MARKET MATE
ROBOTIC SHOPPING CART

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Abstract

An innovative product with societal acceptance is one that aids the comfort, convenience and efficiency in everyday life. Purchasing and shopping at big malls has become daily activity in metro cities. We can see people rush at these malls on holidays and weekends, purchase different items and put them in trolley. After completion of purchases, one needs to go to billing counter for payments which is very time consuming process and results in long queue at billing counter. Hence a product "Intelligent Shopping Cart" is being developed to assist 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 scalable, and rugged system for assisting shopping in person. The developed system consists of 2 key components/modules (a) IR Communication component (b) User Interface and display component. IR Communication component establishes and maintains the connection of the shopping cart with the consumer and follows him in mall. User interface provides the user interface and displays count of items being purchased by user, and the same information is being communicated to main server which generates bill automatically. These 2 modules are integrated into an embedded system and are tested to satisfy the functionality so that purpose is served.

I. Introduction

Innovation in Communication and Information Technologies have caused a revolution in values, knowledge and perceptions in all areas of human understanding. Carving the "Age of Information and Knowledge". Human beings have invented and 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 everyday's work easier and faster. One regular task that human beings spend considerable amount of time is in shopping. According to a survey conducted by US Bureau of Labor on an average, human beings spend 1.4 hours every day on shopping. A survey done by Visa in 2005 points out that an amazing 70% customers will walk out of a queue if the line is too long, and 10% are seriously annoyed the moment they step in a queue. To try to solve the problems previously identified, recent years have seen the appearance of several technological solutions for hypermarket assistance. While doing survey we found that most of the people prefer to leave the shopping mall instead of waiting in long queues to buy a few products. People find it difficult to locate the product they wanted to buy, after selecting product they need to stand in a long queue for billing and payment. Our Shopping Guide aims at designing of interactive mobile shopping companion device for everyday use. The cart navigates person to his place of interest and follows him. Shopping aid stops at safer distance from user and allow him to put the purchased in basket, once shopping is completed the user has to intimate to end shopping so that total number of items purchased is displayed

along with generation of bill. Never the less this service requires sophisticated capabilities in order to work co -operatively side by side with humans in real world scenarios. As the system developed serves in real time, feasibility and functionality of the system should be analyzed in more systematic way.

II. Objectives:

 The main objective of our proposed system is to provide a technology oriented, low-cost, easily scalable, rugged system for assisting public in shopping.

 It navigates the customer to required place (grocery section, clothing section, cosmetics etc.)

 The cart establishes effective communication with the user and follow him in mall (the user need not carry trolley).

 The system senses and counts the number of items purchased by user and generate bill once shopping is completed there-by reducing time consumed at billing counters.

 The system is cost effective and marketable which can be effectively implemented in malls and serve the consumers.

III. Related work

To make user more comfortable at the time of shopping various systems have been proposed but the objective of all design remain the same i.e. save consumers time. In order to fix this problem Satoru Uehara defined the Web shopping cart system as a typical client-server application on the Web. However the system did not serve the purpose in expected way as it encountered several issues in implementation of the Web shopping cart system. One way was design of 'Intelligent shopping cart'. The main objective of this is to provide a technology oriented, low-cost, easily scalable, and rugged system for assisting shopping in-person. The developed system consists of 3 key modules:

(a) Server Communication

(b) User Interface and display

(c) Automatic billing

By identifying several problems with barcode reading (such as static information, requires line-of sight, has low range) the RFID technology was used. In the proposed system, if the object is dropped into or removed from the trolley, the RFID tag identifies the product and updates the bill. After shopping, once 'End Shopping' button is pressed the details are sent to the master computer and the customer has to just pay the amount and leave the mall, which saves the precious time of the customers.

Another approach was design of 'Humanoid robot' which assisted public in mall. The robot was designed to interact naturally with customers and to affectively provide shopping information. It was also designed to repeatedly interact with people to build a rapport; since a shop- ping mall is a place people repeatedly visit, it provides the chance to explicitly design a robot for multiple interactions. For this capability, RFID tags for person identification and robot gave information that user needed.

Limitations:

Above proposed designs have limitations such as:

- In intelligent shopping cart system only the billing was made automatic where as person has to carry cart in mall, since RFID technology is used more often there are chances of system being hanged as all trolleys try to communicate to same central computer.
- The humanoid robot assistant system just guided user to his required destination but percentage of success was very less as speech recognition became major problem.

To overcome the above mentioned limitations there is need for designing model which follows user in malls and assist them during shopping and free user from carrying trolleys there by increasing level of comfort and convenience.

IV. Proposed System

"Intelligent Shopping Cart" is being developed to assist a person in everyday shopping. The developed system consists of 2 key components/modules

(a) Server Communication component (SCC).

(b) User Interface and display component (UIDC).

SCC establishes and maintains the connection of the shopping cart with the user. UIDC provides the user interface and displays information to user. After completion of shopping the user is provided with total number of items he has purchased and bill is generated automatically at the server there by avoiding the user to stand in long queues. These 2 modules are integrated into an embedded system and are tested to satisfy the functionality.

The main technological objective for our presented solution is the usage of IR technology

for the automatic identification and following of person, thus eliminating consumer intervention in the process of carrying trolleys, product reading for payment. IR communication allows one single reading at a time; requires line-of sight; IR technology is more resistant, safer, and cost effective.

The existing image processing systems are of high budget hence these are not implemented in all shopping malls.

System identifies person in a unique way, and establishes communication. It maintains safe distance from user and senses the items purchased. Once user chooses option of 'end of shopping' bill id generated at server and direct payment can be done.

Nevertheless, range cannot be beyond than the carts limits with consequence of not identifying person its range.

V. Design methodology:

Functional block diagram

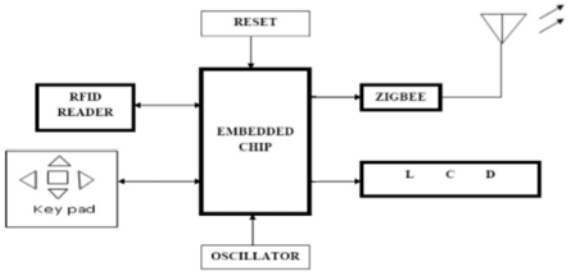
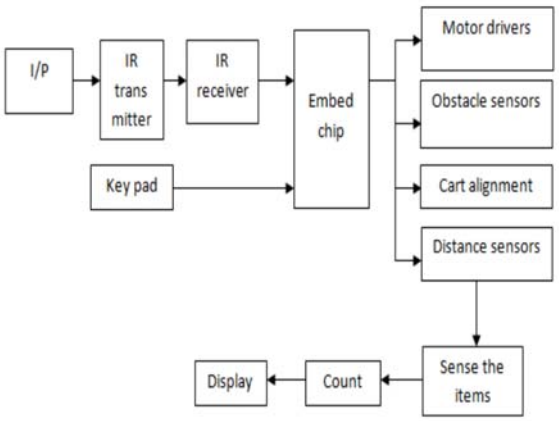


Fig. 1 Block diagram of Trolley Section

The functionality of person following robot represented as shown in figure. With reference to this diagram various blocks involved in design of our system are derived and are as shown in figure.

- The primary sensing section comprises of IR transmitters and receivers. The signals from transmitter are received by IR receivers placed in trolley.
- The microcontroller processes signal and decision is done which controls the action of trolley
- Various sensors such as distance sensors, obstacles sensors are incorporated to ensure that communication between person and trolley.
- User can drop required items in cart and counter counts number of items purchased and displayed on LCD display and at the end bill is generated. Hence from above diagram main building blocks of proposed system are:
  Communication section
  Sensing section
  Display section.



VI. Requirement Analysis

In order to realize the specified functions the various tools and components which are required to build the three sections(communication, sensing, display) are specified below.

Communication section:

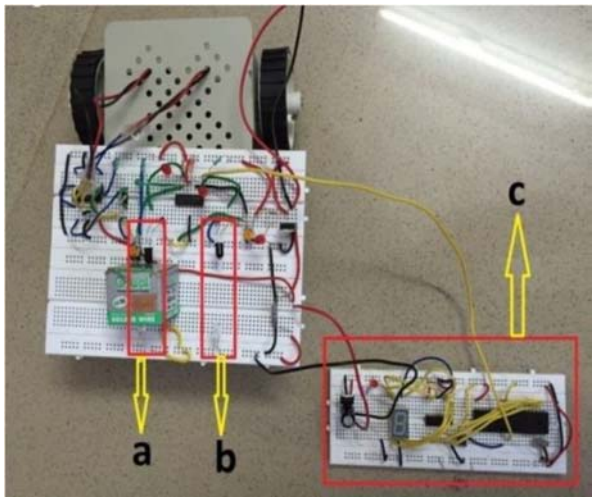
- The primary function of this section is to establish and maintain effective communication between user and trolley.
- Communication is facilitated by set of IR receivers and transmitters.
- Motor driver IC to provide sink between battery and motor.
- Opto-isolator to avoid misbehaving of system due to voltage fluctuation.

Sensing section:

- This section senses the items purchased by user.
- IR transceivers are used as sensors for this purpose.
- When the user drops item in trolley, sensing is done and the information is communicated to display section.

Display section

- The display section shows the total number of items purchased by user.
- It comprises of microcontroller to receive data from sensing section.
- □ LCD display is mounted to communicate count to outer world.
- □ Decoder is used to make microcontroller more compatible with LCD.



a=Communication section
b=Product sensing section.
c=Display section.

VII. Algorithm

The working of the Intelligent Shopping Cart can be explained with the following steps:

1) The customer is provided band which facilitates the communication between user and cart.

2) When shoppers with the cart press "start button" the system turns ON.

3)The user enters input where he wants to go (grocery ,clothing, kids, food etc).and direction is shown on navigator.

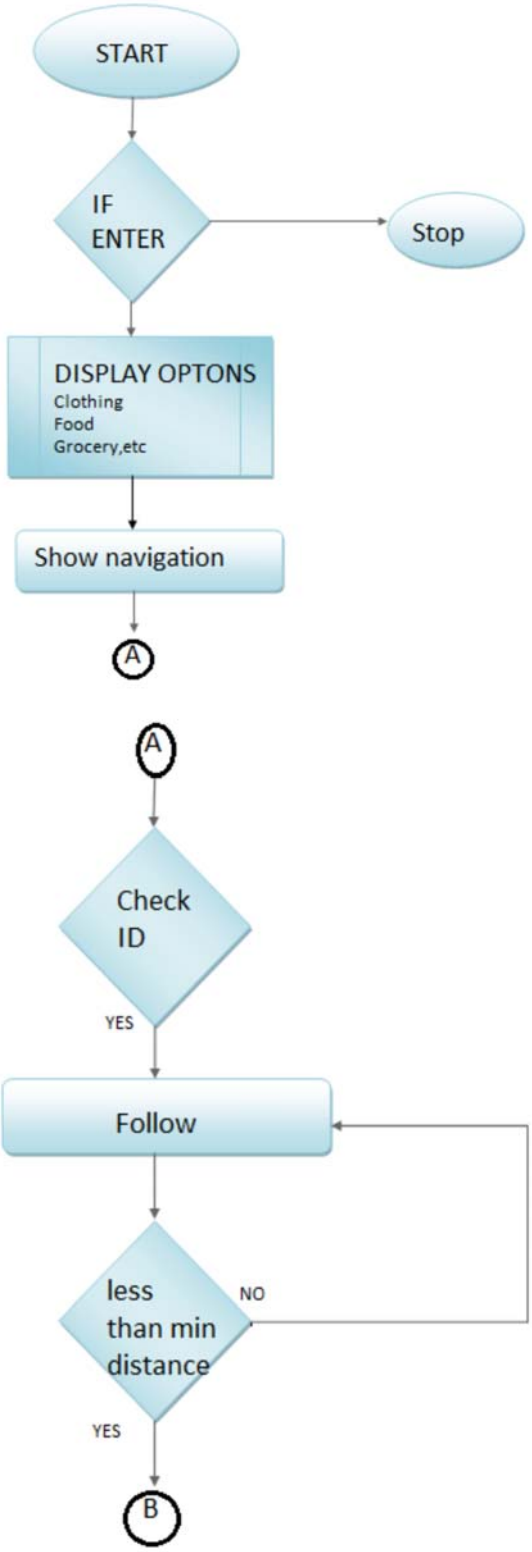
4) Every product has a tag which contains unique ID, which ensures there is no mismatch between user and trolley. The cart follows person.

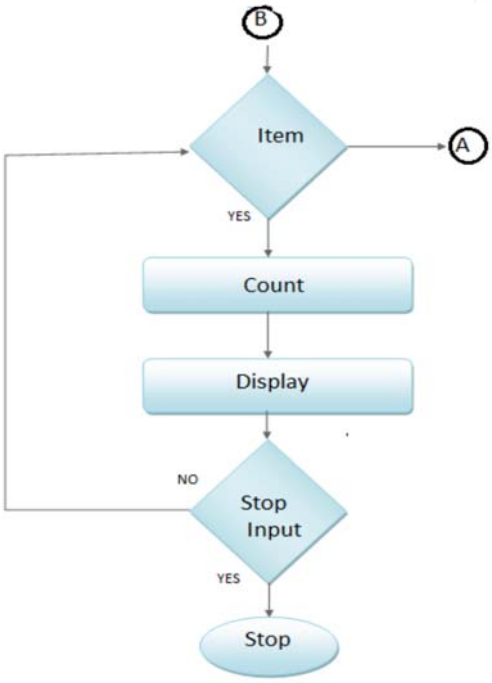
5) When the shopper drops any product in the cart, sensor counts the item and then displayed on the LCD screen. At the same time billing information is also updated.

6) These steps are repeated until the end of shopping button is pressed. Once the "End Shopping" button is pressed.

7) At the end of shopping, the customer can straight away pay the bill and leave.

VIII. Flowcharts





IX. Implementation

X. Conclusion

The intended objectives were successfully achieved in the prototype model developed. The developed product is easy to use, low-cost and does not need any special training. This project report reviews and exploits the existing developments and different types of identification technologies which are used for person identification, billing, etc. , we have designed a shopping cart that provides technological solution for hypermarket assistance.

Most of system use image technique of image processing and are costly to implement, hence we do not find any such application in malls. To overcome this problem we are with innovative product. The system designed is economic, user friendly and cost effective, it can finds its easy implementation in malls to assist public and make shopping more comfortable.

XI. References

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