

Automation of Shopping Malls using Intelligent Shopping Cart

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Abstract - Nowadays, shopping carts have become an indispensable part of shopping. The customers have to pull cart from rack to rack to collect the items and at the same time they have to calculate the cumulative price and compare it with their budget. After this procedure, they have to wait in line for billing. So, to avoid the above-mentioned inconveniences, we present a new concept, the INTELLIGENT SHOPPING CART. In this modern day and age, we introduce a completely automated shopping system which works toward the automation of malls [1]. The cart follows the customer while he/she is purchasing items, all the while maintaining safe distance from the customer. The RFID reader embedded in the cart scans the unique tag of each set of items and corresponding data regarding the product and the total amount payable are displayed. Automated billing system provides the total bill amount. Thus, the rush at the billing section is significantly reduced. In this project, we use infrared transmitter and receivers to follow the customer. The Intelligent Shopping Cart is reliable, effective, inexpensive and above all, user friendly.

Key Words: RFID, Arduino Uno, Tracking Unit, Billing Unit, Ultrasound Transceiver, Motor Driver etc.

1. INTRODUCTION

The past decade has seen an explosion in advancements in science and technology. Utilizing the same to ease day to day life activities of humans has been the latest paradigm and new research is seeing the light of day in this regard. Scientists are looking for ways to simplify the lifestyle of humans. Shopping centers or malls form a great source of convenience to consumers, since all the products of varying choices are found under one roof. A lot of research is also being carried out in the retail sector, to make shopping a more memorable experience. This would not only help consumers but also improvise the economic inflow of such shops as well.

Nowadays, shopping carts are essential for purchasing items. Every time customer has to pull the trolley from rack to rack for collecting items and at the same time has to do calculation of those items and need to compare it with his budget in pocket. After this procedure, customer has to wait in queue for billing. So, to avoid the difficulties like pulling trolley, waiting in billing queue and thinking about budget we are introducing a new concept called Intelligent Shopping Cart.

In this modern era, for automation of malls we are developing a microcontroller based cart which is totally automatic. Microcontroller based design has acquired the status of most happening field in electronics. This is a highly-specialized field that has the power of integrating thousands of transistors on a single silicon chip. The cart follows the customer while purchasing items and maintains safe distance between customer and itself [2]. The RFID reader reads the tag corresponding to each product and the corresponding data regarding product will be displayed on display. By using this cart, customer can buy large number of products in less time with minimum effort

2. PRINCIPLE AND BLOCK DIAGRAM

The project consists mainly of two parts namely the follower unit and billing unit. The follower unit consist of infrared transmitter, infrared receivers, microcontroller, motor driver and two DC motors. The billing unit consist of a microcontroller, RFID reader and LCD display.

2.1 Following Unit

The IR transmitter given to the user emits infrared radiations. These are received by the three IR receivers placed at the front of the cart. When the user moves forward the center receiver starts reception and a high signal is sent to the microcontroller.

The microcontroller on reception of this signal checks for the safe distance condition and drives both motors in forward direction if condition satisfies. If the distance is less than the safe distance both motors are held stall. As the user moves left the left receiver starts reception and output a high signal to microcontroller. The microcontroller now gives more drive to the right motor thus turning the cart left. Now when user moves right, the right receiver starts reception and output a high signal to microcontroller. The microcontroller gives more drive to the left motor thus turning the cart left. This dynamic process continues in a loop and the cart follows the customer all the while maintaining a safe distance.

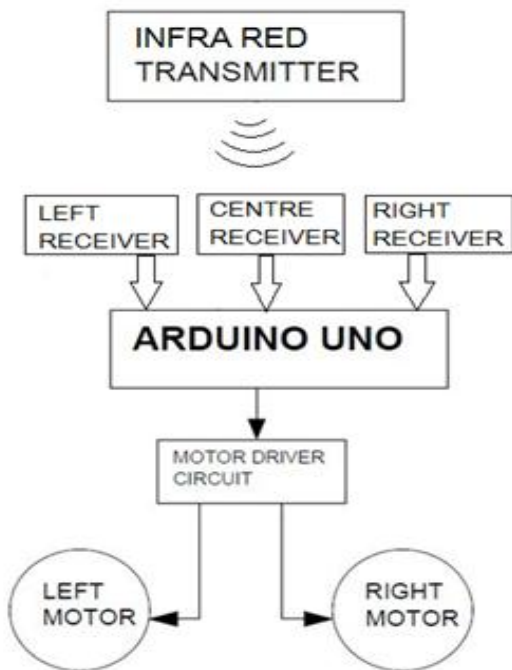


Fig -1: Block diagram of Following unit.

2.2 Billing Unit

The RFID reader placed on the cart reads each RFID tag which corresponds to unique products being purchased. The reader receives a 12-digit alphanumeric code from each tag being read and transmit the same to microcontroller via the serial pins. The microcontroller compares this data with the data in stored database and output the product details and the cumulative sum of purchase to the LCD display. Thus the user can have a comparison of his budget.

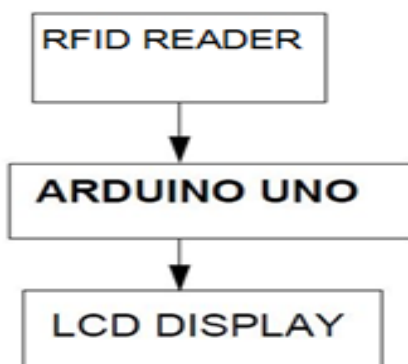


Fig -2: Block diagram of Billing unit.

3. CIRCUIT AND WORKING

3.1 Following Unit

The user following part of the Intelligent shopping cart consists of IR Transceivers, Ultrasonic sensor and motor driver unit [3]. IR transmitter is given to the user or else it would be provided as a wearable to user. The transmitter continuously transmits the IR radiations in a straight direction. IR receivers fixed to each side and center of the cart receives the IR signal from the transmitter (user). The receivers are fixed such that only one receiver receives a high signal from the transmitter and no condition arise where no receivers are activated. The three receivers fixed to the cart will give corresponding states to the microcontroller every time as the user changes his direction. The Arduino board for motor controlling is programmed to drive two motors of the shopping cart separately on account of the user motion and direction. For example, if user changes his direction to left, the left receiver of the cart will be activated and the microcontroller sends a high signal to the enable pin of right motor and deactivate the enable pin of left motor thus moving the cart to left. Apart from the following part using IR, an Ultrasonic sensor is provided at the front of cart to maintain a safe distance between the user and the cart. Irrespective of the user position the motors will be stalled when the distance between user and cart falls below a predetermined value.

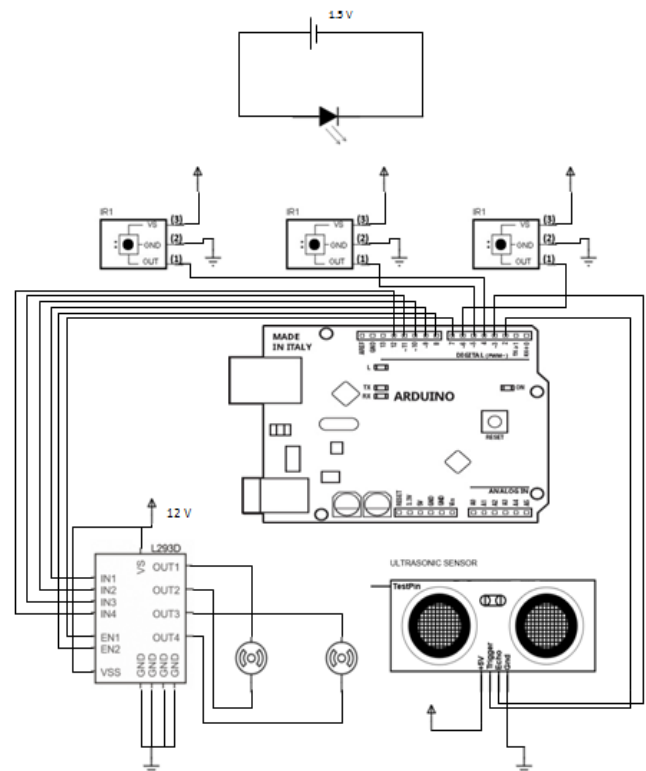


Fig -3: Circuit diagram of Following unit.

3.2 Billing Unit

The billing unit mainly consist of a microcontroller, LCD display and a RFID reader. RFID tags are provided with each product in the mall [4]. The RFID reader emits electromagnetic radiations and when the tag comes in the vicinity of the reader (swiping or dropping), an emf will be induced in the coil inside the tag. This activates the microchip embedded inside the tag. The microchip sends a 12-digit alphanumeric code to the reader. The RFID reader receives the code and transmit it serially to the microcontroller via the serial transmission pin. The microcontroller upon receiving the data compare it with the codes already stored in its database in the form of arrays. When a match is found, the corresponding product is identified and its details including cost and specifications are displayed on the LCD display along with the total cost of purchase. The total cost gets incremented as we purchase the products and this helps to keep an eye on the budget of purchase.

computer through any wireless transmission medium and automated inventory management can be accomplished with the same. The major constraint will be to build a cart that suits different mall structures. In spite of this intelligent carts have a great future in this technological era.

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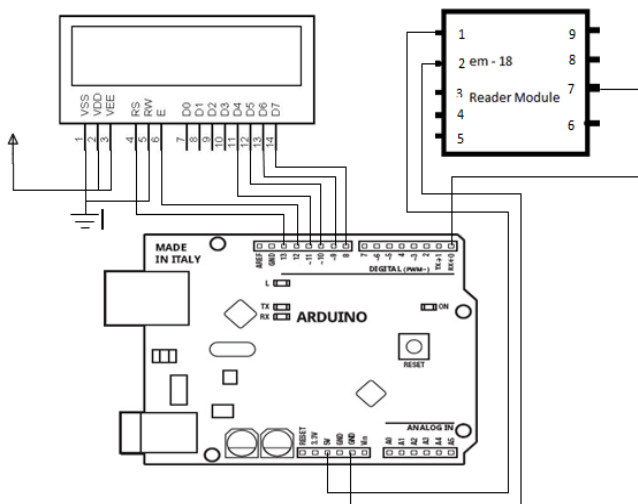


Fig -4: Circuit diagram of Billing unit.

4. CONCLUSIONS

Intelligent shopping cart proves to be user friendly, time saving and economic. As the proverb says 'Time and Tide waits for no one' the intention of the project was to reduce the effort and time spent on shopping and to make it a memorable experience. The automated trolley controlled by a microcontroller was able to follow the user and equipped with on board billing system. The system eliminates the long hard queues for billing after purchase. In this era where humans are investing more on technology for their comfort, intelligent shopping cart is worth marketing. Additional features like on-line payment can be incorporated with the cart by transferring the purchase details to the central