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# Voice Guided Smart Shopping System For Visually Impaired

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***Abstract:*** The increasing integration of the younger generation into daily life provides an opportunity to facilitate access to daily activities for individuals with visual impairments, especially in places like supermarkets and departmental stores, where identification of goods and movement pose huge challenges. This work describes how the system was designed and improved as a voice-guided intelligent shopping solution. with the purpose of making visually impaired customers shop independently and successfully.It incorporates voice reputation, object detection in real time, and audio comments to supply product records, allow customers to find their favorite items, and navigate conveniently inside the store. The proposed solution uses Predefined Locations and AI powered voice assistants capable of situational recognition and fingers-free interaction within dynamic shopping environments. This proves that the device was able to improve accessibility, autonomy, and typical shopping experiences for individuals with visual impairments by the discussion on the structure of the device, essential components, and the implementation scenario with challenges.

***Index Terms* –Assistive Technology, Smart Shopping System, Object Detection , Visually Impaired, Voice Guidance.**

## I. Introduction

India is Access to regular services such as shopping remains one of the major difficulty faced by individuals with visual disabilities. Getting around busy retail spaces, locating products, reading labels, placing products on the shelves and picking something from the shelves, most of them are not able to do these activities without help; thus, this limits their independence. Even though While a few support systems do exist, most traditional retail set-ups are not designed to be inclusive. in mind. Therefore , blind persons are often led through the store by a store employee or companion, Which can compromise privacy, autonomy, and the overall shopping [1].As a result, visually impaired (VI) individuals frequently rely on store personnel or companions, which can compromise privacy, autonomy, and the overall shopping experience. With the rapid development of assistive technologies in the fields of voice recognition, artificial .A Voice-Guided Smart Shopping System is targeted at closing the gap that exists in accessibility and providing proper access. These challenges by providing an interactive, voice-based interface that enables visually impaired Users shop independently using the system, which integrates STT and TTS. modules for voice interaction, coupled with real-time object detection [3,8,9] and location guidance to assist Users navigate the store themselves and identify products with little physical intervention. The primary focus The objective of this project is to design and develop a low-cost, user-friendly solution which empowers visually This means improved mobility, decision-making, and confidence of impaired individuals while shopping. The system shall incorporate RFID tags, BLE beacons, and AI driven voice assistants [11]. Provides for hands-free interaction, identification of items, and direction inside a store. The system also considers safety, simplicity, and efficiency in order to make sure it will suit real-world users.

**Related Work**At present, shopping aid for the visually impaired is limited to human assistance and limited technological solutions. The most common method is traditional shopping This assistance includes finding a product with the help of store staff, friends, or family members; reading the prices of products; tags, and guiding navigation inside stores. While this provides excellent accuracy, this approach lacks autonomy. and privacy for visually impaired individuals, since they always need to rely on other people. Various AI-based tools, like Google Lookout and Seeing AI [5,6] have been developed in recent years that help the visually impaired recognize objects, read labels, and identify text. Although these systems are helpful, they are designed primarily for object recognition and lack indoor navigation. capabilities, making them less suitable for guiding users across large supermarkets or complex store layouts. layouts. T. Ha qu e Mun ia and K. A b u T a h er, “Use of Machine Learning in Object Detection for Visually Impaired Person [13] . Similarly, basic mobile solutions such as barcode scanners or screen readers offer limited independence. Another significant disadvantage using the current systems is the lack of meaningful contextual voice interaction. The tools currently available may describe objects or read out information but cannot continuously converse or navigate step by step. For instance, the user cannot simply ask, ”Where is the dairy section?” and receive an accurate indoor guide. This makes self-navigation very challenging for visually impaired people to perform independently in stores. In addition, this limitation makes the entire shopping process cumbersome and incomplete.

## Methodology

The way the system works is actually very similar to how a visually impaired person would normally shop, except that the guidance comes from the phone instead of another person. The process begins as soon as the user launches the mobile application. The application does not involve any complicated configuration; the user can speak to the phone in a natural manner, similar to conversing with another person assisting them. For example, the user may say ,"I need milk" or "Where can I find biscuits?", and the app listens to this command and tries to understand it through its speech-to- text feature.

Once the app knows what the user wants, it moves on to figuring out which product the person is talking about. Sometimes the spoken name is enough for the system to match it with a product in the database. Other times, especially when the user has already reached the shelf, the camera or the barcode scanner on the phone helps confirm the exact item. The recognition part uses regular computer- vision tools like OpenCV or trained ML models, but from the user's point of view, it is as simple as pointing the phone toward the item. If the system cannot confirm what the user meant, it simply asks them again instead of guessing.

After the product is identified, the app looks up the related details in the database. This includes the usual things: what the item is, its brand, its price, the expiry date, and also where it is kept in the store. The system conveys all of this information to the user in a clear voice so they don't have to touch or open anything to know what they are buying.

If the user needs help reaching the product, the navigation part of the system becomes active. Depending on whether the store has other indoor positioning setup, the app tries to guide the user by giving small, simple instructions. Instead of saying technical things, it gives natural directions like "go straight for a little while," "take a left," or "the shelf should be to your right now." The idea is to make it sound like a human companion walking beside them rather than a machine giving commands.

When the user arrives at the correct shelf, they usually scan the product one more time using the phone camera. This helps the system double-check that the right item has been found. The app then asks the user whether they want to add it to their virtual cart. If they say yes, the item is added quietly in the background.

Throughout the entire shopping session, the app keeps track of everything the user has selected. By the time they are ready to finish, the system already has a complete list of the chosen products. Instead of making the user struggle at the billing counter, the app prepares the total bill and reads it aloud. The user can then choose to make a digital payment or present the generated bill to the cashier.

### *A. Abbreviations and Acronyms*

Mostly consist of meaningful Tokens that includes:

1.VI - Visually Impaired

2.VGSSS - Voice-Guided Smart Shopping System

3.AI - Artificial Intelligence

4.TTS - Text-to-Speech

5.STT - Speech-to-Text

6.ML - Machine Learning

7.UI – User Interface

### *B. System Architecture*

1) **User Layer**: This is where the user actually interacts. Everything happens through voice because the target users cannot rely on visuals.

2) **Application Layer**: This layer does most of the heavy work, such as understanding what the user says and detecting items with the camera.

3) **Database Layer**: Contains product information like the price or where an item is kept.

4) **Navigation Layer**: The Store layout is pre-prepared in the app,showing entrances,aisles,shelves and checkout point.The app calculate the best and the safest route from user current location to the product and scanning its barcode,the apps speaks out name, price ,expiry dates and details

5) **Feedback Layer**: Gives audio instructions and reads out product details, helping the user throughout the shopping process.

These layers together create a flow where the user talks, the system listens, processes, and then responds in a way that feels natural and supportive.

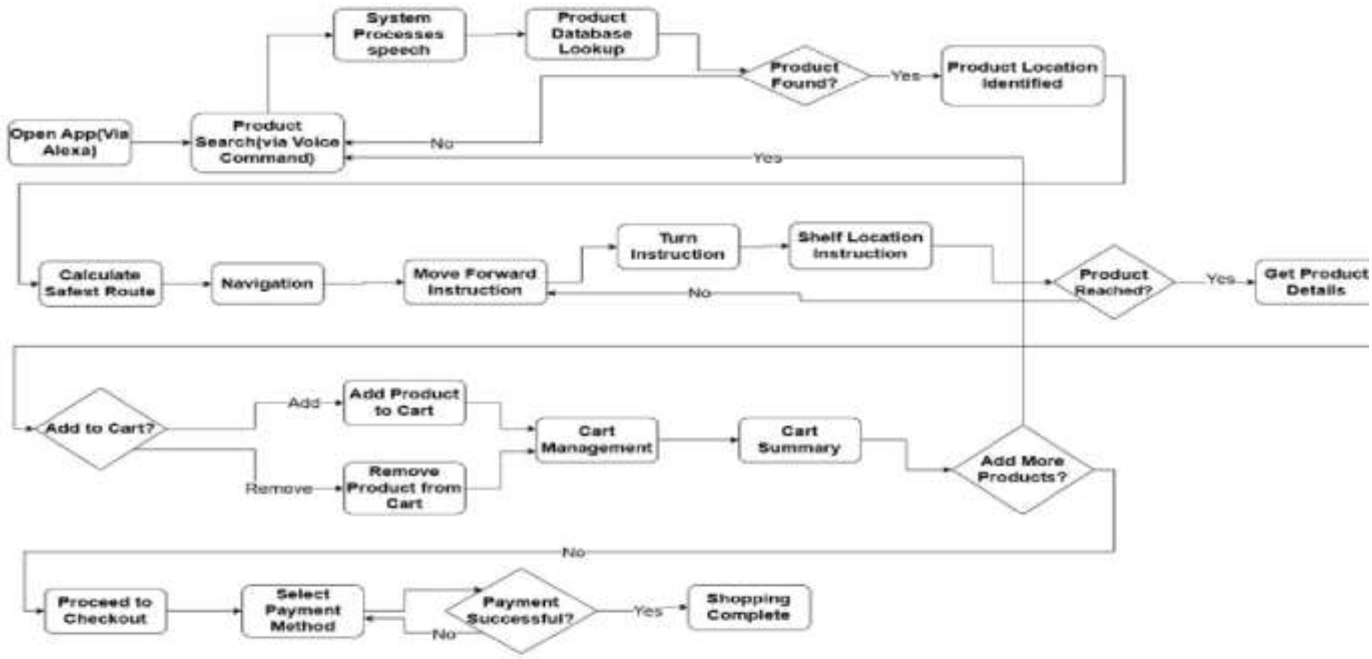


*Figure 1: System Architecture*

### *C. Issues and Challenges*

Although the system functions as intended, certain factors may limit its performance:

• If the lighting in the shop is poor or shelves are messy, the camera may not identify items correctly.

• Product information must stay updated, which can be hard for store owners.

• Some features of the application require an active internet connection.

• Users who are unfamiliar with voice-based mobile applications may require an adjustment period.

## II. Analysis

### *A. Voice Recognition Accuracy Analysis*

| Parameter | Value |
|---|---|
| Total Voice Commands Tested | 100 |
| Correctly Recognized Commands | 92 |
| Incorrectly Recognized Commands | 8 |
| Overall Recognition Accuracy (%) | 92% |

Table 1

The efficiency of the voice-controlled smart shopping assistant system was evaluated by examining its voice recognition ability in a controlled and simulated supermarket environment. A total of 100 voice commands were sent to the system. This comprised typical user interactions ranging from searching a product, getting directions, and asking for prices. Amongst the 100 voice commands, 92 were accurately recognized by the system, while 8 were misunderstood, leading to an overall voice recognition efficiency of 92 percent efficiency, as quantified in ”Table 1”.

The recognition accuracy implies that the system can easily understand the input signals from users, which is a important aspect that must be taken into account, especially for the visually impaired, since they rely entirely on voice-based input. Most recognition issues were experienced due to variations in speech, noise, or partial input signals. Nonetheless, these factors had minimal impact upon the usability of the recognition system.

The accuracy achieved confirms the capability of the proposed solution in minimizing the dependence of the visually impaired on human assistance while engaging in shopping activities. Compared to the traditional manner involved in shopping activities, the designed system is more independent and friendly for the user. It has been confirmed that the use of voice interaction can act as a feasible and efficient means for assisting the visually impaired during shopping activities.

### *B. Comparision of Dijkstra's And Predefined Algorithm*

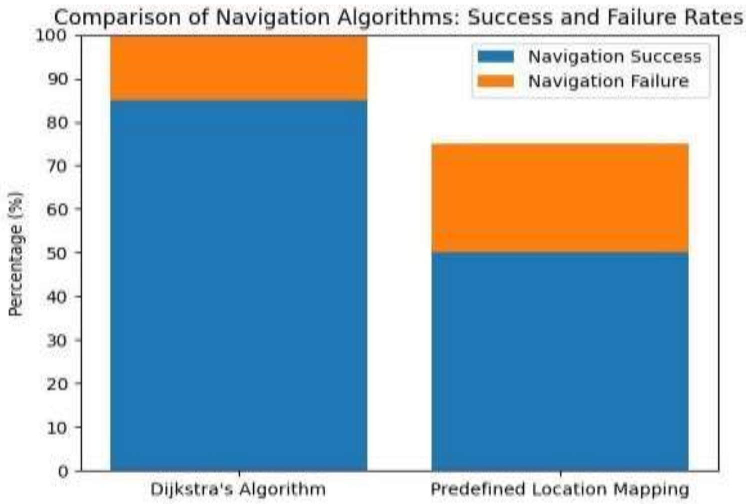


Figure 2: Comparision of Dijkstra's And Predefined Algorithm

The chart is used to compare the effectiveness of the two navigation techniques, Dijkstra's Algorithm and Predefined Location Mapping, through the successful or failure rates. Using a percentage scale on the vertical axis of the chart makes it easy to comprehend the effectiveness of the two techniques, using bars to clearly separate the success and failure rates. Dijkstra's Algorithm enjoys a rate of success that is much higher with an estimated rate of success at around 85%, with very few showing the rate of failure. Consequently, the passage successfully in the majority of cases. This is mainly because it efficiently selects the shortest available route.

In contrast, Predefined Location Mapping has a noticeably lower success rate of about 50% and a higher failure rate. This indicates that it struggles to provide accurate navigation in many cases. This approach is based on fixed routes, so it can't adapt easily to changes. The graph LEGEND makes it clear that the Dijkstra Algorithm provides more accurate and reliable directions. As a result, it is more suitable for real- world use, particularly where accurate navigation is required.

## III. *FUTURE SCOPE*

The system has strong potential to grow and become even more effective in real-world shopping environments. Future enhancements may include:

**A.Smarter Image Recognition:**

•More advanced AI models like YOLOv8 can help recognize products even if they don't have barcodes or are partially hidden. This makes the system more flexible.

This module allows buyers to directly communicate with the artisan about personalized or custom products. Buyers can specify design preferences, materials, size, budget, etc, enabling artisans to offer made-to-order, customized products.

**B.Better Indoor Navigation**: Future versions may use:

- Wi-Fi RTT (for more accurate indoor positioning)
- AR-based smart navigation
- Dynamic 3D sound guidance

These improvements can make movement inside stores smoother and safer.

**C.Wearable Support:**

The entire system can be integrated into:

- Smart glasses
- Head-mounted cameras
- Wearable audio devices

This would make the system hands-free and more convenient.

**D. Cloud-Based Personalization**

User preferences, shopping habits, and frequently purchased products could be stored in the cloud to give personalized suggestions like:

“ You usually buy oats. Do you want to add it?” “Milk is on discount today. E. Design Ideation Module

The design ideation module assists artisans by providing inspiration and guidance for new product designs. It encourages innovation while maintaining traditional artistic elements.

***E.Smart Autonomous Trolleys:***

• In the future, smart trolleys can follow users automatically using sensors and navigation systems, reducing the physical effort required during shopping Events and Community Learning Module

This module provides information about exhibitions, workshops, training sessions, and cultural events. Events are accessible to both artisans and buyers, enabling cross-community interaction. Buyers can also participate in learning sessions to understand traditional art forms, fostering cultural awareness and appreciation.

**IV. RESULT**

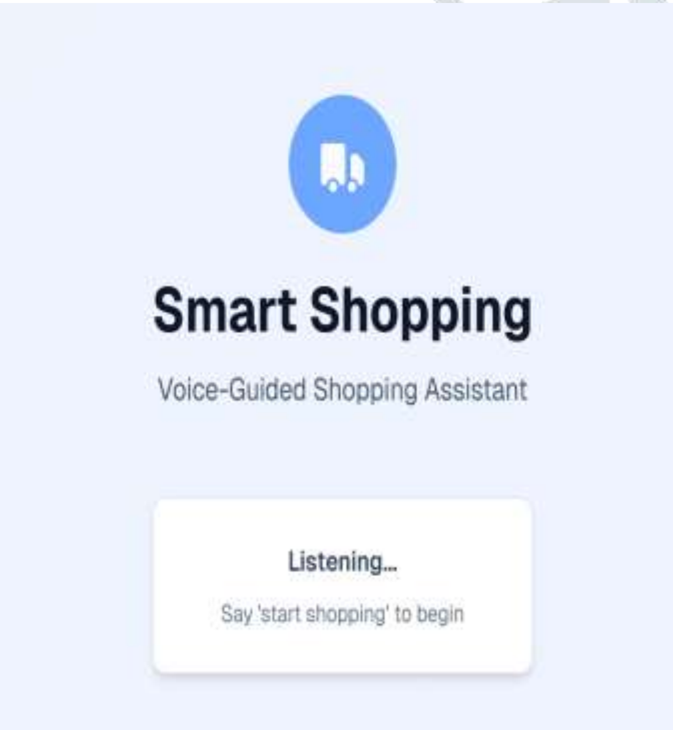


*Fig 4.1 Home Page*


*Fig 4.2 Select Language By Voice Command*


*Fig 4.3 Products Added To Cart By Voice Command*


*Fig 4.4 Payment Interface*

## V. CONCLUSION

The proposed voice-guided smart shopping system provides an innovative and inclusive solution to address the challenges faced by visually impaired individuals in supermarkets and retail environments. By integrating voice commands, image and barcode recognition, and text-to-speech technology, the system ensures that users can independently search for products, access essential details such as name, price, and expiry date, and navigate through stores with minimal external assistance. The system not only bridges the gap between technology and accessibility but also empowers visually impaired individuals by improving their independence, shopping experience, and overall quality of life. With future advancements such as AI-based store mapping, cloud integration, and wearable support, the system has the potential to evolve into a comprehensive assistive technology for smart and inclusive retail environments.

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