Shopping By Blind People: Detection of Interactions in Ambient Assisted Living Environments using RFID

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ABSTRACT

Now-a-days the Internet of Things (IOT) is very popular technology in our life. Internet of Things and Radio Frequency Identification are famous technology which will help Visually impaired people to solve their daily life problem. Visual impairments, other elder people as well as physical and cognitive disable person, they are struggling in their daily life to perform their regular task, such as shopping in a retail store. Ambient Assisted Living (AAL) technologies make visually impaired people more independent and encourage them to stay active longer. This technology helps the blind and elder people to do the shopping from departmental store independently. This system also helps to search any product from shelf in the departmental store. This system if detected any product, also helps to reach at the place where search item is available. This proposed system not only helps the visually impaired people also help elder people and non-impaired people also. It also receives additional information through smart phone about a product details, product offer and navigation message also.

Keywords: Ambient Assisted Living Technology; RFID Reader; RFID Tag; Visually Impaired; Store Server.

1. INTRODUCTION

The Internet of Things [1] is the technology in which network of internet-connected objects also able to collect and exchange data using embedded sensors and which also connect the physical objects like vehicles, building and other items which are embedded with electronics, software, sensors and network connectivity, which enables these objects to collect and exchange data.
RFID [2] stands for Radio-Frequency Identification. The acronym refers to small electronic devices that consist of a small chip and an antenna. The chip can carry 2,000 bytes of data or less. Same function for RFID device   and Bar Code or a Magnetic Strip on the back of a credit card and ATM card; it provides a unique identifier for that object. The RFID device must be scanned to retrieve the identifying information like barcode and magnetic strip device. Significant advantage of RFID devices over the others mentioned above advantage is

that the RFID device does not need to be positioned precisely relative to the scanner. Every time this is very difficult to check the store checkout clerk that all barcode is scanned or not. ATM machine and credit card use special reader. RFID devices will work within 20 feet for high frequency device. Just put all groceries in a bag and set the bag on the scanner then it would be able to query all the RFID devices and bill for total purchase immediately.

The existing system use Barcode technology to detect an item. For a Visually impaired people will face difficulties to scan any item through Barcode scanner. Barcode scanner needs very particular scan precision. Visually impaired people will face problem to reach an item shelf. Through indoor navigation, this system will assist blind people to reach where the search item or product is available. Ambient Assisted Living technology uses RFID Tag and RFID Reader to implement this smart shopping for visually impaired people. Using RFID reader, blind people can easily scan any product and get details about that product and store offer also. RFID tag and RFID reader will help them to search any product and to reach that place. RFID tag will help to get the price of the individual item. This application also helps the visually impaired people to get the total bill amount through voice message. Visually impaired can add any item or remove some item from the shopping list through voice command. Store keeper stores in their server details about product and store map.

The remainder of the paper is organized as follows: Section 2 discusses related work and section 3 describes proposed methodology and section 3 presents implementation. Section 4 describes result analysis and conclusion and future enhancement presented in section 5.

2. RELATED WORK

Barcode technology [3] works on a principle called symbology. Barcode is optical representation of data which machine can read. Barcode is having some lines that is called Bar. This lines (Bar) is having unique Identification. The barcode is scanned by optical scanner that is called Barcode scanner. Barcode number is just like binary representation. Human recognizes barcodes as an array of parallel lines that

is alternating between white and black lines. Barcode technology provides a very simple and inexpensive method of scanning data or information and in several applications. Existing system [4] used Barcode technology, but it has disadvantage in Ambient Assisted Living environments. This existing system use smart Barcode technology to identify the products. An audio message will guide visually impaired people inside the supermarket to do shopping. Automated Billing system make shopping in smatter way [5]. The following table shows comparison between Barcode scanner and RFID scanner [6].

Table 1: Comparison between Barcode scanner and RFID scanner

Parameters	Barcode Scanner	RFID Scanner
Read Rate	High, greater than 100 tag can read one after another.	One tag can be read at a time, read rate is slow.
Line of sight	Not required	Required
Read/Write	Able to read, write, update	Only read
Durability	Very high	Very low
Security	Very high	Less

Zigbee technology is used in automated billing system in smart shopping. This technology mainly used for control and sensor network on IEEE 802.15.4 slandered is mainly used in wireless private area network (WPANS). Zigbee mainly works in physical and Media Access Control Layer to handle low data rate device. This Zigbee run on 868MHz,902-928 MHz and 2.4 GHz frequencies. In case of periodic and intermediate two-way transmission between sensors and controller the 250 kbps Zigbee will provide best performance. Zigbee is low-cost, take less power mesh network widely used for monitoring and controlling applications. Its range is 10-100 meters. This is a cheaper device and simple device which is better than small range wireless sensors like Bluetooth and Wi-Fi. Product information can transmit and receive through this technology.

The aim of this product is to reduce dependency for blind a person who helps to reduced dependent shopping and   provide them independent life. Headache like pulling trolley, waiting in billing queue, guide the blind people can be avoided. There is some system available where departmental store use some are local Wi-Fi and Bluetooth based system to locate blind person. There is some online shopping system are available for visually impaired people through voice message. Locate any item and searching shelf is difficult for a visually impaired people in a departmental store. Using Computer Vision object detection and identification can be performed but its implementation is difficult job. It also includes more

cost in real time environment. The disadvantage of the existing system is blind person need some human interaction to detect object and its position. Barcode system does not provide the navigation assistance.

3. PROPOSED METHODOLOGY

This store-based AAL system helps the user to communicate with objects in a device of less smart system, this improves independence and the shopping experience for visually impaired people. Ambient Assisted Living can be implemented using an RFID tag and RFID reader. RFID tag contains all the information of the object such as product name, price, offer manufacturer etc. and stored in the store' server. Impaired person will be holding an RFID reader, as soon he or she reaches the wrack where products are placed, RFID detector detects the RFID tag and sends the tag number to the server. The server will send the information stored of the RFID tag to the user's smart phone through voice command [7]. In the smart phone the text-to-speech conversion takes place. An audio message is played to assist the user in navigating [8-11] and identifying the items [12].
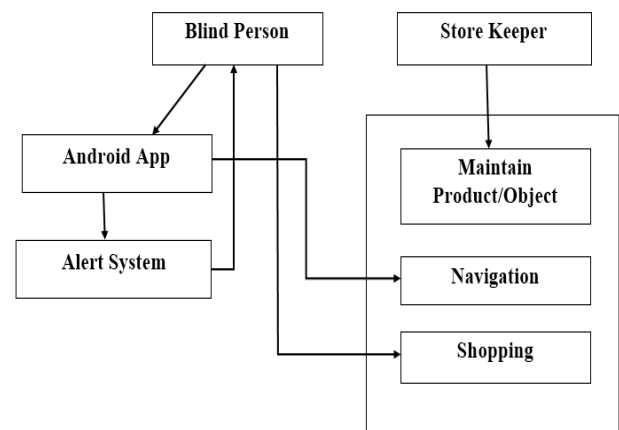

Figure 1: System Architecture

This system will work without any human help. No need to carry any costly hardware for visually impaired people, only they need smart phone and RFID Reader. This architecture will provide total design plan and provide how all framework will communicate. Shopkeeper will maintain store details in their server. Blind persons will communicate with server through android application. All the output will convert to voice message; this is called "Alert System". The proposed architecture for this system is given in Fig 1. It shows the way of the system design and its brief working.
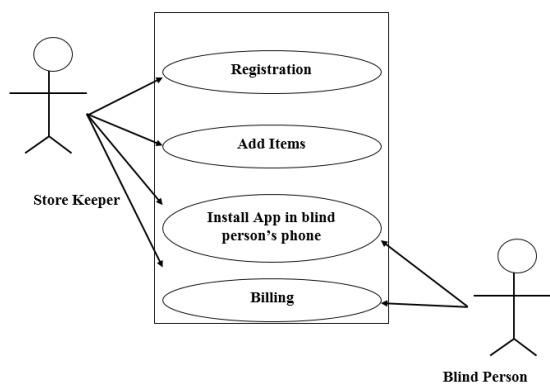
Figure 2: Communication between Store keeper and Blind Person in stage1

Use case shown in Fig. 2 explains how store keeper and blind person communicate through different module. First registration for the visually impaired people with the help of shopkeeper is required. This registration should be done in retail shop having blind people shopping facility. Shopkeeper need to add all items in the server and product details also. One time installation of the application should be done for the same as shown in use case diagram in Fig 3. Billing system will maintain through server. Blind person uses this application through smart mobile. Blind person will get bill details from server through voice message.
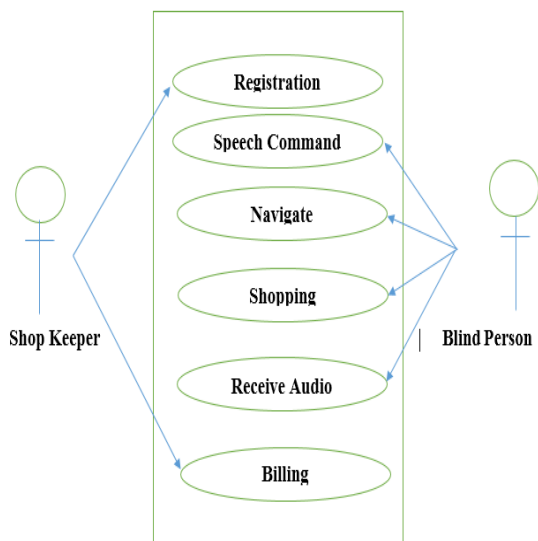

Figure 3: Communication between Store keeper and Blind Person in stage 2

Following table 2 describes advantages and disadvantages of the proposed system.

Table 2: Advantages and Disadvantages of Proposed System

Advantages	Disadvantages
• Perform Navigation inside the building • Constant user positioning • Where the sensors are placed. • User guidance through the calculated routes.	• Does not aid on getting to the building. • May present several errors on positioning related to space, crowd or sensors. • Position update may not follow the walking speed of the user.

4. IMPLEMENTATION

Implementation is the phase it will start after design phase is completed. This system is developed into two parts. To develop storekeeper module design, Java programming language is used. To develop blind mobile application Android studio is used. Smart shopping for visually impaired people is as shown in Fig 4. MySQL is used to store data into the store keeper server. All product details need to store server, along with that RFID Tag details and store layout also need to store into the server. To convert text to voice message, google text to speech have used. The function of an audio command instruction is as shown in Fig. 5. Store server and application must be connecting in same network. Each frame work design separately, so it easily modifiable. This stage includes investigation of the proposed framework and execution step to check the results are obtained. Also, in this stage limitation of the execution, updating required for design of the system and assessment include. After design stage testing stage is needed. All modules must communicate proper way and need to pass the message correctly.

Implementation is an essential stage in the improvement of the task where the product configuration is acknowledged as a situation of the system units. The items that are recognized in the outline stage are actualized and capacities, which control these articles, are figured it out. After performing framework investigation and by outlining and coding, execution is done to check whether the result of the venture is as expected.

The implementation has many stages which includes
  • Methodical planning.
  • Examination of constraints in system.
  • Assessment of methods and changes in the system.
  • Platform selection.

Implementation of any product is constantly continued by critical choices with respect to choosing the stage, the dialect utilization and so forth these choices are frequently affected by a few elements, for example, genuine environment in which the framework meets expectations, the velocity that is needed, the security concerns and other execution choices that have been made before the usage of this venture. They are as

per the following:
• Choosing of programming language.
• Guidelines for coding.
The proposed system modules are as follows:

A. Item Registration
The store keeper adds the product item available in the store into the server using the web portal. The item details contain item_id, description, manufacturer, price etc.

B. Assign RFID Tag Number
The store keeper sets the RFID tag based on two categories, one is Item category and another is Direction category. The Item category tags will be used to detect the items in the racks and the Direction category tags will be used for the navigation purpose. The store keeper keeps the RFID tag in each shelf and updates the item id associated with that racks.

C. Shopping
Once the visually impaired person enters the store, the store keeper sets the blind person contact number in the system with which the RFID device is connected. When the person walks in the departmental stores, the RFID detector detects the RFID tags placed in the racks and sends the mobile number and tag number to the server.

D. Item Details TTS (Text to Speech)
Once the server receive the request from the blind persons device, it checks the RFID tag category and if it is under item category, it fetches the details of the product from the database and sends the information as a text to the user phone. The App installed on the blind person smart phone receives the information and converts into speech and plays the audio.

E. Seeking Help
If the blind person is looking for any item, he gives an audio command ("3. and sends to the server. Server finds the item details and sends the information to the user's phone and the App converts it into an audio and tells in which shelf or rack the item is present.

F. Billing
Whichever the item the blind person has selected, to be stored in the list, once he will approach the billing counter, the counter men can check the list and make the billing.

5. RESULT ANALYSIS

There are many systems available in this smart shopping but most of them are using barcode technology. Blind people facing difficulties to pointing to the barcode scanner, some existing system use PC also to run blind application. Blind person facing difficulties to carry PC, but our proposed system need RFID reader and smart phone to work the system. RFID
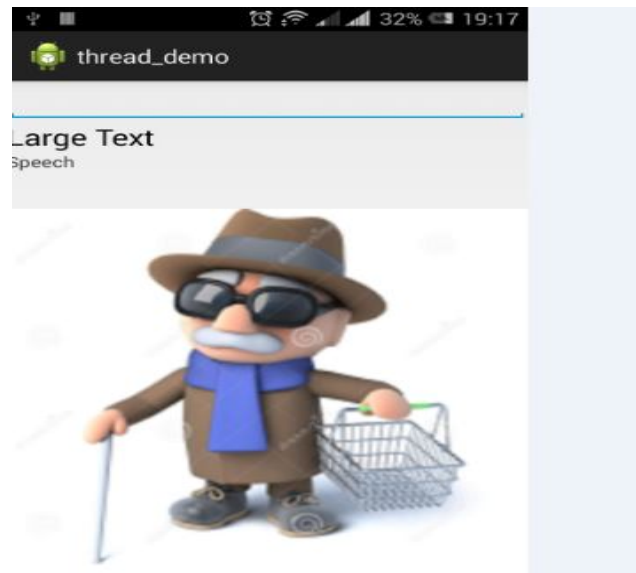
reader within a range it will read data.

Figure 4: Smart Shopping for Visually Impaired People
This system will help to search an item, no need to go every wrack, directly can reach to the item, using navigation system. RFID based system is faster than barcode sensor system for a blind person. In case of navigation store Wi-Fi network is workable.

6. CONCLUSION

The capability of the visually impaired people to be independent and to carry out their day to day activity without any additional aid from a third person is the direct result of the use of the present-day technology for object detection and navigation. The proposed system has major scope in helping as it holds up morals of helping those who need help the most and makes use of enhancements in technology that not only helps them but everyone else who would make use of such a system. The technology that implements the RFID tags makes use of frequencies in MHz but the advancement in present day technology has made available the millimeter waves that have propagation of frequencies in GHz and have a larger bandwidth which can be used for transmitting larger amounts of data. The technology of speech to text and vice versa can itself be enhanced further for providing the better security through voice recognition. It makes use of the android platform to ensure that open source platform for easy modifications and to carry out any further updates. The reason for the latest android operating system is to ensure optimal processor utilization and efficient computing. The basic necessity of a human being is to carry out whatever task is required through an independent effort with a sense of completion of the task and ensuring self-satisfaction.
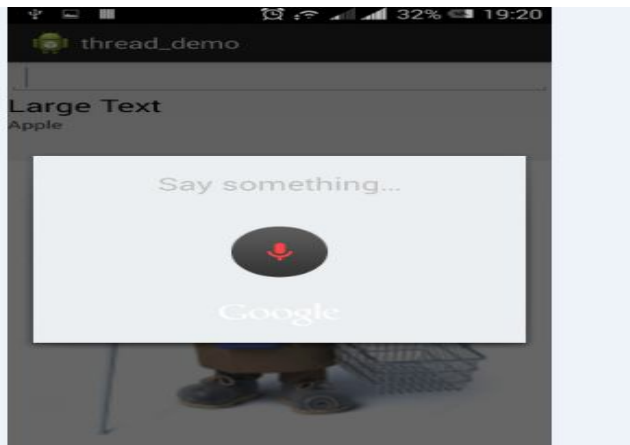
Figure 5: An Audio Command Instruction

The areas of improvement are:

1. Smart Phone can be replaced by any other device if available.

2. The information of items above and below the wrack with currently detected item will be played in the user's smart phone.

3. We can add some GPS system, so blind person can reach home to departmental store easily.

4. Software should not store specific, we can make it for any store

ACKNOWLEDGEMENT

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