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Design and Fabrication of Automated Shopping Cart System

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ABSTRACT

In cities, shopping malls experience high rush on holidays and weekends, particularly with offers and discounts. To minimize time spent at billing counters, a project proposes equipping merchandise in malls with RFID tags and trolleys with RFID readers and digital displays. This smart shopping trolley solution aims to enhance the shopping experience by addressing long queues, difficulty-finding products, and limited pricing visibility. The project focused on a small, cost-efficient, and user-friendly design, gathering ideas from group members. The trolley has been, successfully designed and fabricated, tested under loading conditions, meeting requirements. It is easy to use, requiring no special training, and benefits both retailers and customers by serving more customers simultaneously.

Keywords : Shopping Trolley, RFID reader and Central Billing Unit

I. INTRODUCTION

Supermarkets have replaced traditional markets as the primary source of food and goods distribution. They provide a wide range of home and personal products under one roof, offering competitive prices. To improve the shopping experience and solve existing problems, a project has been designed. Its core objective is to offer customers good products at great value.

The research aims to design and fabricate an adjustable trolley with multi-purpose functionality. The trolley incorporates mechanical controls and a smart shopping app for enhanced user experience. It introduces the innovative concept of a two-in-one facility, supplied by supermarkets for customers to use within the premises. This enables shoppers to collect a larger quantity of goods in a single trip, increasing store profitability. The integration of the trolley at shopping malls is based on creative techniques, making it more effective and convenient.

This machine combines cutting, punching, and bending operations at one working station, saving time and space compared to larger machines dedicated to single operations. The project embodies the concept of minimalism, indicating a trend for the future.

II. PROBLEM STATEMENT

The current shopping experience can be time-consuming and inefficient, often resulting in long

queues, difficulty in finding products, and limited visibility into pricing and promotions. The time takes at the billing counter is much more than the automated shopping billing system. This creates a need for a smart shopping trolley solution that addresses these challenges and enhances the overall shopping experience for customers. So, we the group of engineers developing an automated shopping cart system. Comprises of, Trolley, Arduino UNO, RFID Tags and RFID Reader, Buzzer, LCD 16x2 Display and Jumper Wires.

Main objective of the project is to make shopping experience smooth and efficient.

- To solve the problem at weigh counter.
- To save time at big queue.
- To save space by small trolleys and also the trolley can stand alone.
- It can carry maximum capacity load up to 30 Kgs

III.METHODOLOGY

It explains the methodology we intend to adopt to achieve overall aim of proposing effective mechanisms to develop a smart shopping trolley for supermarkets.

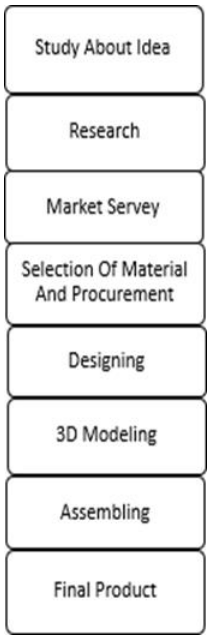

Figure 1. Flow Chart of methodology

A. Study About Idea

At first, we studied about the shopping trolley and to add some additional features. Then we focused on the disadvantages or loop holes in the currently used shopping trolley. We studied electronic components required in this system, time required for the billing counter, materials required for the process to complete the smart shopping cart system.

B. Research

Various research papers and journals related to the project topic were studied in order to get the information about prior findings. Information about shopping malls, Supermarkets and its Trolley Specification and functions properties was gathered.

C. Market Survey

A market survey was done for existing technologies and components. We also had a quick survey of current machinery used for Shopping Trolley and we thought about how efficiently we can make a machine with less number of parts so as to reduce the machine costing. Actual market prices of Trolley and machine parts were also considered. Also some research was done for standard parts readily available in the market.

D. Selection of Material and Procurement

Selection of raw material for the parts according to dimension was done. The standard components like Aluminium alloy pipes, steel rods, Arduino UNO, Rfid reader and Rfid tags, LCD 16x2 and Caster wheels were selected according to matching quality standards, availability with minimum cost. Procurement of these materials and parts was done early in order to make changes in the design if required. The following components survey is done

- Aluminum steel rod pipes.
- Electronic components i.e. Arduino UNO, LCD, 16x2, RFID reader and RFID tags, etc. which is to be used in manufacturing of Smart shopping trolley.

E. Rough Design (Designing)

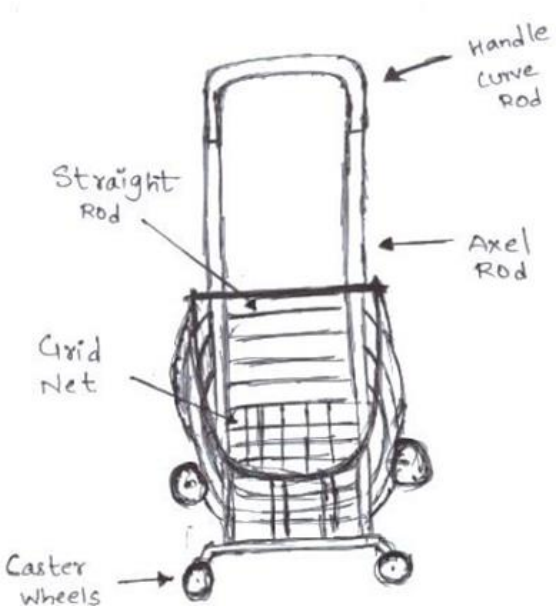

Figure 2. Rough Design

Based on information from the internet and previous research papers a rough design of the machine was created. It should be able to present a rough idea how the machine will visually appear, function and operate. We tried to keep the machine model as small as possible and also cost efficient and also not complicated in design. We gathered designing ideas from all members of the group and then finalized a design which we thought would fulfil all the above considered parameters. During this process some of the basic dimensions and requirements were finalized for the machine manufacturing and assembly.

F. 3D Modelling

Figure 3. 3D Modelling

A 3D model is a digital representation of a three-dimensional object or scene created using specialized software. It allows you to visualize and manipulate objects in a virtual environment with depth and perspective. 3D models can be static or dynamic and are commonly used in various fields such as animation, video games, virtual reality, architecture, engineering, and product design.

G. Circuit Diagram

A circuit diagram, also known as a schematic diagram or electrical diagram, is a visual representation of an electrical circuit. It uses symbols to illustrate the components and connections within the circuit. Circuit diagrams are widely used in electrical and electronic engineering to design, analyse, and troubleshoot circuits.

In a circuit diagram, each component is represented by a specific symbol that represents its function. Commonly used symbols include resistors, capacitors, inductors, diodes, transistors, switches, and various types of connectors. These symbols are standardized and widely recognized in the field. The components are connected by lines that indicate the electrical connections between them. These lines represent wires or conductive traces on a circuit board.

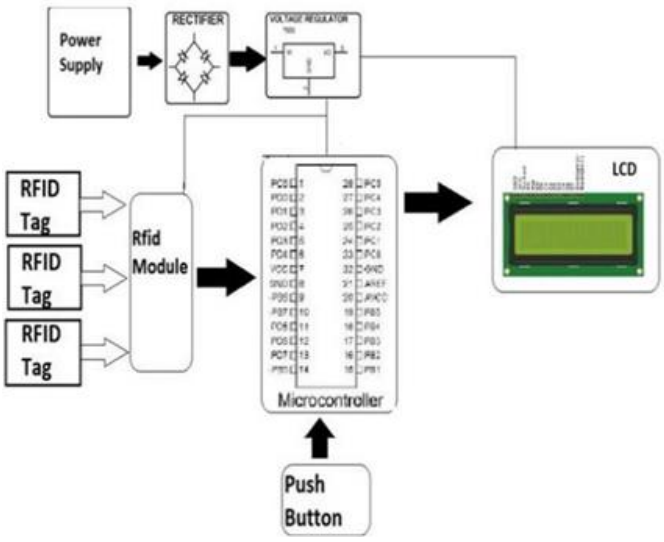

Figure 4. Circuit Diagram

The connections are shown as points where the lines intersect or join together. Circuit diagrams provide a concise and standardized way to represent complex electrical circuits. They allow engineers and technicians to understand how a circuit is designed,

how its components are connected, and how signals flow through the circuit. By following a circuit diagram, one can build or repair circuits accurately and efficiently. In this circuit diagram the components are Arduino UNO, RFID Reader, RFID Tags, Buzzer, Liquid Crystal Display 16x2, and Jumper Wires

H. Assembling

After procurement of the materials and components and code are generated with testing then we perform the assembling task of the product. All the components

i.e. Trolley, RFID reader, RFID tags, Buzzer, Arduino UNO, and jumper wires. Were connected and assembled nicely and all components are working properly.

I. Final Product

After rectifying the errors and developing the CAD models for the trolley was done. Then we did actual mounting of the components on the trolley ergonomically and aesthetically. All the objectives were achieved and the model was working properly. Also we tested with several riders and it worked properly. Following figures shows the various mountings on the trolley: -

Figure 5. Automated Shopping Cart System

IV.RESULTS AND DISCUSSION

The proposed model is easy accessible and convenient to use. It does not require special training. The manpower is decreased and will save time that the user spends in billing queue. Many users can be attended in same time which is useful for retailers and customers.

We discussed with the customers at shopping centres and come with the outcome of general standard weight and standard cost of the total bill. The final result affected the outcome where RFID technology replaced barcode due to its drawback where barcode requires the line of sight and should be placed in its exact boundary while scanning, but RFID's only constraint to be considered is its distance coverage. RFID tags are more durable than the barcode which damages due to temperature, water, physical tear etc. This ensures the process of scanning easy and precise.

Table 1. Results & Testing of Percentage Error

Trial	Set Weight (Kg)	Actual Weight (Kg)	% Error in Weight	No. of Product	Buzzer Set time (Sec)	Actual Time (Sec)	% Error in time
1	10	10.5	0.5	1	2	1.5	0.5
2	15	14	1	1	3	2.5	0.5
3	20	18	2	2	4	3	1
4	25	23	2	4	5.5	5	0.5
5	30	28	2	4	6	5.8	0.2

V. CONCLUSIONS AND FUTURE SCOPE

A. Conclusion

The goal is successfully accomplished in the model created. The smart shopping trolley is an innovative solution that aims to transform the traditional shopping experience by incorporating advanced technologies and functionalities. By addressing common challenges faced by shoppers, such as long queues, difficulties in product discovery, limited pricing information, and the need for customer assistance, the smart shopping trolley enhances efficiency, convenience, and personalization. The created product is of minimal effort, genial to utilize and does not require a particular practice. The capacity to make a choice should be possible in the cart itself which can be utilized in the shopping

buildings for an easy and smart method for obtaining things to spare essentialness, time and cash of the clients. The venture is assessed with various preliminary cases with particular things evaluated for all the pragmatic preliminaries. Furthermore, besides, labels utilized in this undertaking have the limit of identifying just one side, hence, labels are appended to items in a round manner so as to dodge non detection. The deployment of smart shopping trolleys has the potential to revolutionize the retail industry, improving customer satisfaction, optimizing store operations, and driving sales. With ongoing advancements in technology, the future of smart shopping trolleys holds even greater possibilities for enhancing the shopping experience and meeting evolving customer needs.

Based upon the research, recommendations proposed for the further study are as follows: -

- It can likewise be stretched out by utilizing all the more dominant RFID readers with the upgraded limits if there should be an occurrence of progressively the number of items in the trolley.
- Water delicate and all the more dominant labels with further developed highlights like a metal safe and temperature safe are under research which will be exceptionally valuable later on.

B. Future Scope

Scopes for future work on smart trolley are mentioned below:

1. To fix a camera with ultrasonic sensor: A camera with ultrasonic sensor which is used to scan the product and the trolley displays all the information related to the product in the display unit (weight, quantity and price).
2. Application Upgrades: Current location of the costumer and the product can be more specifically shown in the mobile application by further updating. Enhancement in the product scanning feature.

VI. REFERENCES

[1]. SK Shankar, S Balasubramani, S Akbar Basha, Sd Ariz Ahamed, N Suneel Kumar Reddy 2021 5th International Conference on Computing Methodologies and Communication (ICCMC), 9(2), 390-394, 2021.

[2]. R Nithiavathy, R Asmitha Shree, S Praveen Kumar, S Raghul, Journal of Physics: Conference Series 1916 (1), 102-106, 2021.

[3]. S Vidyashree, Journal of Research Proceedings 1 (2), 243-252, 2021.

[4]. Sainath Satavse,Sachin Shinde, Shubham Sawant, Pratik Raut,Pratik Raut, "DESIGN OF PORTABLE CNC" ,6 th National Conference on Role of Engineers in Nation Building, 9 th & 10 th March 2018, International Journal of Advance Research, Ideas and Innovations in Technology, pp D-168 -D-172, (ISSN: 2454-132X)

[5]. Aileen Anak Bita, Safaa Najah Saud Al-Humairi, Adzliza Salmi Binti Mohamad AzIan2021 IEEE 11th IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE), 4(1). 141-145, 2021.

[6]. Pratik Raut, Harshad Botle, Aniket Birwatkar, Rushikesh Bhosale, "Modelling and Control Design of Shadowbot in Real Time Basis", 8 th National Conference on "Role of Engineers in Nation Building" organized by VIVA Institute of Technology, Mumbai (6th and 7th March 2020) International Journal of Engineering Research & Science (IJOER), Vol-6, Issue- 3, March- 2020, pp 278-283. (ISBN: [978-93-5321-411- 1] ISSN: [2395-6992])

[7]. Hartiwi Prabowo, Enny Noegraheni Hindarwati 2020 International Conference on Information Management and Technology (ICIMTech), 16(7), 40-45, 2020.

[8]. Design and construction of a smart shopping trolley Andrea Adjoba Mensah, 24(12), 130-136, 2020.

[9]. Smart Shopping Cart Siddharth Sharma, Tarun Kumar International Journal of Research in Engineering, Science and Management 3 (8), 437-442, 2020.

[10]. A multimodal user interface for an assistive robotic shopping cart Dmitry Ryumin, Ildar Kagirov, Alexandr Axyonov, Nikita Pavlyuk, Anton Saveliev, Irina Kipyatkova, Milos Zelezny, Iosif Mporas, Alexey Karpov Electronics 9 (12), 106-112, 2020.

[11]. Online shopping cart abandonment: a consumer mindset perspective Daniel Rubin, Chrissy Martins, Veronika Ilyuk, Diogo Hildebrand Journal of Consumer Marketing, 16(3), 118-124, 2020.

[12]. K Ashokkumar, K Amirtha, G Akshaya Journal of Computational and Theoretical Nanoscience 16(8), 3201-3203, 2019.

[13]. A Case Study: Comparison of Software Cost Estimation of Smart Shopping List Application Tuncay Yigit, Huseyin Coskun, 12(9), 208-215, 2019.

[14]. A.T. Madhavi M. E, S. Praveen Balaji, Dinesh Ezhil, Hari Haran M., "Smart shopping trolley and stock management system". International journal of current engineering and scientific research, Vol. 8, Issue 12, December, 318-326, 2019.

[15]. KP Vidya, KM Swathi, D Chaitra, SH Jayalakshmi, MV Manoj Kumar, HR Sneha, Likewin Thomas, BH Puneetha 2018 IEEE Distributed Computing, VLSI, Electrical Circuits and Robotics (DISCOVER), 8(4), 135-140, 2018.

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