International Journal of Engineering Research in Electronic and Communication Engineering (IJERECE) Vol 2, Issue 9, September 2015

Intelligent Shopping Cart

[1]Rosamma Sebastian,[2]Philip Chethalan,[3]Philip T Nedumpuram,[4]Prathibha S Nair,[5]Tomin George
[1]Assistant Professor, Department of Electronics and Communication Engineering
[2][3][4][5]Department of Electronics and Communication Engineering
Amal Jyothi College of Engineering, Kanjirappally, India

Abstract: **An intelligent cart for the customer at shopping malls. The objective is to make a user friendly cart for shopping process. By the development of this cart, the customer does not need to push the cart. It will automatically follow the person throughout the shopping by sensing the movements of the customer. When any item is put into the trolley, RFID reader will read the tag value of that item and starts billing operation. When any item is taken back, it will reduce the price of that item from the calculated bill amount. After completing the shopping, the customer can just pay the final bill amount after the pc in billing section gives a request command. Deactivating command resets the cart. When the customer reaches the main entrance, he or she can collect the bill and pay the amount easily without any time delay.**

Keywords: **Radio Frequency Identification (RFID), Wireless ZigBee Module, Infra-Red (IR) transmitter and receiver, AVR Microcontroller,Ultrasonic Sensors Arduino module.**

I. INTRODUCTION

Main purpose of innovation in technology, irrespective of the domain, has been in simplifying life on earth or making everyday chores easier and faster. One mundane task that human beings spend considerable amount of time is in shopping. According to a survey conducted by US Bureau of Labor [1], on an average, human beings spend 1.5 hours every day on shopping. A survey done by Visa in 2005 [2] points out that an amazing 70% customers will walk out of a queue if the lines too long, and 10% are "seriously annoyed" the moment they step in a queue. Further, according to a study conducted by CISCO Internet Business Solution Group [3], the top four reasons for shoppers to use technology are to (i) Find best price, (ii) Save time, (iii) Find best assortment and (iv)Find best quality.

The current scenario on shopping classifies it into two categories (1) Shopping in-person and (2) Shopping in absentia. Shopping in absentia is facilitated in multiple ways including, internet shopping, tele-shopping, etc. wherein a shopper does not have to be physically present in the shopping area. Shopping in-person typically involves a personal visit to the place of shopping and selecting the product/s based on various parameters including need, convenience, brand, discount/offer, etc. The proposed ISC system intends to assist shopping in-person that will minimize the time spent in shopping as well as locate/purchase the desired product at the best rate.

The ISC system is based on four important technologies(i) Ultrasonic sensors – used innovatively for dynamic location detection and tracking (ii) RFID tags for product identification (iii) Zig Bee for wireless communication and (iv) Integrating System with

One of the critical design decisions has been in developing an approach to dynamically detect the location of the shopping cart and integrating it suitably into a useful low cost embedded system. Widely used location determination technologies including Global Positioning Systems (GPS)does not augur well for solving the proposed problem. Few disadvantages include, higher implementation cost, movement of cart in an enclosed area, and location accuracy. In this paper, we discuss the System Design, Implementation, Testing, and Conclusions.

In conclusions we also discuss about opportunities of improving ISC to make it into a commercially viable product as an excellent way to help customers reduce the time spent in shopping by displaying the list of products, their cost, the best deals/rate son the products and automatic billing. The system helps the store management with an automatic update of the inventory on every purchase of an item. ISC has the potential to make shopping more pleasurable and efficient for the shopper.

II. ISC SYSTEM DESIGN

Objective: To develop an intelligent shopping aid that assists the consumer to locate and select products and inform them on any special deals on the products as they dynamically move in the shopping arena. Additionally, with each product identified uniquely and usage of centralized server, support billing and inventory updates.

III. LEG DETECTION AND TRACKING

Intelligent Shopping Cart is a user friendly shopping cart which makes shopping easier and enjoyable. When the customer enters the mall, he will be given a trolley. The trolley will not be activated unless the PC in the billing section gives a command to activate through xbee. When the activation command is received the trolley displays "ACTIVATED". Only after activation, the user following process of the trolley starts to work. After activation, the trolley follows the customer.

The cart consists of three Ultrasonic sensors which acts as distance sensor and obstacle sensor. We provided the distance range between 100 and -1 that is 100 denotes an obstacle and -1 the customer is out of the range. The cart moves in all directions with the help of two motors attached to the wheels. When the customer moves either right or left, the cart turns an angle to the respective direction till the sensor placed at the middle of the cart detects the customer.

IV. DESCRIPTION OF PARTS

AVR MICROCONTROLLER: The major heart of this project is AVR microcontroller [4], it has more features like 16bit timer, 10-bit ADC, USART, SPI, I2C, 256 bytes of EEPROM memory, and 32kbytes of flash program memory, then at last its speed of program execution is about to 1 microsecond or 10 MIPS (10 Million Instructions per second), etc. However, compare to other microcontroller it is fast and very ease to program in C language because of huge support can gain from the manufacturer for programming. The special IDE offered by the manufacture, it is named as AVR Studio IDE for it code generation purpose.

Fig 2.1

RFID MODULE: It consists of an RFID reader and corresponding tags. The reader collects the data from the tag when the tag is placed within the range of the receiver. The data is a code having a length of 12 bits. This code is unique for a tag so that an individual holding this tag can be uniquely identified. Driver is used to interface RFID reader module[5] to micro controller

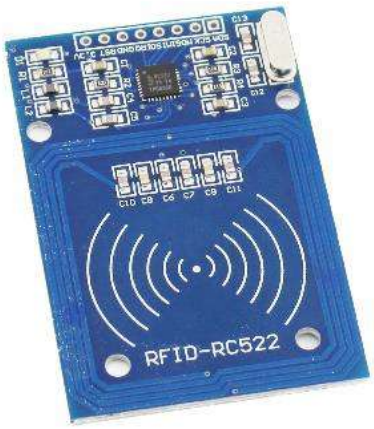

Fig 2.2

XBEE MODULE:The xbee module[6] facilitates the data communication between handset and trolley sections. The signals corresponding to each switch in the keypad is transmitted to trolley through the xbee module. Any messages like the weight of the luggage, result of luggage checking etc that are to be displayed on the LCD screen are send through the xbee module.

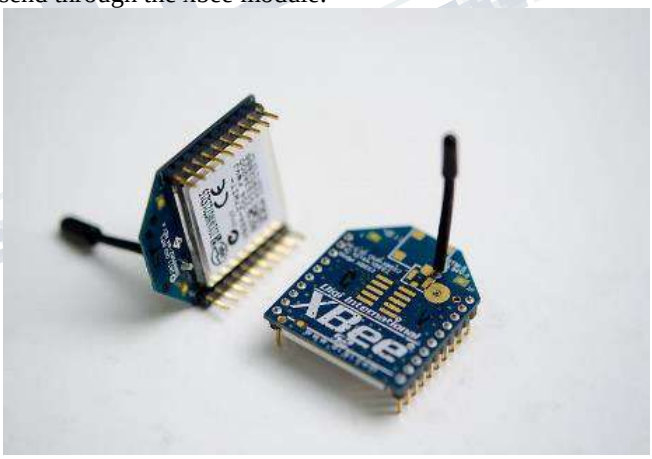

Fig 2.3

MOTORS: There are two DC motors of 150 rpm, working with 12V supply, are connected to the two back wheels of the trolley. The motor driver IC L293D is used for driving the motors. By controlling the direction of rotation of the motors, the trolley can be moved in the forward, backward, left & right directions.

Fig 2.4

ULTRASONIC SENSORS: Ultrasonic ranging module [7] HC-SR04 provides2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:
(1) Using IO trigger for at least 10us high level signal,
(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
(3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time× velocity of sound (340M/S)) / 2

Fig 2.5

ADRUINO MODULE: Adriano is a tool for making computers that can sense and control more of the physical world . It can act as both controller and burner. The Adriano programming language[8] is an implementation of wiring, a similar which is based on the processing multimedia programming environment.

Fig 2.6

TROLLEY-FOLLOWING AND BILLING SECTION

The intelligent shopping cart we proposed consists of an automated billing system. The RFID reader in the cart reads the tag of the items and calculates the bill amount. When a customer puts an item to the cart, the RFID reader reads the tag of the item and displays the item and its amount. When the item is removed from the cart, the RFID reader again reads the tag and deducts the bill amount of the item. When the shopping is complete, the PC in the billing section will have to send another command to request the billing information from the cart. After sending the request, all bill details will be sent to the PC and the customer just need to pay the bill. Another request will be sent to deactivate and reset the trolley from the PC after bill payment.

V. FOLLOWING SECTION FLOWCHART

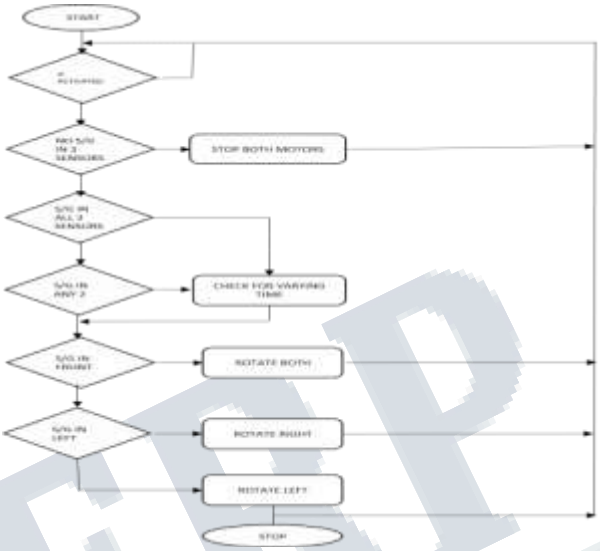

Fig 2.7

ALGORITHM

i. Start
ii. Check for activation.
iii. If activated go to step 4, else go to step 2.
iv. If all three sensors get no signal, stop both motors and go to step 2.
v. If all three sensors get signal, go to step 6, else go to step 7.
vi. Check which sensor outs a varying time, if front then rotate both motors; if left then rotate right motor, else rotate left motor and go to step 2.
vii. If any two sensors get signal, check which two and go to step 6, else go to step 8.
viii. If front sensor receives signal, rotate both motors and go to step 2.
ix. If right sensor receives signal rotate left motor and go to step 2.
x. Rotate right motor and go to step 2.
xi. Stop

VI. BILLING SECTION FLOWCHART

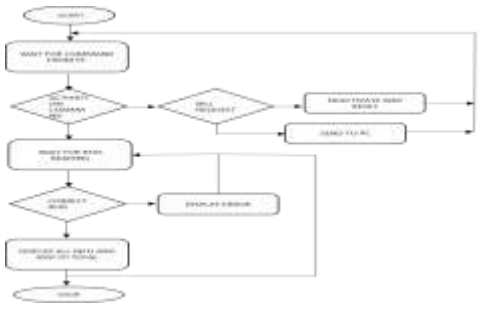

Fig 2.8

ALGORITHM

i. Start
ii. Wait for command from PC.
iii. If command is to activate, go to step 6.
iv. If command is to request bill, send all information.
v. Deactivate and reset, go to step 2.
vi. Wait for RFID reading.
vii. If correct RFID read, display all information about the bill and add the cost to total and go to step 6.
viii. Display error message and go to step 6.
ix. Stop

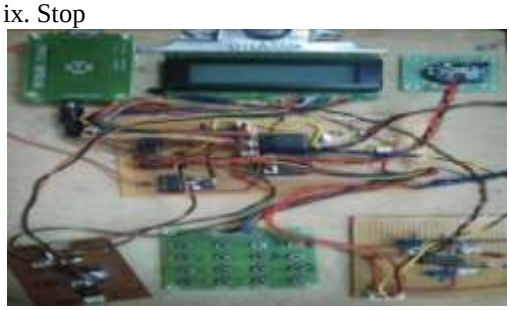

Fig 2.9

VII. TESTING

Testing was a very critical component of this project. Unit testing of various modules was performed independently followed by integrated system testing.
Unit testing scenarios included:
(a) Dynamic location detection – aisle numbers.
(b) Entry and Exit status of the cart from Aisle
(c) Shopping cart and server communication using the wireless Signee module
(d) Retrieval of relevant information based on the shopping cart location from server and display on the display unit
(e) Identifying items based on RFID tags and synchronizing with central database
(f) Automatic billing
Next test modules involved testing the entry and exit of the cart at any particular aisle.

Table 1. Sample Database of Product Details

Product id	Product	Aisle	Cost (In Indian	Discount
11021	Washing powder	1	75	3
11022	Washing soap(Dr.	2	45	0
11023	Tooth brush	3	32	0
11024	Hand wash	1	55	2
11025	Face wash	3	120	6
11026	Tide powder	2	90	4

Subsequently, we had to retrieve the items in particular aisle. Table 1 provides a sample database that was used to test NLISC. The aisle number was passed on to the Signee module from the shopping cart which in turn communicated with the server. Based on the received aisle number, all items in the location aisle number were transmitted back to the shopping cart. The received items were manually checked with the product details on the server and found the same to be matching with the contents on the server. Finally, to simulate shopping, unique RFID cards were used to indicate distinctive products being shopped. As the RFID card reader read the product, details were displayed on the display unit. The product details of the shopped items were temporarily stored in the local memory. Once the shopping "Complete" button was pressed, the memory contents were read and billing was done.

VIII. CONCLUSION

Successfully implemented a cart which automatically follows the customer with the help of ultrasonic sensors. We make this cart for a customer friendly use which does not have a physical contact with customer and cart.The product is easy to use, low-cost and does not need any special training. Billing is done simultaneously with the shopping. The total amount is transferred to the billing counter making shopping enjoyable.

REFERENCE

[1]. American Time Use Survey
http://www.bls.gov/tus/charts/

[2]. Australian Time use Survey
http://www.abs.gov.au/ausstats/abs@.nsf/mediareleasesbytitle/368156C4264E4D8ECA2568A9001362E8?OpenDocument

[3]. Cisco Internet Business Solution Group survey document"My Shopping My Survey - Findings"
http://www.cisco.com/web/about/ac79/docs/retail/Mashop-survey-metrics_UNITED-STATES.pdf

[4]. Website on AVR Microcontroller
http://www.atmel.com/products/microcontrollers/avr/

[5]. Website on RFID
www.rfidjournal.com

[6].Website on Zigbee Module
http://www.digi.com/products/zigbee-rf-modules/zigbee-mesh-module/

[7]. Website on Ultrasonic Sensors
http://www.micropik.com/PDF/HCSR04.pdf

[8]. Website on Arduino programming
http://arduino.cc/en/Tutorial/HomePage

[9]Novel low cost intelligent cart IEEE Journal