International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

Line Follower Smart Cart using RFID Technology

Josna Jose[1], Rahna R N[2], Rehna Illiyas[3] and Reshma Susan John[4], Vandana P[5] (Asst. Prof.**)**

[1-5]*Department of Electrical and Electronics Engineering, Mar Baselios College of Engineering and Technology, Thiruvananthapuram, Kerala, India*

Abstract - *In large metropolitan cities, the grocery shops will be filled with customers and long waiting queues at the cash counter. People may forget the list of items they need to purchase and may not be aware about the availability of the items in the grocery. The project deals with these problems and has solutions which includes Radio Frequency Identification (RFID) technology, Infrared (IR) line followers, IR proximity sensors and mobile application. Thus, the customers can list out the items available at the grocery shops from their home itself, they can choose any quantity for each item and calculate the total amount. According to the shelf arrangement, the list is sorted which can be seen in the window interfaced with the raspberry pi. The RFID technology and IR line follower are linked so that the cart can move automatically searching for the shelf that has the item. A mechanical or a manual lock is provided at the door side of the cart to control theft. The totals amount will be seen in the Liquid Crystal Display (LCD) screen interfaced with the microcontroller. The cart uses raspberry pi to link with the QR code sensing camera with the cart screen with the help of a VNC viewer software.*

Key Words: RFID, IR proximity sensors, IR line follower, mobile application, raspberry pi.

1. INTRODUCTION

In metropolitan cities, the people are having a busy lifestyle. Spending unnecessary time at the cash counter of supermarkets and malls is inevitable. People may often forget about the products they need to purchase and at the end of shopping they need to spend time waiting behind queues at the cash counter. People may find it difficult to locate the exact product in a new shop or when shelfs are rearranged, they need to spend time running inside the malls to find the product. Sometimes the money they have will be insufficient, thus creates a lot of worries for the customer. The trolley while loading the products may feel heavy to move around the shops and search for the next product in the same time. The customer ay be unaware of increased product cost or the availability of a certain item. Every object will be having a bar code and while scanning the bar codes for billing people have to wait at the cash counter and pay the amount after scanning each products by the cashier, which creates queues and other customers should wait until the former customer finishes his/her payment.

To tackle all these problems, we have designed LINE FOLLOWER SMART CART USING RFID TECHNOLOGY which includes the mobile application, RFID tags and reader which is interfaced with the microcontroller. The proposed system also uses line follower technology where it uses ir proximity sensors. The smart trolley has a screen interfaced with the raspberry pi which shows the sorted list of products.

2. EXISTING SYSTEM

There are many existing and novel solutions for the stated problems. The currently available solution in shopping malls is the Barcode method in which there are barcode labels on every product which is browsed through barcode readers. All barcode readers contain decoder circuit which analyses the barcode's image data provided by the sensor and sending the barcode's content to the scanner's output port. When we choose any product for purchasing, we place it within the trolley and take it to the cashier. The cashier scans the product through the barcode scanner and offer the bill. But this becomes a slow method and lots of products is to be scanned, therefore creating the billing method slow and this results long queues. Although advances have been made in this area, developing and maintaining such applications is still a critical challenge and expensive. Thus, the barcode scanning method is seen in most of the shops and grocery centres.

3. PROPOSED SYSTEM

The proposed system solves the problems by integrating several technologies into a compact form. The proposed system includes a mobile application where the customer can select and list out the products they need to purchase from their home itself. While selecting the items customer can see the availability, cost and they can add the number of quantities required for each amount. The total amount will be seen in the application itself therefore they can change the list according to the cash they have in hand, or they can take the money with them. Thus, no need to worry about cash. While entering the shops when the customer links the trolley with the generated QR from the mobile application, the items will be sorted according to the shelf arrangement and the trolley moves automatically following the black lines drawn on the floor reading the RFID tags. Every product will be attached with a RFID tag, when the customer picks up each item the RFID reader senses the tags and the door of trolley will be opened and the products can slide in. The RFID reader reads the cost of each item which will be shown on the LCD screen interfaced with the reader and the microcontroller. Thus, at the billing counter the cashier can see the total amount and customer can directly pay the amount. After payment,

the cashier unlocks the door of the trolley and the customer can take away the products to their home

4. METHODOLOGY

4.1 RFID Technology

Radio Frequency Identification (RFID) is one of the most energizing advancements that advances the working practices by expanding efficiencies and improving benefits [1], [3]. It is frequently introduced as a replacement for the present standardized identifications such as barcodes), however the innovations have a lot more noteworthy prospects, for example, singular sequential number for each product. Electromagnetic and electrostatic coupling is used which uniquely identifies an object, an animal, or a person. It stores and remotely recovers information utilizing devices called RFID tags and transponder. RFID technology permits transmission of data with no contact and line of sight from a data medium, transponder to a reader and vice versa [2].

A basic RFID system consists of an antenna or coil, a transceiver with decoder and a transponder (RF tag) electronically programmed with unique information. There are two basic types of RFID tags; active tags and passive tags where the proposed system is using only passive tags. The passive tags operate without a separate external source and obtain operating power generated from the reader. Passive tags are comparatively much lighter than active tags, more affordable and offer a virtually unlimited lifetime.

Radio frequency identification uses tags, or labels attached to the products to be identified. The RFID reader which is a two-way device (transmitter and receivers), send a signal to the tag and read its response. The reader generally transmits their observation to a computer system running RFID or RFID middleware. The tags information is put away electronically in a nonvolatile memory such as microcontroller devices. The RFID tags incorporate a small RF transmitter and receiver. An RFID reader transmits an encoded radio signal to the RFID tag. The tag receives the message sent by the receiver and responds with its identification information.

4.2 Line Follower

Line follower is a robot that can follows a path or line. The path can be a black line on a white surface. The robot utilizes IR (infrared) proximity sensors to detect the path. Output of the sensors is an analog signal which relies upon the measure of light which is reflected. This analog signal is given to the comparator to create 0s and 1s which are then fed to the microcontroller [9]. The microcontroller chooses the position and movement of robot left or right direction. At the point when a sensor is on the dark line it peruses as 0 and when it is on the white surface it peruses as 1. At the point when the left sensor moves toward the white surface at that point right motor stops its movement while left motor keeps on moving so that right turn happens, and robot returns on the white line. Right sensor will turn out to be low as that sensor will confront the black line and the rest of the sensor's responses will be high for example the right wheel is held steady and the left wheel will move freely. At the point when the right sensor comes in white surface then the left motor stops its movement while right motor keeps on moving so that left turn happens and robot returns on white line. At the point when both the sensors are on dark line then robot pushes forward.

4.3 Other technologies used

In the proposed system, an image sharing technology is used to scan the QR code using a camera attached with the cart. The working of this technology is similar that off a barcode reader when every small black square and dots which is loaded with some information and using this image sharing takes place and the 2D information is read by the camera.

Languages such as Java, Python, C and C++ are used and softwares such as Android studio, Pycharm, Arduino IDE are used. VNC viewer [4], software used for the screen on the cart which relates to the raspberry pi. Android Studio is a large platform and all the details needed for the development of the mobile application is done in Android Studio [9].

5. WORKING OF SMART CART

Every customer will be having a smart phone in which they install the mobile application from the playstore or appstore. The mobile application namely "Easy and Access ", in which the user can select and create a list of products they need to buy according to their needs and amount of cash they have. The application also shows the items whether it is available in the market or not. The application will generate a QR code at the end while clicking the proceed option given in the application.

While the customer enters the shop, they can link the QR code which they have in their Smartphone, with the cart from the shop. The cart will be having a camera to scan the generated QR code. The camera is linked with the cart screen with the help of raspberry pi, so that the customer can see their list sorted in the screen.

The cart will move automatically while clicking the proceed or go option in the cart screen. The cart which self navigates using the line follower technology, where it senses the black lines using two IR proximity sensors. While encountering with the RFID tags placed on the black lines or the track drawn on the floor of the shop, the tags will be read by the RFID reader. The motor of the cart will be controlled using two microcontrollers where one of them is linked with the line follower technology and the other with the RFID technology. The reader will compare the information from the tag with the pre-programmed information in the microcontroller and if it is true the cart stops in the aisle. The tags are placed according to the nearby shelf. The customer picks up the product from the

shelf and the RFID tags attached with the product will be read by the RFID reader thus the door will be automatically opened, and the LCD screen will be displaying the product amount and the total amount at the same time. The microcontroller is used to interface both the LCD screen and the door to open automatically when the tag is sensed. The cart will move to the next location and so on.

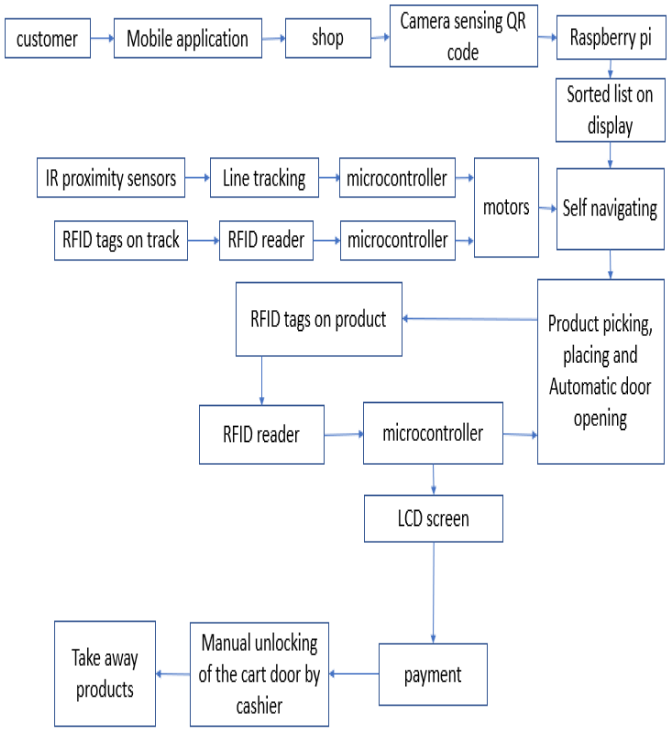

Fig -1: Block diagram

After purchasing all the products required, the customer will head toward the billing section or cash counter. At the cash counter, the cashier settles the payment by checking the LCD screen. After the payment the cashier unlocks another door of the cart to open and take away the products.

6. EXPERIMENTAL SETUP

The mobile application is developed in the Android studio platform which can list the products and generates the QR code at the end of selection as shown in Fig.2. The cart is successfully tested with RFID tags. The Fig.3 shows the cart which is on the track having the RFID coils attached with the track. The payment section of the whole system is developed which is successfully tested with RFID tags as shown in Fig.4. The prototype shows the accurate results for all the test cases.

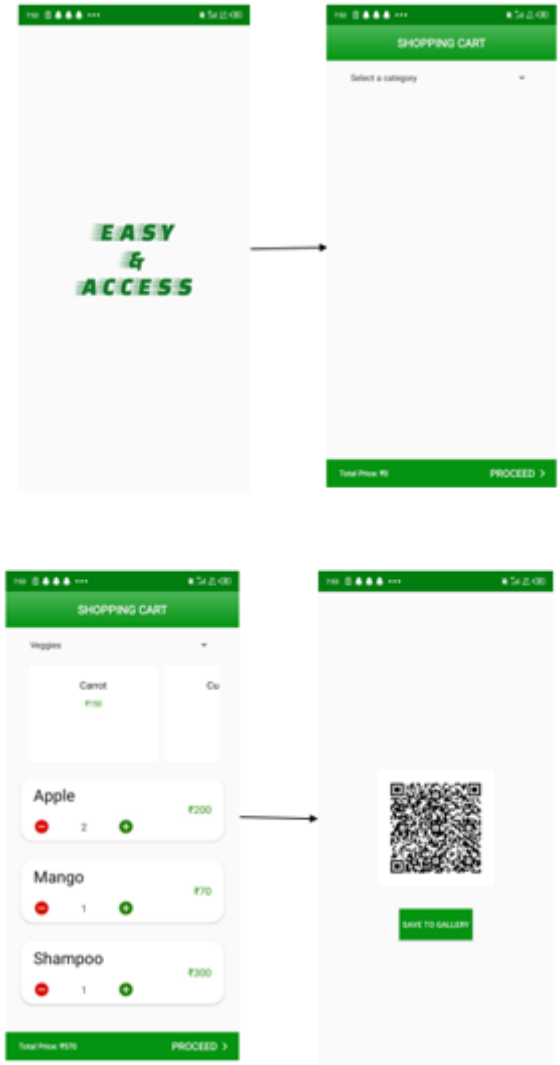

Fig -2: Selection and listing of required items in the mobile application.

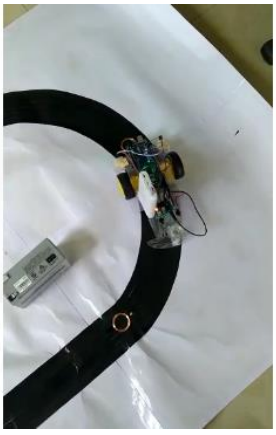

Fig -3: The cart reads the RFID tags placed on the track.

Fig -4: Each product is scanned, item's cost and total amount is displayed on the LCD screen.

7. CONCLUSION AND FUTURE WORK

Experiences with Smart Shopping has shown that there are many technical challenges that can be met in deploying a retail system. In the consumer market, as the technologies which capture the information about the interactions and details between the physical products, are very expensive and are not mature enough to be used in a consumer market. A few endeavours to make principles are in progress however are still at any rate years away. In spite of the fact that in the relatively controlled environment of the smart shopping cart project it has been possible to address this problem on a wireless basis, it is difficult to envision a circumstance where retail administrations can work without such principles. One of the issues is that new frameworks must be composed in existing retail foundations, which regularly work utilizing inconsistent frameworks. In addition, the arrangement of retail causes enough development in electronic exchange loads which current frameworks can't adapt to. In spite of the fact that advances have been made here, creating and keeping up such applications is as yet a basic challenge.

The proposed system will diminish the customer's time in searching and finding the location of the product and reduces long queues at the cash counter with minimum cost for installation of the system in shops and grocery centres. The proposed system which uses a self-navigation technology where the customer need not apply pressure to move the cart. Also, the customer will be aware about the amount they have to pay for the products from their house itself. The customer simply needs to type the name of the product he/she needs to buy on the mobile application. The cart will automatically manage them to the specific area of the rack where the item is placed.

ACKNOWLEDGEMENT

We would like to express our gratefulness to our project supervisor Ms. Vandana P who has always been there to guide us in carrying out this project. She has always supported us with her educative guidance and her readiness to help us at any times has been a great source of motivation for us. We would also like to give our sincere thanks to Dr. Shalu George and all other faculty members who have been a great hand of help without whom it would have been difficult to complete our project work. Also articles, journals and books from online and offline sources helped us a lot in carrying out our project work. At last it would have never been possible to concentrate and work on this project without the blessings of our parents and the Almighty.

REFERENCES

[1] Vaishali Rane, Krutik Shah, Kaushal Vyas, Sahil Shah, Nishant Upadhyay." Smart Trolley Using RFID," International Research Journal of Engineering and Technology (IRJET), vol. 06, Jan. 2019.

[2] P. Seema, M. Shalini, R. Sindhu," SMART SHOPPING TROLLEY USING RFID," International Journal of Pure and Applied Mathematics (IJPAM), vol. 118, 2018.

[3] Prem Kumar G., Bangre Sushruth B., Kavya M., Varun M., Anupama R., "Smart-Cart for Smart-Cities," 2018 Second International Conference on Advances in Electronics, Computers and Communications *(ICAECC)*, Bangalore, 2018, pp. 1-5.

[4] A. Omer, "Raspberry pi as a Video Server," 2018 International Conference on Computer, Control, Electrical, and Electronics Engineering (ICCCEEE), Khartoum, 2018, pp. 1-4.

[5] Rachana Doshi, Amrita Sutar, Sonali Aher, Sanvida Dalvi, "RFID Based Smart Trolley for Automatic Billing System," International Journal of Engineering Science and Computing IJESC, vol-11, 2017.

[6] J. C. N. Swamy D. Seshachalam and S. U. Shariff "Smart RFID based Interactive Kiosk cart using wireless sensor node" 2016 International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS), pp. 459-464, 2016.

[7] Rupali Sawant, Kripa Krishnan, Shweta Bhokre and Priyanka Bhosale "The RFID Based Smart Shopping Cart" International Journal of Engineering Research and General Science, vol. 3 no. 2, March-April 2015.

[8] K. M. Hasan, Abdullah-Al-Nahid and A. Al Mamun, "Implementation of autonomous line follower robot," 2012 International Conference on Informatics, Electronics & Vision (ICIEV), Dhaka, 2012, pp. 865-869.

[9] S. Y. Fiawoo and R. A. Sowah, "Design and development of an Android application to process and display summarised corporate data," 2012 IEEE 4th International Conference on Adaptive Science & Technology (ICAST), Kumasi, 2012, pp. 86-91.