SMART SHOPPING TROLLEY AND STOCK MANAGEMENT SYSTEM

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Abstract

The advancement of technology has changed people in shopping over the years. The retailers are continuously working to improve the ease of shopping for the customers by providing them item level informationduring purchase to promote their business. Nowadays super markets come up with a RFID based shopping basket where price of each item is tagged using UHF RFID whichprovides accuracyof the readings. The proposed smart trolley in this paper evaluate the ability to integrate all components (reader + antennas + user interface) to the shopping cart itself at a lower cost and communicate through low-power Bluetooth (only uses 1/4 of power in contrast to Zigbee, hence increase battery life for the same cost) with kiosk. The shopping items are tagged using UHF RFID tags with unique identification codes. The shopping trolley is installed with a self-checkout system which aims in designing and implementing UHF RFID based smart trolley which can track products stock and provide item level information to consumers in real time as well as to the distributor for purchase order if item count becomes zero.

Index terms: Microcontroller,Arduino mega, LPC2148-Zigbee pair, RFID module, LCD Display, Graphical LCD, GPRS Module, Bluetooth Module.

I.INTRODUCTION

people used to have a list of items written in a piece of paper when they went shopping for groceries; however, the advancement of technology has changed how people do shopping over the last decade. In addition, the emergence of smart phone has changed the retail shopping experience drastically. The retailers are continuously working on improving the shopping experience to make sure their customers are satisfied in overall shopping experience. There have been various attempts which were carried out in the past to eliminate lengthy shopping lines in retail stores. One of the famous approaches is the introduction of self-checkouts where customer convenience has been improved drastically. Self-check outs have been popular since then due to low overhead cost; however, the shoplifting and lower operating efficiencies are considered as major drawbacks in the retail environment. The selection of a single technology that can be used to enhance shopping experience is a difficult task as the expectation in a brand clothing store to grocery store can be quite different, and can also depend on individual perception. In addition, it was found that the consumers prefer to have item level information to make purchase decisions. Moreover, demands for visual technology and privacy have a greater influence in consumer satisfaction. Therefore, it is important to identify ways to improve shopping experience while the factors such as return on investment, expected sales growth and meeting customer expectations are also considered.

II.RELATED WORK

Many shopping applications have researched since smart shopping trolley plays a major role in supermarket to develop automatic monitor system and it is implemented for monitoring product in storage place.There have been three major attempts, where shopping trolley was used as the medium to improve shopping experience.In 2005, Fujitsu, a Japanese company has demonstrated a shopping trolley with an inbuilt barcode scanner. The barcode

scanner was used to scan both products and loyalty cards in real time.Amazon has recently come up with a smart retail store concept "AmazonGo" where the customer picks a product from the product gets tracked and self-checked[6].Amazon Go is a chain of convenience stores in the United States operated by the online retailer Amazon, with four locations in Seattle, Washington and Chicago, Illinois, and two in San Francisco, California as of January 2019[1]. The AmazonGo system uses image processing, neural networks and deep learning algorithms to forecast which item is picked by the consumers. The system accuracy largely depends on consumers historical purchased patterns. AmazonGo also uses sensor fusion techniques to process multiple images taken from cameras around the retail store to predict best estimate of an item picked by the consumer in real time.Finally, Panasonic, another Japanese company has come up with a RFID based shopping basket where each item is tagged using UHF RFID (ranging from 916-924MHz). Panasonic has revealed that this smart basket is part of "cashier free convenient store concept" where customers can drop items into the basket and each product gets scanned through a self-serving kiosk[8].

II. SYSTEM COMPONENTS

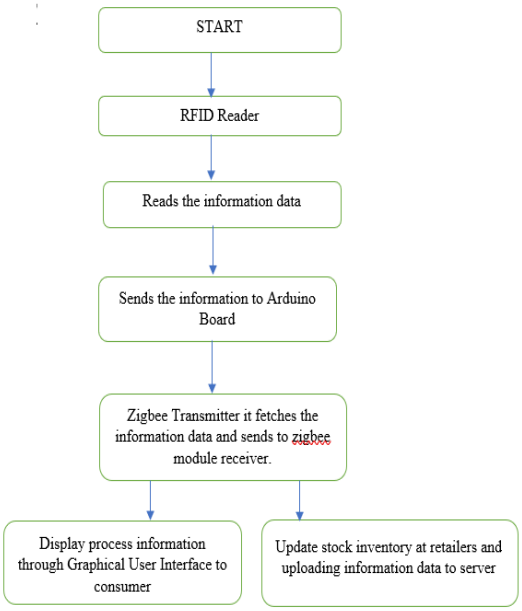

Fig.1 Process flow chart of the system

RFID READER

RFID tag is a small device which stores and sends data to RFID reader. They are categorized in two types – active tag and passive tag. Active tags are those which contain an internal battery and do not require power from the reader. Typically, active tags have a longer distance range than passive tags. Passive tags are smaller and lighter in size than the active tags. They do not contain an internal battery and thus depend on RFID reader for operating power and certainly have a low range limited up to few meters.

The passive tags are available in different shapes and sizes. The identity of an RFID tag, RFID reader sends radio signals which is captured by the coil (working as antenna) for the tag. The coil receives these signals as alternating current and passes to the chip. The chip extracts both the power and the information from this alternating current. By communicating with the non-volatile memory of the chip that stores unique id as well as other information, it sends back the required signal to the antenna which is then transmitted to the RFID reader.

ZIGBEE MODULE

Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network.The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs).

Its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics.[1] Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones.

BLUETOOTH

An obvious solution was to get rid of the cables and use short-range, wireless, inexpensive and universally adopted by device vendors to facilitate on-demand connectivity among devices. The marvel of engineering gave us the freedom of exchanging data without using yards of wires and popularly known as Bluetooth. Bluetooth is a wireless technology standard for

connecting fixed or mobile devices using short radio link. It aims at providing wireless communication along with small size, minimal power consumption and low price. The technology was designed to be simple, and the target was to have it become standard in wireless connectivity.

RFID FREQUENCY

UHF RFID tags typically works at 860-960MHz without exception surroundings as itaccepts UHF bands. Strikingly, for Australian maxims, the RFID field is 918-926MHz at 1W EIRP (Equivalent Isotopically Radiated Power) or 920-926MHz at 4W EIRP.

III.SYSTEM DEVOLOPMENT

In secured smart shopping system barcodes are continuous black bars which contain some useful information and that information could be read by a scanner. As we all know that RFID stands for radio frequency identification, it uses radio waves to interact between an item and a system.

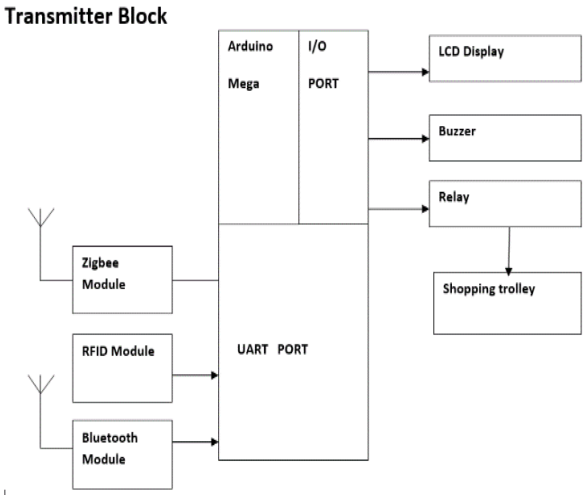

Fig.2 Block Diagram of transmitter of SecuredSmart Shopping System

Robot Control:

Fig.2 Block Diagram of robot controller on the server side

In the aboveblock diagram of fig 2 and 3 the two controllers are used for monitoring the product purchasing and product quantity checking updated information to store server and also bill payment.When transmitter side detects RFID tag of particular product and detects through RFID reader immediately it stores the data and sends to receiver through ZigBee module and product data to Bluetooth module and GPRS module.[11]

SYSTEM REQUIREMENT

Software Requirement:

- Language-Embedded 'C'
- Compiler- Arduino, KEIL

Hardware Requirement:

- Microcontroller Arduino mega-1,LPC2148-1
- Zigbee pair -1
- Buzzer-1
- RFID module-1
- LCD Display -1
- Graphical lcd-1
- GPRS Module-1
- Bluetooth Module-1

Receiver Block:

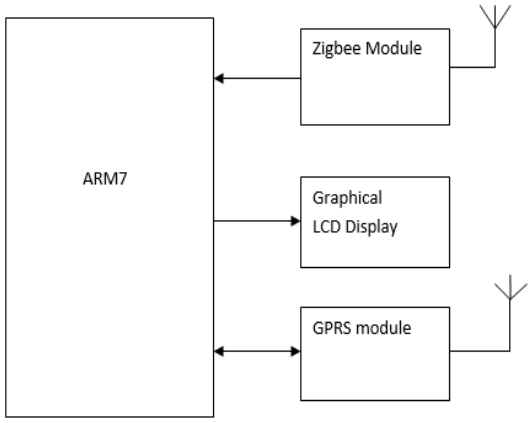

Fig.4Block Diagram of receiver of Secured Smart Shopping System

In our smart shopping framework, we are replacing RFID rather than scanner tag in light of the fact that RFID has more points of interest over standardized identification which are recorded previously.

- Barcodes needs sightline however RFID does not require sightline. If there should

arise an occurrence of a framework which has standardized tag and if a thing must be perused/examined, the thing and the scanner must be set specifically before one another or else the scanner tag won't filter the thing legitimately. Be that as it may, if there should be an occurrence of RFID it's not the equivalent. Here the RFID per user and the thing need not be in sightline in light of the fact that they utilize radio waves to speak with one another.

- Barcodes must be perused yet RFID can be both perused/compose. Standardized identification arrangement of shopping prompts bunches of perplexity in light of the fact that scanner tags must be perused and they can't be revised. For instance, if in a store, and if there is a markdown deal going on and if the store worker has neglected to apply the rebate for a specific thing then he can't have any significant bearing the rebate for the thing indeed in light of the fact that standardized tags can't be changed/altered as required. In any case, if there should be an occurrence of RFID, the labels can we changed/altered as required.
- Barcodes are not tough but rather RFID are sturdy. In the event that any data must be composed on a scanner tag, it must be imprinted on paper marks which are not extremely solid and can be effectively harmed because of cruel climatic conditions and won't give legitimate outcomes or else they are disjointed. In any case, if there should be an occurrence of RFID, they are normally secured by a hard case so they can withstand heat and unforgiving climatic conditions. In view of this present RFID's are progressively tough when contrasted with standardized tags.
- Barcode does not encode information but rather RFID can scramble the information. Standardized tags can without much of a stretch be hacked and any outsider client can undoubtedly peruse the information on the grounds that the information is constantly intelligible in scanner tag. Be that as it may, if there should arise an occurrence of RFID, the data is secure in light of the fact that the data is in an encoded structure and it can't be effectively perused.
- Barcode can contain/store constrained measure of data though RFID labels can contain and store information in colossal sums.
- Barcode can filter/read just a single tag at one time yet RFID can check/read up to 40 labels without a moment's delay.
- When product stock is decreased the product, quantity indicates low and immediately it sends the stocks information to distributors.
- It can be further concluded that the suitable tag developmentwhich has a ground plane, and two optimized CP antennas with correct tuning of RSSI filtering can lead to high accuracy tag detection inside the trolley environment in real-life scenario.

IV.METHODOLOGY

1) REGISTRATION:

When the user wishes to shop in our system, first he has to login in to our system. If he is a new user then he has to first register with the system and then he is allowed for shopping. The user has to register by giving details like name, mobile number, email-ID and a password where all the fields are validated and password is encrypted and all these data is stored in the database.

2) LOGIN:

After the user registers for the system, he can log into the system by entering his/her email-ID and password. The system now will validate the email-ID and password and logs the user into the system.

3) POST LOGIN:

After the user has registered and logged in to the system, the system requests the user to scan his user card which would be given to him at the time of check in.As soon as the user scans his card, the system will be navigated to the menu page, where the menu page contains options like this-

- ✓ Add item to the cart.
- ✓ Remove item from the cart.
- ✓ Display the bill.
- ✓ Pay and Checkout.
- ✓ Exit.

i) Add item to the cart: When user wants to shop and add items to the cart, he can select this option. As soon as the user selects this option, the system tells the user to scan the item which he/she wants to shop and add it into the cart. After the user scans his item which is equipped with RFID tags/cards, the system tells the user that the item is added/updated to his cart. The

system gives the user an option to wish to add more items to his cart or not. The user can choose any of the options and proceed further for billing.[9]

ii)Remove item from the cart: The user after shopping his items can also wish to remove the items from the cart by selecting this option. The system tells the user to scan the item which he wants to remove. If proper item which he wants to remove is scanned and if that item is found in the cart then the system pops up with a message saying that the item is removed from your cart. If that item is not found in the cart, the system pops up with a message saying that the item is not found in your cart. Later the user can choose any of the options and proceed for billing.

iii)Display the bill: The user wishes to see his/her bill at any time of shopping by selecting this option. The bill contains item id, item name, quantity, price, total number of items and the total amount that the user has to pay at the time of checkout.

iv) Pay and Checkout: The user after seeing the bill can select this option number 4 for paying the bill amount. The system asks user to enter the amount that he has to pay, if he pays the entire amount then he can check out.

v)Exit: The user after seeing his/her bill and paying the entire amount can exit from the shopping system by choosing option number 5.

V. EXPERIMENTAL RESULTS

The system was evaluated on a real-time basis.Numerous information about the users were asked to log in. The results is based on stock monitoring product so the physical fault does not occur so computerized system monitors the real time live stock monitoring system.

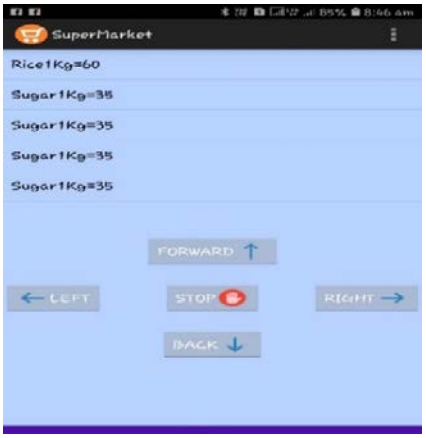

Fig.5 Analysis of Quantity and Quality products and controlling of trolley movements

Operation done successfully

ID	productname	productid	productcount	notification	UTIME
1	100	111	123	OK_ROL	2018-01-23 07:48:25
2					2018-03-05 06:01:26
3		10			2018-03-05 06:01:31
4	suagr	10			2018-03-05 06:06:39
5	sugar	10			2018-03-05 06:07:30
6	100	111	123	OK_ROL	2018-03-05 06:12:26
7	100	111	123	less	2018-03-05 06:34:13
8	sugar	111	1	less	2018-03-05 06:34:45
9	sugar	111	1	less	2018-03-10 11:42:56
10					2018-03-10 11:43:59
11					2018-03-10 11:44:08
12					2018-03-10 11:44:41
13	100	111	123	OK_ROL	2018-03-10 11:47:39
14	sugar	111	1	less	2018-03-10 11:49:34
15	sugar	111	1	more	2018-03-10 11:49:51
16	sugar	111	1	more	2018-03-10 11:49:56
17	Monitor	1	1	Kit_Start	2018-03-14 05:53:00
18	Monitor	1	1	Kit_Start	2018-03-14 05:55:29
19					2018-03-14 05:55:31
20	Sugar	IR1234	1	less	2018-03-14 05:56:59
21	Monitor	1	1	Kit_Start	2018-03-14 05:58:29
22	Rice	CR1234	1	less	2018-03-14 05:59:14
23	Monitor	1	1	Kit_Start	2018-03-14 06:00:38
24	Monitor	1	1	Kit_Start	2018-03-15 10:46:35
25	Monitor	1	1	Kit_Start	2018-03-15 10:48:57
26	Sugar	IR1234	1	less	2018-03-15 10:52:34
27	Monitor	1	1	Kit_Start	2018-03-16 10:46:08
28	Sugar	IR1234	1	less	2018-03-16 10:49:09
29					2018-03-16 10:49:11
30	Monitor	1	1	Kit_Start	2018-04-10 13:05:17
31	Rice	CR1234	1	less	2018-04-10 13:06:55
32	Rice	CR1234	1	less	2018-04-10 13:08:23
33	Monitor	1	1	Kit_Start	2018-04-10 13:11:03
34	Monitor	1	1	Kit_Start	2018-04-10 13:13:39
35	Monitor	1	1	Kit_Start	2018-04-17 12:50:45
36	Sugar	IR1234	1	less	2018-04-17 12:52:32
37	%s	%s	%s	%s	2019-02-14 14:20:50
38	Monitor	1	1	Kit_Start	2019-02-14 14:21:53
39	Monitor	1	1	Kit_Start	2019-02-14 14:23:55
40	Monitor	1	1	Kit_Start	2019-02-14 14:26:53
41	Monitor	1	1	Kit_Start	2019-02-14 14:28:42
42	Sugar	IR1234	1	less	2019-02-14 14:29:38
43	Monitor	1	1	Kit_Start	2019-02-15 09:47:54
44	Sugar	IR1234	1	less	2019-02-15 09:49:32
45	Monitor	1	1	Kit_Start	2019-03-08 10:06:24
46	Sugar	IR1234	1	less	2019-03-08 10:08:34
47					2019-03-12 06:25:03
48	Monitor	1	1	Kit_Start	2019-03-12 06:35:45
49	Sugar	IR1234	1	less	2019-03-12 06:37:36

Fig.5 Stock inventory management

Fig.5 and 6 shows the analysis and stock managementof the proposed model and moving the trolley using android application when it is used in a wireless environment.

VI. CONCLUSION

The following sensible advance for remote systems, by putting Radio Frequency in each possible question made by organizations and governments.The items canbe detected irrespective of its tag orientation, size and shape.These were the drawbacks addressed in previous shoppingtrolley applications which were overcome in this application.The development of antenna and hybrid coupler is based onthe original work which has been carried out by MonashMicrowave, Antennas, RFID and Sensor laboratories. Finally,this particular application may bring novel experience forshoppers when they benefit from coordinated collaborationamong technologies.Thus, shoppers will have the capacity toencounter a scope of new portable associated gadgets more qualified for variable innovation applications.[10]

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