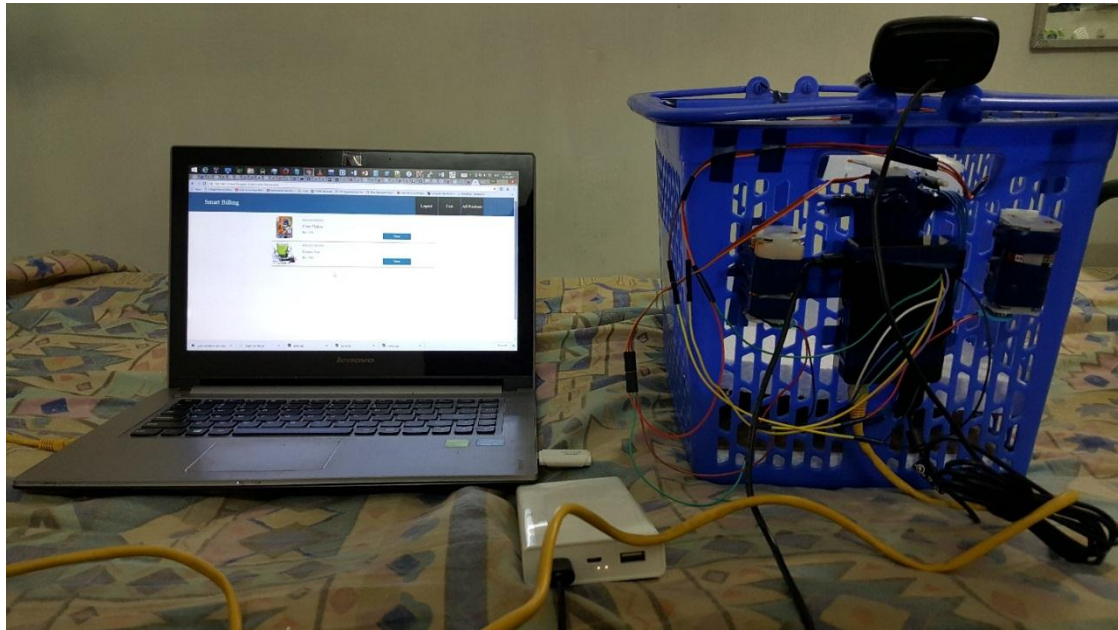
**Snapshot 8- Admin portal for updating the stock**



**SNAPSHOT 9 - Top view Of The Smart Kart Displaying Servo Motor, Web Camera And The Slab**

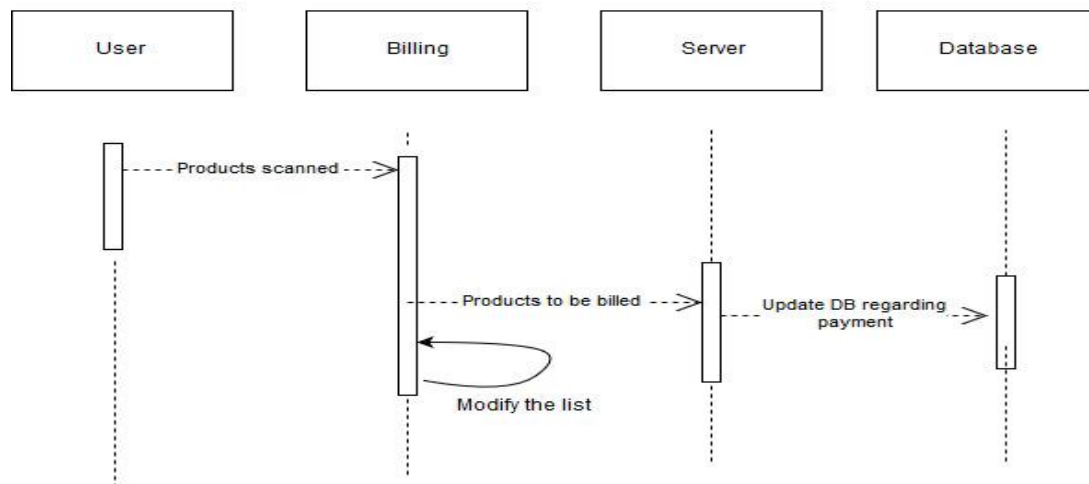


**SNAPSHOT 10 - Showcasing the load cell (equalizing the torque)**



**Snapshot 11:- Final prototype model of the shopping kart**

At the end when the user has made the payment then the user can proceed for the security check where the smart kart having a unique id will be scanned. And after scanning if the payment was already made then a confirmation will be received by the security guard in the form of notification, which in turn will automatically unlock the slab or the platform. Then the user can leave the premises along with his purchased items. If incase the payment was not made then the user has to pay before leaving to avoid all the cases of deception or dishonesty. The following four figures are the sequence diagrams which shows us in which sequence all the events will be happening.



**Figure 3- Sequence diagram for billing**

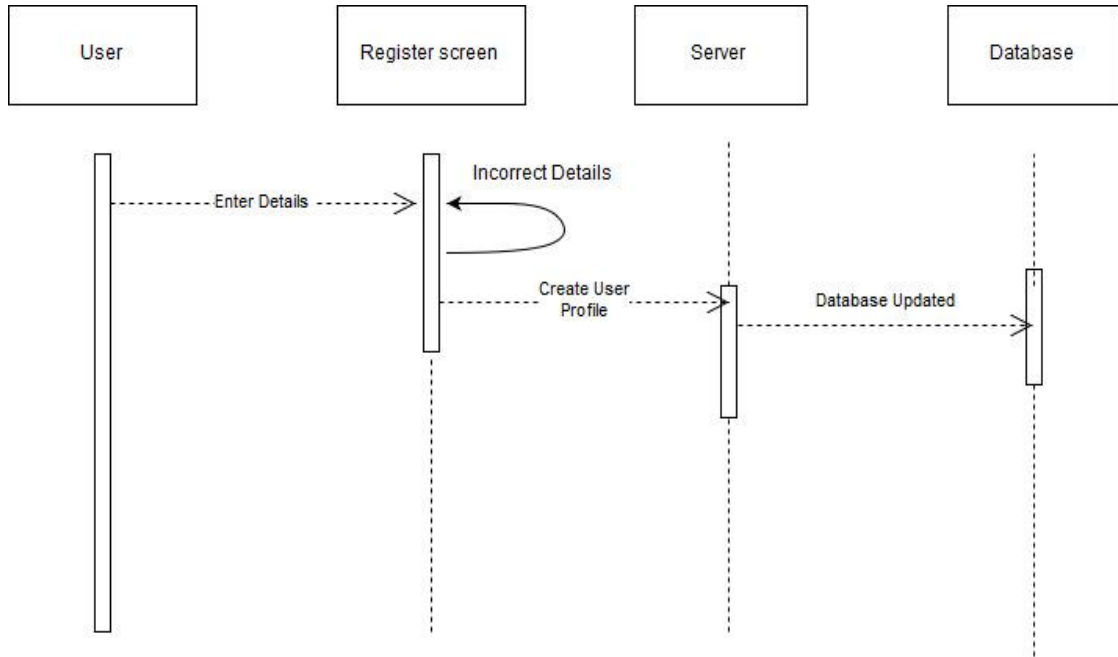


Figure 4- Sequence diagram for customer

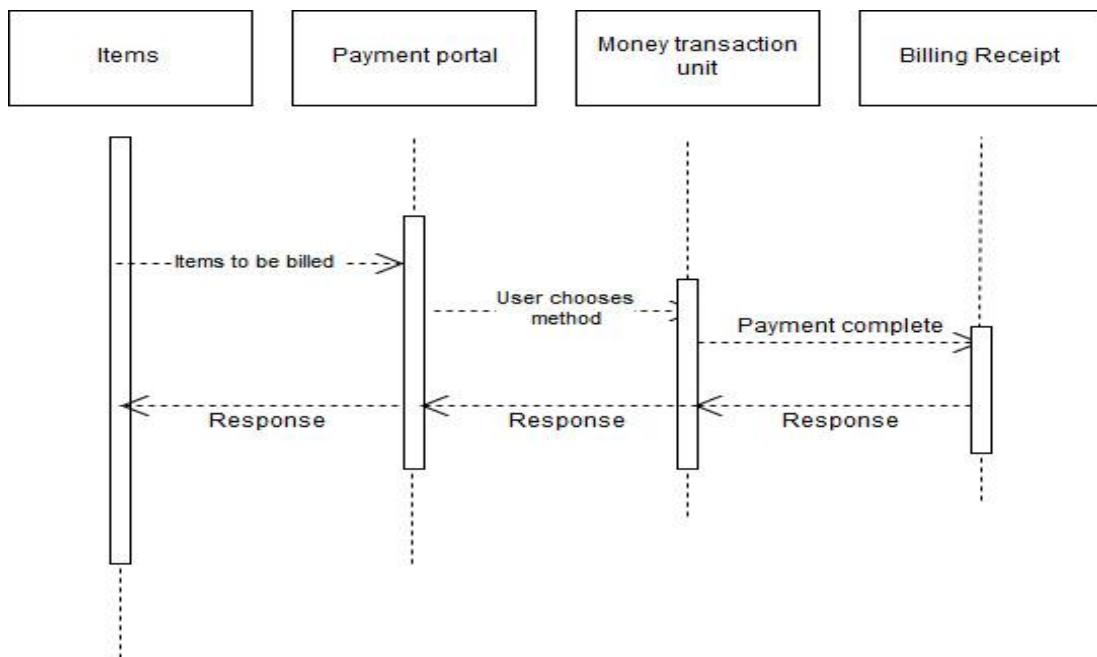
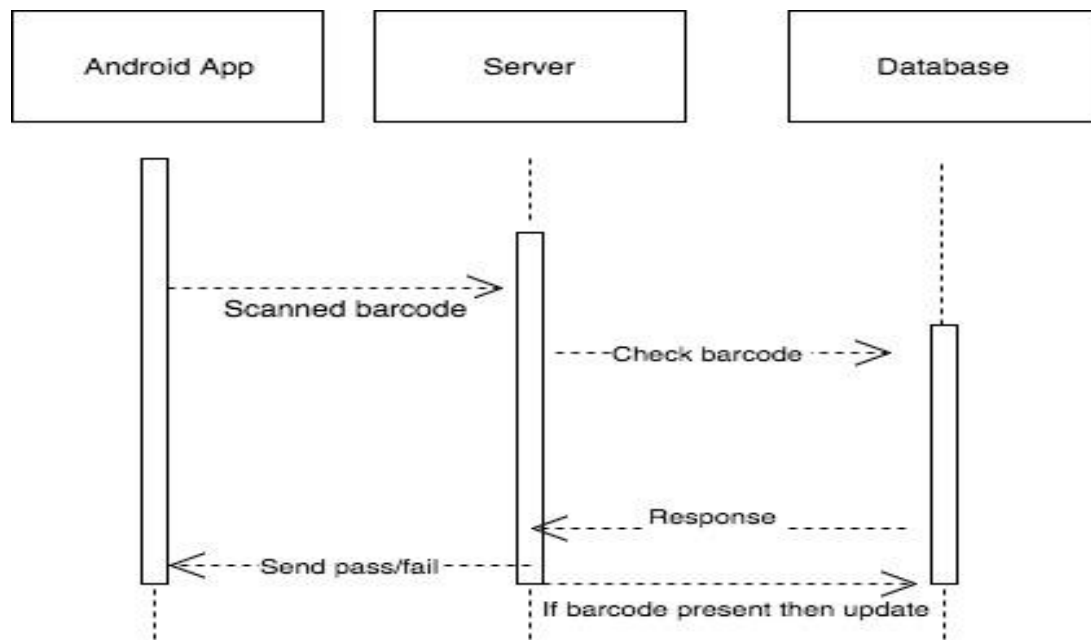


Figure 5- Sequence diagram for payment



**Figure 6** Sequence diagram for security

## 5. RESULTS

The experimental set-up is tested for various test cases, with various products in Section IV. The system gives the customer an option to generate the bill at the cart which makes saves their time and usually gets wasted by standing in long queues.

Once the customer enters the shopping complex, he/she is required to enter their mobile number which is looked up on the database to check if it is an existing customer, their profile is loaded into the cart. In a case where the mobile number is not registered, the user is requested to give their name and number for registering them.

After the identification process, they can proceed to shop. While shopping, to add a particular product to the bill, the barcode of the product has to be scanned which is done by bringing the barcode of the product close to the camera installed in the cart.

The details of the product and the bill displayed on the mobile application/ tablet application. If the customer wants to remove a product, he/she can navigate through the options provided on the mobile application/ tablet application. There is a load cell installed in the cart which measures the total weight of all items purchased in the cart. The weight of the product obtained from the database by scanning the barcode and the weight sensed by the sensor is compared to make sure that all products are billed and no extra products have been added to the cart.

When the user has completed his/her shopping they can finalize their bill and a list of payment options are displayed on the mobile application/ tablet application. If E-wallet

is chosen as the mode of payment, a QR code of the corresponding E-wallet is displayed on the mobile application/ tablet application and the customer can complete the responding payment.

If Smart Card is chosen as the mode of payment, the user has to scan the QR code of the user's smart card after which the user is requested to enter a 4-digit security pin to confirm identity. Once the payment is successful, the security guard allows the customer to leave the shopping area. Without completing the payment, the security guard has to scan the QR code of the Smart Kart and the security guard will get the notification that the customer hasn't paid which not allow the gate to open of the shopping complex.

## **6. CONCLUSION AND FUTURE WORKS**

This project successfully demonstrates the possibility and feasibility of developing a Smart Shopping System which includes a smart trolley or a smart kart along with a smart card which in turn automates the entire billing procedure or the payment process. The system which is developed by us is highly reliable, fair and cost-effective. It is reliable and fair because of the unique Id-card with a QR-code printed on it for all the customers which is to be scanned for authenticating the payment process. The decision-making process is done locally within the kart. Also, the payment process is made by us is quite simple in which the kart itself is designed in such a way with an interactive user interface which has the provision to accept payment by all three probable methods which a user might use to pay that is in cash, smart card and E-wallet. The system is cost-effective as it requires only one passive sensor (the load-cell), two servo motors and a camera-based barcode scanner (which is way cheaper than any other type of barcode scanners) per Kart. In the bigger picture, it reduces the man-power requirements to a greater extent. Our system is robust in preventing all sorts of forgery and cases of deception. In future, we hope that there is a lot of scope to advance the system as we can actually replace the smart karts with automated robots who will do the shopping for us and deliver the products to our doorstep or may be the payment can be authenticated via voice recognition, retina scan or fingerprint swipe.

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