AI Based Low Cost Shopping Robot System with Real time Shopping Experience

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***Abstract*- Searching the products in a big grocery market is really time-consuming and human assistance provided will also be less in such super markets. This paper presents a shopping robot which assists human in searching the products by automatically picking up grocery items and other products based on the grocery list given by the customers and hence they will get the same real-time shopping experience. The billing will be done automatically at the end by the robot which helps the customer to avoid waiting in a long queue. This robot has a trolley system combined with pick and place arm, and a bar code reader. The system incorporates a line follower circuit, gripper to pick and place the products and a barcode scanner built around and Arduino board. Line follower will track black lines using IR modules. The list is read by the robot using a camera and the corresponding barcodes are identified. The locations of the products of these barcodes and the path to reach these locations are already stored in the memory of the robot. When the robot moves to the location of the product the bar code scanner will scan the bar code found on product box or packet and identifies it price. This helps to bill the products immediately after collecting.**

***Index terms*- Autonomous guiding, robot, Arduino, wagon, artificial intelligence**

INTRODUCTION

Recently, the proliferation of massive supermarkets and looking centres additional to the speedy development of mechanism technology has created robotic systems for serving to individuals in these specific environments. Some specific varieties of applications, like enhancing the physical capabilities of the user, serving to within the transport of merchandise by providing a mobile basket, and rising the knowledge given to the user during a a lot of intelligent manner, are delineated in scientific literature. Aiding elder individuals in their environments could be a means of considerably rising their quality of life. As Associate in nursing example, networks of sensors and actuators embedded in buildings (i.e., close Intelligence) will offer helpful functions. In fact, many global organization comes have centered on this specific subject. However, serving to aged individuals outside their usual atmosphere is additionally necessary, to assist them to hold out daily tasks like looking. Population ageing could be a concern for many developed countries and it's forecast that it'll accelerate within the years to return. the most goal within the field of help AI is to assist users in their everyday lives, in tasks like traveling, handling objects, or interacting, presumably remotely, with others, either friends or relatives, or professionals. During this context, mechanism devices square measure aimed not solely at aiding individuals, rather than commutation them, however conjointly at adopting the role of companions. Therefore, they need to be designed to move with untrained individuals, and a good effort should be created to change users to just accept them simply.

Moreover, these help robots could get to operate in unstructured environments that can't be custom-made, like homes, shops, or parks. This suggests a desire for the mechanism that's tuned in to its surroundings, which needs the employment of a range of sensors. Additionally, several of the items that require to be handled, like food, don't are available customary sizes and shapes, as they usually kill associate industrial context. So individuals really don’t have abundant time to pay for searching that is associate innovative factor. That’s why individuals like searching within the mall so they'll get the complete product at an equivalent place. This protects them from going into completely different outlets to get solely restricted sorts of product.

Through searching in mall offer the advantage of the saving time to peoples, they need solely weekend to go to store. This makes a haul at the money counter due to increasing range of consumers. The client needs to sub the request counter. Within the mall all and sundry take product place in to the self-propelled vehicle. once the searching is completed that person have to be compelled to sub the queue for request. once this method the sell person scan barcode of the every and each product and provides its final bill. This method is incredibly time overwhelming and it became worst of vacation special offers or weekends. To avoid this downside we have a tendency to introducing a completely automatic microcontroller primarily based self-propelled vehicle. during this self-propelled vehicle the client needs to choose the product within the display screen which list square measure transmitted to the self-propelled vehicle employing a sensible phone. The self-propelled vehicle is line following and therefore the corresponding distance square measure coated the self-propelled vehicle is stopped which item is choose and place to the self-propelled vehicle victimisation robotic arm. The robotic arm is connected to the self-propelled vehicle. The self-propelled vehicle collects all things and move to the request counter.

Figure 1: Product following shopping cart assistance robot

II. RELATED WORK

Janhvi Iyer et al. [1] planned a system wherever every and each product has associate RFID tag rather than a barcode scanner. The good tramcar can contain RFID reader, show|LCD|digital display|alphanumeric display} display and Zigbee transmitter. once an individual place any product in a very tramcar it'll scan the merchandise and therefore the price and name of the merchandise are going to be displayed. RFID (radio frequency identification) mechanically identifies and track tags connected to the objects. All the product ought to be connected with RFID tags. The tags square measure browse in any orientation and accuracy of the reading is additional. It reads several tags at a time and therefore the exactness is additional. Within the looking, tramcar things are often browse while not a necessity to keep up a transparent line of sight.

Bhagyashree Bhumkar et al. [2] during this paper all the trolleys within the mall square measure connected with the device that contains RFID reader, Microcontroller, Zigbee. thus every tramcar can send the item data to the most request server for hard the ultimate bill of the purchased things. The client places {the things|the things} into tramcar here items square measure with RFID tag thus once the client selects the item associated put an item into the tramcar, the RFID reader reads the information, the information is nothing however the tag variety. the sole amendment during this paper is that it's associate robot application wherever the client should register.

P. Chandrasekar et al. [3] the authors have conferred their plan within which every trade goods {in a|during a|in associate exceedingly|in a very} mall are going to be connected with associate RFID tag and every tramcar are going to be connected with an RFID reader which might be acting on the ZigBee wireless module. A centralized system is gift for any facilitate and queries and for the request dealings of the product by the purchasers. Even the exit gates of the mall square measure laced up with the RFID readers for police work any felony. However, there's no program and thus it's not a easy system.

Vrinda et al.[4] have featured a cart equipped with associate RFID reader, a ZigBee transceiver associated an show|LCD|digital display|alphanumeric display} display. This good cart keeps associate account of the bill created by keeping running total of the purchases. associate LCD screen shows the entire bill of the things gift within the cart. However, this method doesn't have a program and ZigBee is employed rather than a Wi-Fi module. This work, however, lacks intrinsic security checks for discrepancies.

Ankush Yewatkar et al. [5] planned good Cart with Automatic request, Product data, Product recommendation victimisation RFID & Zigbee with

Anti- felony system This good cart system keeps the track of all purchased product victimisation RFID & Zigbee. For final request, on-line transactions square measure counseled. The system conjointly offers suggestions to the patron with the assistance of the centralized system concerning offers/discounts supported the acquisition history of a client with the assistance of a centralized system. one in every of the vital feature this method introduced for associateti-theft by attaching an RFID reader at the entrance.

Dhavale Shraddha et al. [6] planned IOT based mostly intelligent tram for a shopping center with RFID technology for request throughout the acquisition in looking malls and IOT is employed for bill management by means that of psychic phenomenon module. The payment details are going to be sent to the server by that the central request unit can contend with the customer's payment. The psychic phenomenon modules are going to be operating as a brief distance Wi-Fi chip for wireless communication. However there's a downside which incorporates constraints like distance and interference. The servers are going to be busy if customers are high and web property ought to be stable for finishing the method

Sainath et al. [7] planned the machine-controlled looking tram for a grocery store request system with barcode for request of product, wherever client scans the merchandise mistreatment barcode technology. The bills are going to be forwarded to the central request system wherever the client pays them by showing a novel id. The limitation of barcode scanning needs line of sight for scanning and it ought to be mounted at intervals its boundary.

Budic et al. [8] planned a system of money register lines optimisation system mistreatment RFID technology and developed a system for looking mistreatment RFID. The RFID is used for scanning product and also the info is hold on within the info that may well be paid on-line or in an exceedingly central bill. It additionally uses net application to take care of entire looking details. It needs maintenance of an internet application server. No necessary steps are taken for the product that ar accidentally born into the tram by the client.

Jadhav Rahul Ravi Shankar et al. [9] planned RFID based mostly Automatic request tram technology. In machine-controlled request technology, every looking tram is hooked up with RFID reader & liquid crystal {display|LCD|digital display|alphanumeric display} display {and every|and every} each product is RFID hooked up with AN RFID tag to produce an improved answer to the manual request methodology in an exceedingly shopping center.

Raju Kumar et al. [10] planned AN Intelligent pushcart system. It consists of 3 modules- Server Communication part for association of the pushcart with the most server, program and show part to produce the program, and Automatic request part handles request section.

Udita Gangwal et al. [11] projected a sensible go-cart for machine-driven request Purpose victimization Wireless device Networks. this technique used WSN combined with a extremely reliable Image process technique to change the whole request method and to scale back the whole communication needs only 1 Passive device (load-cell) is employed.

G.S.Rajagopal et al. [12] projected a sensible Intelligent System for searching and request. during this paper sensible go-cart equipped with RFID tags is taken into account, to verify the acquisition details. Centralized request system to mechanically bill the consumer for the purchases

Anjali Verma et al. [13] projected RFID based mostly sensible Multitasking searching tramcar System. The projected system evaluates several ways to help shopper to attenuate the general searching time needed within the mall. this technique additionally provides time period updates supported the inventory to the shop management.

Mohit Kumar et al. [14] projected a sensible tramcar with Instant request to Ease Queues at searching Malls victimization ARM7 LPC2148: A review. it's sensible & faster-embedded request system by interfacing RFID and ZIGBEE module with the microcontroller.

III. METHODOLOGY

The proposed system consists of a grocery product selector which is interfaced with trolley. After receiving input through keypad, robotic arm installed/attached with the trolley, moves in line path by path choosing mechanism. At the same time, barcode reader fabricated with controller scans the barcode in each product/item. • When the barcode result matches with the input product list, the robotic arm picks the item and puts it in trolley by pick and

place mechanism. After getting all items in product list, trolley will be automatically closed by trolley mechanism. • After paying the amount, trolley will be automatically open by trolley mechanism.

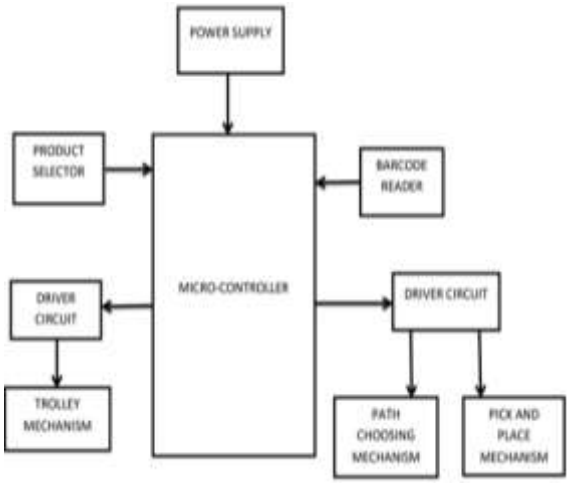

Fig 2: Proposed Block Diagram

A. Hardware Requirements:

- Arduino Board
- Barcode reader
- Driver circuit
- DC motor
- Power Supply
- Keypad
- Gripper
- Driver Board

B. Software Requirements

- Arduino IDE
- Embedded C

IV. HARDWARE IMPLEMENTATION

A. Arduino UNO

The Arduino UNO is AN ASCII text file microcontroller board supported the silicon chip ATmega328P microcontroller and developed by arduino. The board is provided with sets of digital and analog input/output (I/O) pins that will be interfaced to numerous growth boards (shields) and alternative circuits. The board has fourteen Digital pins, half dozen Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a sort B USB cable. It will be power-driven by a USB cable or by AN external nine potential unit battery, although it accepts voltages between seven and twenty volts. it's additionally like the Arduino Nano and carver. The hardware reference style is distributed underneath Common artistic Attribution Share-Alike a pair of.5 license and is out there on the arduino web site. Layout and production files for a few versions of the hardware also are on the market. "UNO" means that one in Italian and was chosen to mark the discharge of Arduino computer code (IDE) one.0.The UNO board and version one.0 of arduino computer code (IDE) were the reference versions of arduino, currently evolved to newer releases. The UNO board is that the 1st in an exceedingly series of USB arduino boards, and therefore the reference model for the arduino platform. The ATmega328P on the arduino UNO comes preprogrammed with a boot loader that enables uploading new code thereto while not the employment of AN external hardware computer user. It communicates exploitation the initial STK500 protocol. The UNO additionally differs from all preceding boards in this it doesn't use the FTDI USB-toserial driver chip. Instead, it uses the Atmega16U (Atmega8U2 up to version R2) programmed as a USB-to-serial device.

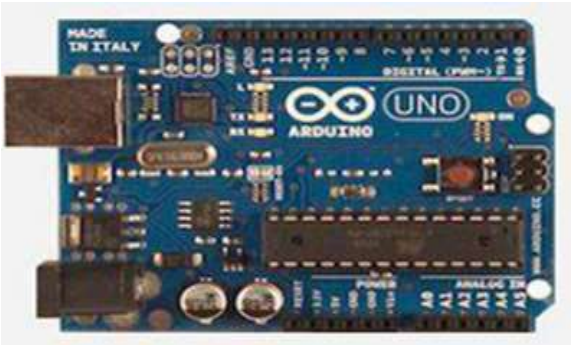

Fig -3: Arduino Board

B. Barcode Scanner

The paradigm uses a camera-based barcode scanner for implementation, that uses atiny low video camera to capture a picture of the barcode then use refined Image process techniques to decrypt the barcode. we've got used a digital camera for this purpose, that is meant to be fastened at the highest, facing the block hooked up to the cart. The ZBar barcode reader [5] is employed for the implementation, that supports several well-liked symbologies (types of barcodes). it's created to run on the UNIX (Ubuntu) software system. It conjointly encompasses a programme that's displayed on the monitor during which the client will see the inexperienced lines on the barcode if it's been

detected properly or a red light-weight if it's not been detected. Figure 4 a pair of shows the 2 conditions.

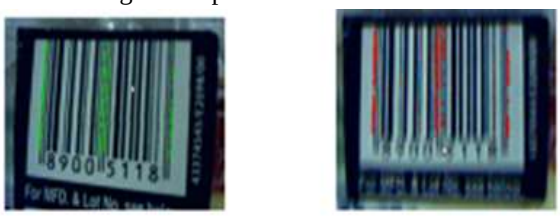

Fig. 4. User interface of the barcode scanner showing the detection and non-detection of barcode

C. Switch module

A toggle may be a category of electrical switches that area unit manually motivated by a mechanical lever, handle, or rocking mechanism. The phrase "toggle switch" is applied to a switch with a brief handle and a positive snap-action, whether or not it really contains a toggle mechanism or not. once the actuator-the toggle itself-is affected, the coil within the switch moves the transferable contact into position either energizing the circuit or de-energizing it.

Adding merchandise: The corresponding toggle is place to ON state before adding products into the trolley car, it additionally activates the barcode scanner with camera module that scans the barcode on the merchandise control before of it and displays the corresponding weight and value of the merchandise on the LCD.

Billing: Presently when the client finishes searching, they will straightaway put off the toggle adore the "adding products" and switch ON the charge switch that straightaway sends AN e-mail to the most server at the charge counter Removing products: once the client needs to get rid of a product from the trolley car and place it back within the rack, it may be accomplished before turning ON the charge switch by toggling the switch, 1st to ON then to OFF state, provided for removing merchandise then scanning the barcode adore the merchandise to be removed.

D. LCD

Liquid Crystal show could be a important device in associate degree embedded system. It offers high flexibility to user as he will show the specified information on that. LCD driver could be a link between the microcontroller and LCD. we have a tendency to set the interface mode, show mode, address counter increment direction, set distinction of LCD, horizontal or vertical addressing mode, color format. Next step when data formatting is to send information bytes to needed show information RAM memory location. Firstly, set the address location victimisation address set command computer memory unit then send information bytes victimisation the DDRAM write command. 14-pin access is provided having 8data lines, three management lines and three power lines. The connections area unit ordered out of in one amongst 2 common configurations, either 2 rows of seven pins, or one row of 14-pins.

E. DC MOTORS

The DC Motors provides reliable speed control environment. When the Bluetooth based device like mobile phone is connected to the microcontroller which sends data to the Bluetooth in the microcontroller to run the motor by controlling the speed and direction of motor with pulse width modulation signals.

Fig. 5. DC Motor

F. Robotic arm

Robotic arm could be a variety of mechanical arm, typically programmable, with similar functions to somebody's arm. The robotic arm consists of base plate and gripper. The motion to the robotic arm is given by dc motors. The motors were chosen supported the force needed for operating of the arm. the sunshine weight gripper is employed for selecting the item and inserting it at the streetcar. The robotic arm motions square measure controlled by Arduino

V. RESULTS AND DISCUSSION

This system is basically designed to help the customers in supermarket where there is less availability of space and movement is very frequent. When the customers need any product, they will give command from the main system. The list of

components will be stored in the main system and the customers will just select the list of components and send it to the controller through keypad. DPDT Relay is connected to the controller to give the proper switching between Barcode Scanner and switch module as there is only one UART. For normally close connection switch module is connected and for normally open connection Barcode Scanner is connected. As soon as the list of components are provided to the controller the signal will be send to line follower unit. The line follower will move as per the guided lines, it will trace all the black lines. As the line follower reaches the bin where the components are kept, the Barcode Scanner is mounted over the gripper. The gripper will move to scan the Barcode present on the component products. Then the scanned Barcode will be matched with the stored barcodes (first bits of each barcodes). As soon as the scanned barcodes matches with the stored barcode the gripper will pick the product. In the openings of the gripper there is IR module connected to monitor that the product is held by the gripper. The gripper will pick the product and place it in the trolley and move to the destination. This system would be useful to any supermarkets using products for their customers.

After initializing the device led indicates the signal availability and LCD displays "Shopping Trolley" as in the below figure.

Figure 6: After initializing the system

Figure 7: product 1 details

By pressing the "Select" the product will be selected, by pressing "move" button the trolley move to the position of the item, by pressing the "Pick" button it will pick the product and place in the trolley and by pressing the "total" button the total bill will be displayed on LCD

Fig 8: Experimental Setup

Fig 9: Product Pick and Placed

VI. CONCLUSION

In automatic smart trolley, there is no need to pull heavy trolley, no need to wait in billing queue and no need of thinking about budget The microcontroller based trolley follow the path and the robotic arm is pick and place the selected item safely. It gives number of products, weight of products in trolley and total cost of the product on the spot. It is user friendly and cost effective. The implementation is easy, very economical and will reduce the time required at the billing counter. In our project, we designed automated shopping trolley for the billing system, which can be used in any supermarket and by any person easily. The Smart Trolley was designed to function as a self-checkout system providing users with the flexibility to make transactions from it within the retail store. It is designed to be highly efficient and fully synchronized with the retailer's current system. The future scope of the trolley is the distance sensor is eliminated and to added the barcode scanner to identify the product.

REFERENCES

[1] Janhavi Iyer, Harshad Dhabu, Sudeep K. Mohanty. "Smart Trolley System for Automated Billing using RFID and ZIGBEE.", International Journal of Emerging Technology and Advanced Engineering, Vol. 5, Issue 10, October 2015, 112-116.

[2] Bhagyashree Bhumkar, Tejaswini Changal, Bhagyashri Dahifaler, "Automated billing trolley using RFID and Zigbee with android application rewarding system".

[3] Mr P. Chandrasekar and Ms T. Sangeetha Smart Shopping Cart with Automatic Billing System through RFID and ZigBee, IEEE, 2014.

[4] Ms.Vrinda, Niharika, Novel Model for Automating Purchases using Intelligent Cart, e-ISSN: 2278-0661, pISSN: 1; 2278- 8727Volume16, Issue 1, Ver. VII (Feb. 2014), PP 23-30.

[5] Ankush Yewatkar, Faiz Inamdar, Raj Singh, Ayushya, Amol Bandale. Smart Cart with Automatic Billing, Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft. International Conference on Communication, Computing and Virtualization, 2016, 793 - 800.

[6] Dhavale Shraddha D, Dhokane Trupti J, Shinde Priyanka S, IOT Based Intelligent Trolley for Shopping Mall, IJEDR, 2016.

[7] Sainath S, Surender K, Vikram Arvind V, Thangakumar J, Automated Shopping Trolley for Super Market Billing System, International Conference on Communication, Computing and Information Technology, 2014.

[8] Budic D, Martinovic Z, Simunic D, Cash register lines optimization system using RFID technology, IEEE Explore, 2014.

[9] Jadhav Rahul Shankar, Avale Pradeep Nandkumar, Tarali Shivkumar Vaijanath, Prof. Pawar S. U. RFID based Automatic Billing Trolley. International Journal for Scientific Research & Development, Vol. 3, Issue 02, 2015, 2297-2299.

[10] Raju Kumar, K. Gopalakrishnan, K. Ramesha. Intelligent Shopping Cart. International Journal of Engineering Science and Innovative Technology, Volume 2, Issue 4, July 2013, 499-507.

[11] Udita Gangwal, Sanchita Roy, Jyotsna Bapat. Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks. International Conference on Sensor Technologies and Applications, 2013, 168-172.

[12] G.S.Rajagopal, Mr.S.Grout, Prof. M.Janarthanan. Smart Intelligent System for Shopping and Billing. International Journal of Advanced Research Trends in Engineering and Technology, Vol. 3, Issue 19, April 2016, 339-343.

[13] Anjali Verma, Namit Gupta. RFID based Smart Multitasking Shopping Trolley System. International Journal for Scientific Research & Development, Vol. 3, Issue 06, 2015, 1389-1392.

[14] Mohit Kumar, Jaspreet Singh, Anju, Varun Sanduja. Smart Trolley with Instant Billing to Ease Queues at Shopping Malls using ARM7 LPC2148: A review. International Journal of Advanced Research in Computer and Communication Engineering, Vol. 4, Issue 8, August 2015, 39-42.