

# Smart Shopping Basket using Object Detection and Load Cell

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**Abstract** - This paper aims to provide a smart shopping basket is a system that utilizes object detection and load cell technology to provide an innovative and efficient shopping experience. The system is designed to automatically detect and track the products added to the basket using computer vision algorithms. Load cells are integrated into the basket to measure the weight of the products, allowing for accurate tracking of the quantity and cost of items purchased. The system can also provide real-time feedback on the total cost of items and allows payments to be made which enhances the shopping experience. By reducing the need for manual scanning and weighing of products, the smart shopping basket system can streamline the shopping process, increase efficiency, and improve customer satisfaction.

**Index Terms** - Load Cell(A sensor that can measure weight)

## I. INTRODUCTION

The advent of technology has transformed the way we shop, making the process more convenient and efficient. One such technological innovation is the smart shopping basket. This is a system that utilizes advanced technologies such as object detection and load cells to provide an innovative and efficient shopping experience. The traditional shopping process involves customers picking products off the shelves, scanning them at the checkout, and bagging them. This process is time-consuming and can result in long queues, especially during peak hours. Furthermore, the manual scanning of products can be prone to errors, resulting in incorrect pricing or missed items. The smart shopping basket system is designed to address these challenges by streamlining the shopping process and providing accurate product tracking. The system works by integrating object detection algorithms with load cells to create a basket that can automatically detect and track the products placed inside it.

Object detection is a computer vision technology that allows machines to recognize and locate objects within an image or video. This technology is used in the smart shopping basket system to recognize and track the products placed in the basket. The system uses cameras and sensors that are strategically placed within the basket to capture images and data on the products. The images are then processed using machine learning algorithms that analyze the product features and compare them to a database of known products to identify them. Load cells, on the other hand, are used to measure the weight of the products placed in the basket. These are integrated into the basket and can accurately measure the weight of the products in real-time. This allows the system to calculate the cost of the products based on their weight and provide real-time feedback on the total cost of items.

The combination of object detection and load cell technologies in the smart shopping basket system offers several advantages. Firstly, the system can eliminate the need for manual scanning of products, reducing waiting times and queues at the checkout. The system can also improve the accuracy of product tracking, reducing the likelihood of errors in pricing or missed items. Another advantage of the smart shopping basket system is its ability to provide personalized recommendations for additional products. The system can analyze the customer's purchase history and preferences to provide targeted recommendations for additional products. This not only enhances the shopping experience but also increases sales for retailers.

## II. RELATED WORK

Under this section, we are going to discuss works related to smart shopping systems.

[1] IoT plays an important role in this smart shopping basket. R. Nair, A. Bhatia, and A. Pradhan in their paper propose a smart shopping cart that uses image processing and Internet of Things (IoT) technologies to create an intelligent shopping assistant. The system can recognize and track products in the cart, offer personalized recommendations, and provide real-time feedback on the cost of items.

[2] RFID technology can also be used to implement this system. R. Nair, A. Bhatia, and A. Pradhans paper presents a smart trolley system that utilizes RFID technology to identify products and provide personalized recommendations based on the customer's purchase history. The system also offers real-time feedback on the cost of items and can reduce waiting times at the checkout.

[3] S. H. Jang and Y. H. Lee in their paper introduce a smart shopping basket system that uses IoT and deep learning technologies to recognize and track products in the basket. The system can provide personalized recommendations, real-time feedback on the cost of items, and can be integrated with a mobile application for enhanced customer experience..

[4] Many retail stores have developed mobile applications that allow customers to browse products, make purchases, and receive personalized recommendations. Some smart shopping basket systems can be integrated with mobile applications, allowing customers to view their purchase history, receive personalized recommendations, and make payments using their mobile devices.

[5] Paper by M. U. Akhtar and M. H. Raza proposes a smart shopping cart system that uses a combination of Convolutional Neural Network (CNN) and RFID technologies to recognize and track products in the cart. The system can provide personalized

recommendations, real-time feedback on the cost of items, and can be integrated with a mobile application for enhanced customer experience.

[6] In a paper by Q. Wang and Y. Zhou they present Automated checkout systems, such as self-checkout kiosks, which have become increasingly popular in retail stores. These systems allow customers to scan and bag their own items and pay using a variety of methods, including credit/debit cards and mobile payments. Automated checkout systems can reduce waiting times at the checkout and improve the overall shopping experience. Some stores have even begun using mobile scan-and-go technology, where customers can scan items with their mobile phones as they shop and pay via the app, eliminating the need for a checkout altogether.

[7] Computer vision technology, such as object detection and recognition, has been used in retail stores to monitor inventory and prevent theft. Some smart shopping basket systems also use computer vision technology to recognize and track products in the cart and provide real-time feedback on the cost of items. For example, cameras mounted on the shopping basket may recognize products and add them to the customer's bill automatically.

[8] In a paper by R. H. Kim and J. W. Kim have explained how Radio-frequency identification (RFID) technology has been widely used in retail stores to track inventory and prevent theft. RFID tags can be attached to products and can be read by RFID readers, allowing retailers to monitor their inventory in real-time. Some smart shopping basket systems also use RFID technology to identify products and provide real-time feedback on the cost of items. For example, when a customer places an item in the basket, the RFID reader can detect the tag on the product and add it to the customer's bill.

### III. ARCHITECTURE

The architecture includes the following components:

1. Load cells: Load cells are sensors that are used to measure the weight of the shopping basket. In a smart shopping basket system, load cells are integrated into the basket to provide real-time weight measurements of the products placed inside.
2. Microcontroller: A microcontroller is the brain of the smart shopping basket system. It receives weight measurements from the load cells and processes the data to calculate the total weight and cost of the items in the basket.
3. Object detection system: An object detection system, such as a camera or RFID reader, is used to identify the products placed in the basket. The system may use computer vision algorithms to detect and recognize products based on their shape, color, and texture.
4. User interface: The user interface of the smart shopping basket system allows customers to view the total cost of the items in their basket and make payments using a variety of methods, including credit/debit cards, mobile payments, and cash.

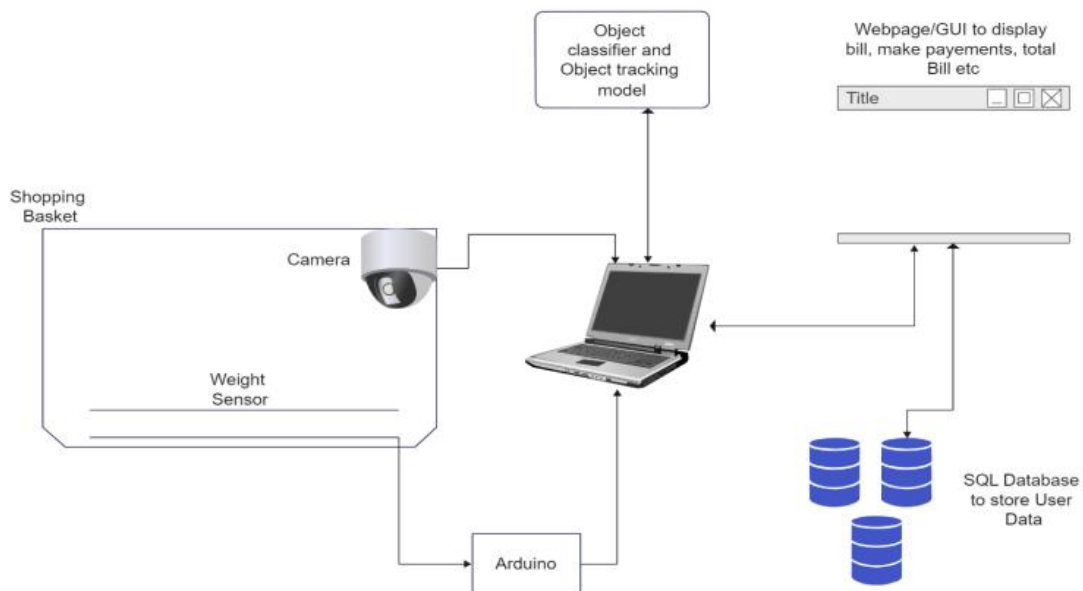


Fig.3 Architecture

### IV. IMPLEMENTATION

The implementation can improve the shopping experience by reducing the time and effort required to complete the shopping process. The system can identify the products placed in the basket and keep track of their weight, thereby automating the billing process. Additionally, the system can provide real-time information about the products, such as price, nutritional information, and other related details. The system can also reduce errors in billing, as it eliminates the need for manual billing.

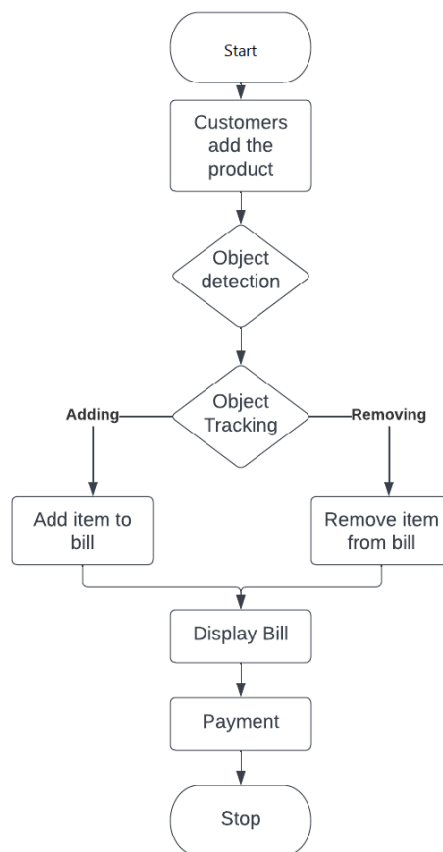


Fig 2.Object Detection and Billing process

The implementation consists of a smart shopping basket, load sensors, object detection cameras, and a computer vision system. The load sensors are placed at the bottom of the basket to measure the weight of the products placed in the basket. The object detection cameras are mounted on the top of the basket and can identify the products placed in the basket. The computer vision system is used to process the data collected from the load sensors and object detection cameras. The following is the methodology shown in steps.

The system works in the following way:

- 1.The customer places the products in the basket.
- 2.The load sensors measure the weight of the products and send the data to the computer vision system.
- 3.The object detection cameras identify the products and send the data to the computer vision system.
- 4.The computer vision system matches the data received from the load sensors and object detection cameras to determine the products placed in the basket and their weight.
- 5.The system provides real-time information about the products, such as price, nutritional information, and other related details.
- 6.The system automatically generates the bill based on the products placed in the basket and their weight.

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## V. CONCLUSION AND RESULTS

In conclusion, the proposed smart shopping basket using object detection and load sensors can significantly improve the shopping experience. The system can automate the billing process, provide real-time information about the products, and reduce errors in billing. The system can also reduce the time and effort required to complete the shopping process. Future research can focus on improving the accuracy of object detection and exploring other technologies to enhance the shopping experience further.

The proposed system may not be as accurate as barcode scanning but eventually it can be made accurate in the future.



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