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Intelligent Trolley

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Abstract:
Purchasing and shopping at big malls is becoming daily activity in metro cities. There is a huge rush in such places during weekends and holidays. People purchase different items and put them in trolley. After completion of purchases, one needs to go to billing counter for payments. At the billing counter the cashier prepares the bill using bar code reader which is very time-consuming process and results in a long queue at the billing counter. I-Trolley is a product that aids the comfort, convenience and efficiency in everyday life. The key idea here is to assist a person in everyday shopping in terms of reduced time spent while purchasing a product. A trolley that will follow the customer and reduce the pain of pushing it.

Keywords: I-Trolley, Automated Billing System, Human Following, MFRC522 RFID, Ultrasonic Beacon, ESP 8266 WIFI Module.

I. INTRODUCTION

At present, many supermarkets still adopt traditional shopping mode and bar code scanning, which is a waste of manpower and material resources. Also, long wait in the queues for transactions and the tiresome pushing of shopping cart, all make customers suffer a lot and may cause customer volume go down. Consequently, there is a need to reduce queuing time for customers to check-out and to free people from the tedious job of pushing the shopping carts is an issue to tackle. We are implementing an intelligent trolley that will keep a track of your budget and display it on an LCD display. I-trolley will automatically generate a list of products in the trolley and this list will be sent to the mobile. It will also follow the user and the problem of pushing your own cart will be solved.

II. LITERATURE SURVEY

While going through various research papers we found various approaches for smart shopping cart with certain disadvantages and shortcomings.

AUTOMATIC BILLING SYSTEM USING LIFI
Zubin Thomas, Nikil Kumar and D. Jyothi Preshiya [1] proposed a model in which each and every product is having LIFI transmitter and it store the encoded data similar to the product id, cost of product and quantity. Here the mobile is integrated with LIFI receiver via OTG communication in the shopping cart. It can read the commodities information when the LIFI transmitter holding goods are chosen by the customers, each information of the goods can be entered by using the mobile LIFI and when the product is kept into the trolley, which also contains the LIFI module, double check the product identity. After completing the purchase, the payment is processed in mobile itself via mobile banking system.

Disadvantage: It is not possible to equip LIFI module on each product and consume more power. It also requires line of sight.

PERSON FOLLOWING SHOPPING CART ROBOT
Soh Nishimura, Hiroshi Takemura, Hiroshi Mizoguchi [3] proposed a system which uses image processing for tracking the customer.

Disadvantage: Image processing requires high performance processor and high capacity battery. Therefore, it is not suitable for embedded system that has limited resources. Also, it is hard to distinguish between different users in one location.

AUTOMATIC BARCODE BILL CALCULATION BY USING SMART TROLLEY
R. Rajeshkumar, R. Mohanraj, M. Varatharaj UG Scholar, Assistant Professor [8], used Barcode scanners for scanning and generating the list of products in the shopping cart.

Disadvantage: It requires line of sight. Barcode scanners are costly.

III. PROPOSED METHODOLOGY

A. SMART BILLING SYSTEM USING RFID
Radio Frequency Identification (RFID) is becoming preferable technology as an alternative to barcode systems. RFID systems provide an automatic identification method, relying on storing and remotely retrieving data using RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product, animal or person for the purpose of identification using radio waves. Chip-based RFID tags contain silicon chips and antennae. In this paper, we have developed a smart shopping cart system that allows customers to manage their shopping list while shopping and only pay the bill at the checkout counter. The shopping cart has the ability to calculate automatically and display the total prices of all the products inside it. This makes it easy for the customer to know how much he or she has to pay while shopping and not at the checkout counter. This way the customer can receive faster service at the checkout. The advantage for the shop owners is that they would need less cashiers which would result in a large cut in their costs.

B. HUMAN FOLLOWING USING ULTRASONIC SENSOR
We need to build an ultrasonic transmitter module for the user and a pair of receiver modules which will be placed on the trolley. The transmitter will transmit the signal and the receiver modules will detect the signal and would provide us with the direction and distance at which the transmitter is

positioned. This will provide us with a proper human following trolley. The process can be further improved by using a HC-05 Bluetooth module for unique identification of a particular customer.

IV. ACTUAL PROCESS

A. Budget Tracking using RFID

The budget tracking system includes a RFID reader placed at the top of the shopping cart. Each product in the shopping mall will have a passive RFID tag on it which will allow the customer to scan the products at the time of shopping. We have an LCD display which gives us the real time list of the products purchased along with its quantity and cost.This allows the user to keep the track of the total cost at the time of shopping which improves the shopping experience. The components used for this process are MFRC522 RFID reader, Arduino UNO, 20X4 LCD Display, ESP8266 Wi-Fi Module and a Buzzer.

An example for the tabular format of the bill is as shown in the below image:

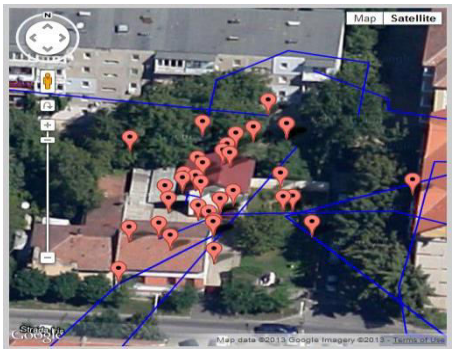
NAME	QTY	COST
PEN	4	50
BOOK	10	60
SOAP	4	25
TOTAL : ₹ 2550		

The final circuitry will be developed once all the errors are eliminated during the testing times.

B. Human Following Method

The first method which can be thought of for implementing Human Following is GPS method. A global localization method using GPS. The PROs are that we can place a GPS module on the trolley and the user can have a mobile phone with its own GPS module. The phone can establish a connection to the robot using Bluetooth and send the user coordinates periodically. Then the robot can calculate the path it needs to run, to get in close proximity of the user, and follow him/her. But, the CONs are bad: first, the GPS errors are too big to allow us to make the robot follow the user; it would rather jump like a crazy monkey all around the user, and this is the best scenario. Another issue is also the GPS signal which is poor.

If we place a stationary GPS receiver, here's how the GPS coordinates look like:



The local method will use a closed system for localization, formed of only the robot itself, the user, and a signaling beacon. Normally the user will carry a signaling beacon (ultrasonic, infrared, radio, etc.), which the robot will "see" and follow. As we need a smooth robot movement, so a lot of error compensation and fuzzy logic must be involved. The user needs to carry this tiny, low power ultrasonic beacon which the robot should be able to "hear" and use the signal to navigate to the target, and follow it. These modules will not only return a signal when ultrasounds are detected but the output amplitude is directly proportional with the actual distance to the beacon. So, we'll know both where the beacon is, and how far. Given these tools, there are several ways of implementing the working mechanism:

Using a single ultrasonic receiver placed in front of the Trolley:

The trolley will need to rotate until it detects a maximum level of signal. Then it should move forward until the detected signal reaches a given threshold (so it will not hit the user, but stop right before him/her.

a) Similar to method 'a', but use a servo motor to rotate the ultrasonic sensor instead of rotating the entire trolley.

When the maximum signal is detected, the robot should turn towards the source, and begin moving forward. It still doesn't solve many of the issues found with method 'a'.

b) Using two ultrasonic receivers, placed some space apart, in the frontal part of the trolley.

Now we can make differential measurements, so it's easy to know from which part is the signal coming from, as the corresponding sensor will have higher readings. The trolley can now directly turn towards the beacon, and follow the forward direction while the two sensors give approximately similar readings. If the right sensor output increases, then it means the trolley needs to turn right, to face the beacon and continue moving forward. Same case for left.

c)using more than two sensors, ideally 8, placed at 45 degrees in a radial disposition.

This would pinpoint the source more accurately, and reduce the time needed to find the beacon.The ultrasonic sensors already return an output signal which is a function of the distance to the beacon / user. This can be used to measure the distance. If greater accuracy is required, we can involve infraredlight in the process:

– the beacon sends a set of 38KHz modulated Infrared pulsesmarking moment of time t0
– the beacon immediately sends out the ultrasonic pulses
– the receiver which is a few meters from the beacon, receives the infrared pulses practically instantaneously and knows the time is t0 (using a TSOPXX38)
– the receiver registers the incoming ultrasonic pulses at the time t1, where t1>t0. By using the speed of sound in air, we can get the exact distance to the beacon.
All in one we use light to signal the start for counting, and we stop when the ultrasonic waves reach the destination.

V. ADVANTAGES OVER EXISTING METHODS

*We have proposed a system in which we will use RFID scanners for product detection in the cart and generate the list in the mobile.
*We are using passive RFID tags which do not consume any energy.
*It is cheap as compared to all the ideas proposed in the above papers.

VI. CONCLUSION

In this paper we implemented a smart, efficient, productive, safer and low cost RFID system in shopping malls for budget tracking at real time. The human following makes it even a better experience since the tiresome job of pushing your own trolley is eliminated. The system is capable to eliminate the hassle in the present shopping system. Our system is potent and capable of removing shopping woes in the current system and provides the best possible shopping experience. It is our belief that the model shopping system proposed will become one of the most promising technology in future generation.

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