SMART CART

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Abstract

This paper presents a smart shopping cart that can be integrated into crowded shopping centers. The smart cart can make shopping efficient and less time consuming. It provides an app where the customers can select the items they wish to purchase. The shortest path between the selected items was found using an algorithm. The use of radio frequency identification tags helps to direct the customers to next item. Image processing is used to find the counter with less people, this can save time. These all functions can be grouped into 3 categories: Control and Communication unit, Guidance unit, and Image Processing unit.

Index Terms: image processing, RFID, shortest path algorithm

I. INTRODUCTION

Nowadays with the hike in shopping spree the primary faced by a shopper is the time consumption. To minimize the issue we have come up with an innovative idea to manage time and utilize time effectively. The work to be undertaken in our proposed project is divided into 3 categories. The proposed system helps to utilize the shopping time efficiently, minimize lag and crowding. The impact of this system on the society varies on different scales, including better organized crowd control. This also helps users to select the right products without the wastage of time, or more accurately before reaching the destination of the actual product. The merit of this system is to manage consumer flow in and out of a location efficient and quickly as possible.

II. LITERATURE SURVEY

[1] A shopping smart cart that can be integrated into a mall system. It mainly consist of a user interface, face recognition unit and automatic billing section. User interface helps the customer with product searching, map information and automatic billing. The customer details will be print on the screen by the face recognition system. The automatic billing system provides a bill at the end of shopping.

[2] A crowd detection and management system using Raspberry pi3 that uses quad core ARMv8 processor. It processes the videos frame by frame. The software used is Open-CV. After the humans are detected, their positions are tracked to find the direction of motion.

[3] An Android App that helps the user to keep in touch with the lost phone. The app also sends a notification to an alternate number if the SIM card has been changed. The app also helps the user to manage the personal information remotely and securely.

[4] A system for tracking the location of the items in warehouse storage racks. RFID system is used to find the items. A tag will be incorporated with an item. The received signal strength indication (RSSI) and radio frequency (RF) phase are utilized for localization.

III. PROPOSED SYSTEM

The functions of this system can be mainly divided into 3 categories: Control and Communication unit, Guidance unit, and Image Processing unit. Control and Communication unit includes the App which helps the customers to select the items they wish to purchase. These data are transferred via Bluetooth module to the cart. Guidance unit is to direct the customers to the destination it through the shortest way. Image Processing unit to display the number of counter with less crowd.

A. Control and Communication Unit

The Smart Cart App establishes a mobile to device communication. It provides an interface to communicate and transfer data to the device through Bluetooth. The customer selects the items to purchase using this app. The items are assigned with a RFID number corresponding to the placement of the items. The App design involves:

(a) Bluetooth Sync: The Bluetooth sync is the process by which the app connects the mobile to the device module and vice versa. This consists of codes to allow access to the systems Bluetooth functions and permission to send and receive data from and to the external components. After the permissions the module was coded to perform data sharing with paired devices.

(b) Item Database: The item database is the place where the lists of items to be transferred into the cart are stored. This data to be processed by the mobile is processed and sorted in order. The database was implemented in the local store of the phone memory rather than cloud access for modification without net connectivity. The database can be uploaded in cloud for storage purposes. The database folder in the phone memory is the root folder that cannot be accessed externally by users, for the security and safety of the database. The database is expanded or deleted automatically according to the size contained by the item list.

(c) UI for database management: The UI for database includes the action buttons for adding and deleting items from the database for easy usage by the user. The UI is designed in such a way to prevent accidental data overwrite and deletion.

(d) UI for App: The UI for app is designed in a way for easy user accessibility and, delayed with startup screen for background processing of information and database management. The app UI connects all the individual elements using a nav bar. The UI is built to support screens of multiple dimensions.

B. Guidance Unit

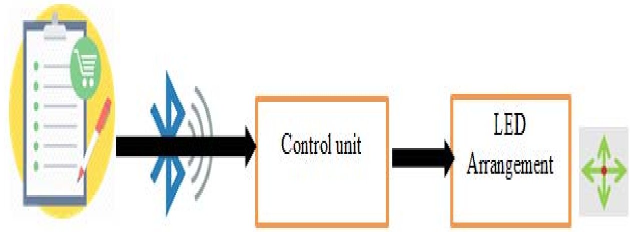
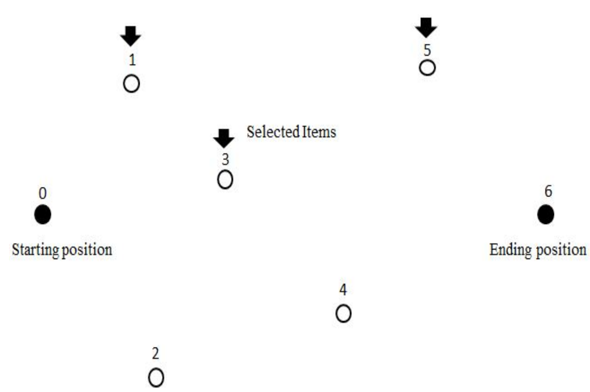


Fig.1. Guidance unit

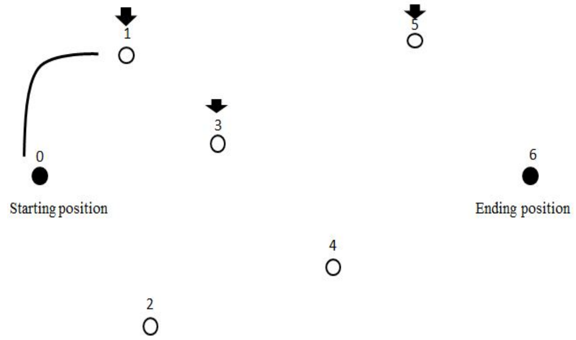
The data from the mobile app is transferred to the cart via Bluetooth module. These data is transferred to a control unit where shortest path algorithm is applied to find the shortest way through which the customer can collect the items as shown in Fig.1. LED arrangement is used to direct the customers.

(a) Shortest path Algorithm: This algorithm is used to find the shortest path between the positions of the selected items. The starting and ending position is identified in Fig.2. Sort the positions of the selected items and starting and ending position, and then find the shortest path. Steps involved in the process are:

Step1: Start
Step 2: Find the grid layout
Step 3: Set the starting, ending and the product positions
Step 4: Move from the starting position to the nearest item location
Step 5: Simultaneously move from the ending position to the nearest item location
Step 6: Continue the movement until all the items have selected through the shortest path
Step 7: Stop



(a)



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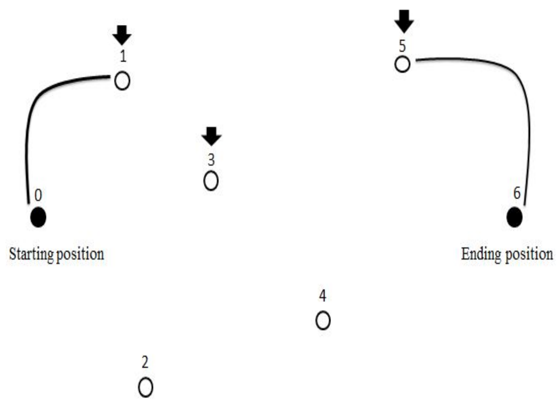

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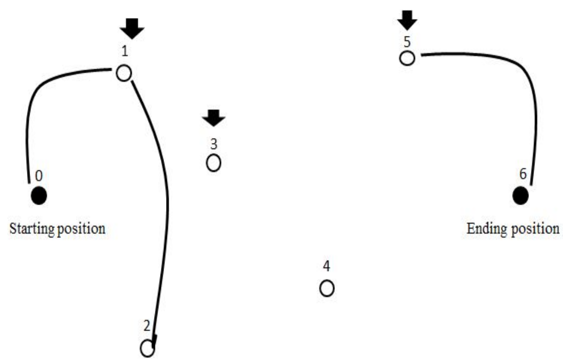

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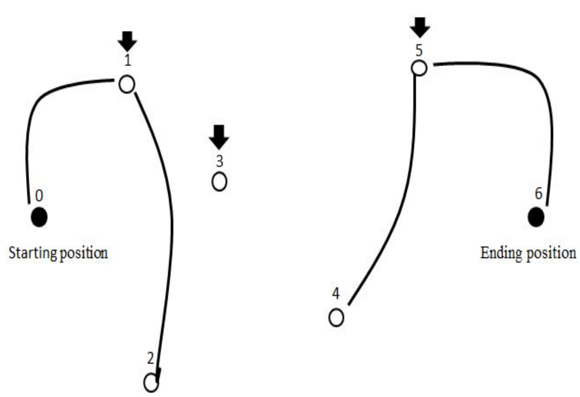

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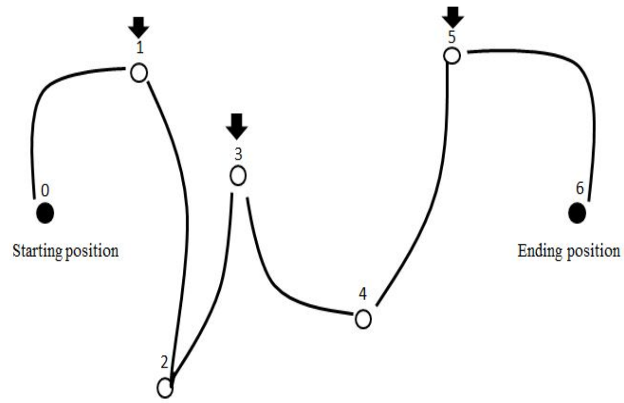

(f)

Fig.2. Shortest Path Algorithm (a) Grid Layout (b) Move to the nearest item from the starting position (c) Move to the nearest item from the ending position (d) Move to the next item through the shortest path (e) Move to the next item through the shortest path (f) Shortest path.

(a)LED Arrangement: 4 LED's are arranged in a manner to show the direction. A LED is placed at the center to indicate the customer has reached the desired position. Consider the numbers of the corresponding RFID tags that are placed on a shop as shown in Fig.3. The numbers represent the RFID numbers. The algorithm is described as shown in Fig.4.

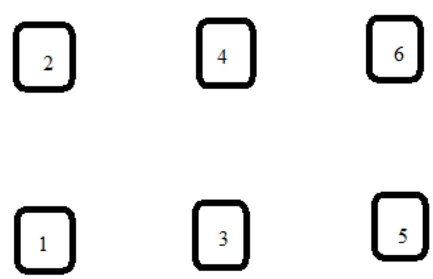

Fig.3. RFID tag placement on the track

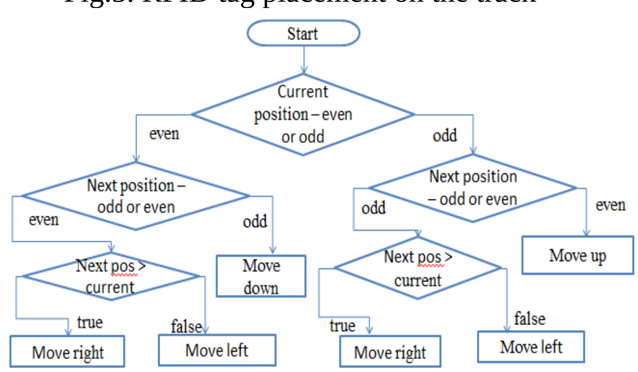

Fig.4. Flowchart

(c) RFID Placement: To detect the positions of the items RFID receiver and tags are used. RFID receiver is placed below the cart and the tags are placed on the track as shown in the Fig.5. Here Passive RFID's are used. It does not require any power source, so our system will not become bulky. Since the RFID receivers are placed beneath the cart, a RFID tag which is placed few feet's apart can be detected.

Fig.5. Illustration of RFID module installed on the cart

C. *Image Processing Unit*

In our proposed system counter with fewer crowds is found. The image processing unit can be summarized as shown Fig.6. The input is taken from a camera. Raspberry Pi is the SoC (system on chip) that is used. For the experimental setup we use Raspberry Pi 3 model B board. It uses a quad-core 64-bit ARM Cortex A53 clocked at 1.2 GHz. It has 4 USB ports, HDMI video output, 17 GPIO plus specific functions. The software used is OpenCV – Python. OpenCV is a library of programming functions. It is mainly aimed at real-time computer vision. OpenCV supports a wide variety of programming languages like C++, Python, Java, etc. OpenCV-python is the Python API of OpenCV[5][6].

Fig.6. Image processing unit

The initial step is to find the area of the queue in the respective counters as shown in Fig.7. Then this area is sorted to find the smallest area. The counter corresponding to this smallest area is found by comparing the coordinates of the contour with smallest area and the counter.

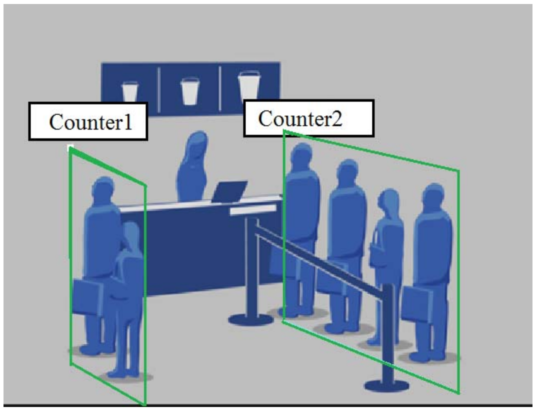

Fig.7. Counters

IV. RESULT

The Smart Cart App is developed that provides a simple way to select the items they wish to purchase as shown in Fig.9. The provision for connecting the Bluetooth using the app is as shown in Fig.9 and for selecting the items is as shown in Fig.10. The cart as shown in the Fig.11 would show the direction to the customers to their selected items through the shortest path. In displaying the counter with fewer crowds first areas are sorted to find the smallest area as shown in Fig.12, the coordinates corresponding to the smallest area is found as shown in Fig.13. After comparing the coordinates the counter number is displayed as shown in Fig.14.

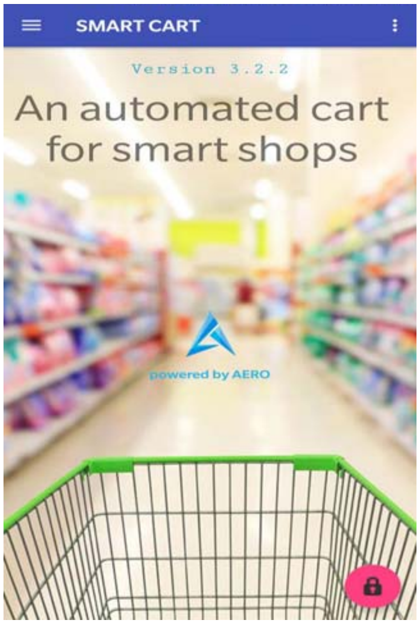

Fig.8. Smart Cart App

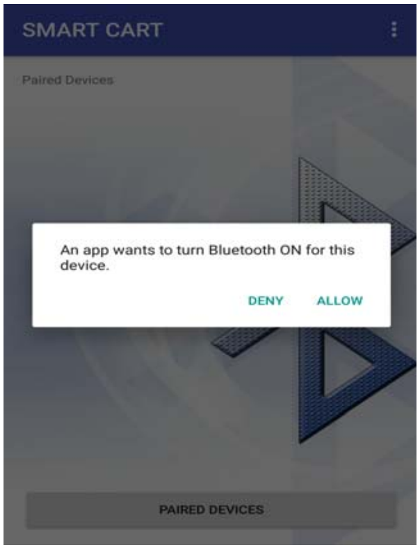

Fig.9. Bluetooth Sync

Fig.10. UI for Databases

Fig.11. Smart Cart

Fig.12. Contour areas

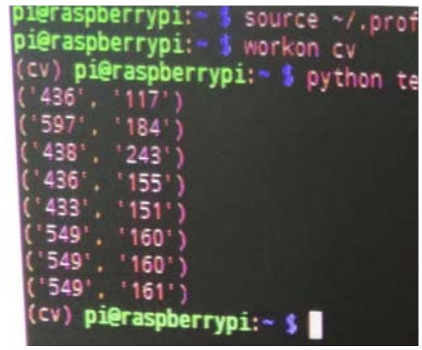

Fig.13. Contour coordinates

Fig.14. Counter number

V. CONCLUSION

This system provides a smart cart that can be applied in supermarkets. The App helps the customers to select the items they wish to purchase. The system also directs the customer to the items using two algorithms. One algorithm for finding the shortest path between the positions of the items selected by the customer and second for the LED's to direct the customer. At the end of the shopping it helps to find the counter with fewer crowds.

REFERENCES

[1] Hsin-Han Chiang, Wan-Ting You, Shu-Hsuan Lin, Wei-Chih Shih, Yu-Te Liao, Jin-Shyan Lee, and Yen-Lin Chen, "Development of Smart Shopping Carts with Customer-Oriented Service", International Conference on System Science and Engineering, 2016

[2] Dr. S. Syed Ameer Abbas, Dr. P. Oliver Jayaprakash, M. Anitha, X. Vinitha Jaini, "Crowd Detection and Management using Cascade classifier on ARMv8 and OpenCV-Python ," International Conference on Innovations in Information, Embedded and Communication Systems, 2017

[3] Bharath Sai Pochampally and Jiangbo Liu, "A Secure Tracking Mobile App Development," 2th IEEE Conference on Industrial Electronics and Applications, 2017

[4] Sheng Huang, Oon Peen Gan, Sethu Jose, Mo Li, "Localization for Industrial Warehouse Storage Rack Using Passive UHF RFID System," 22nd IEEE International Conference on Emerging Technologies and Factory Automation (ETFA), 2017

[5] https://www.raspberrypi.org/

[6] https://opencv.org/