IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, April 2024

Smart Shopping Trolley

Atish Doke, Harshal Dhondge, Prasad Govekar, Prof. V. B. Baru
Department of Electronics and Telecommunication Engineering
Sinhgad College of Engineering, Pune, Maharashtra, India
Savitribai Phule Pune University, Pune
atishdokpatil9596@gmail.com, dhondge.h13@gmail.com, prasadgovekar873@gmail.com

Abstract: *This review presents a new project idea called the Smart Shopping Trolley. The paper outlines the design, development, and implementation of a smart shopping trolley system that aims to change the traditional shopping experience. The project involves installing various sensors, including ultrasonic sensors, RFID sensors, and IR sensors, to analyze the system architecture, functionalities, and potential benefits. Through this analysis, the paper demonstrates the potential of smart shopping trolleys to streamline shopping processes, enhance customer satisfaction, and optimize retail operations.*

Keywords: Arduino-based smart shopping trolley, ultrasonic sensor, RFID RC522, IR sensor, DC motors, LCD Display 16*2, Load Cells

I. INTRODUCTION

The "Smart Shopping Trolley" project is aimed at transforming the traditional shopping experience by integrating cutting-edge technology into the process. This project utilizes advanced hardware and innovative software to create an intelligent shopping trolley that enhances convenience, efficiency, and user experience for shoppers. Some of the key features of this smart trolley include automated item billing, a user-friendly interface, and real-time price calculation. These features enable shoppers to keep track of their purchases and stay within their budget.Shopping carts, which are also commonly known as shopping trolleys, are used to temporarily transport goods before cashing out. Since its invention, shopping carts have undergone limited changes, with most modifications focused on increasing their capacity and reducing their weight. However, with advancements in technology, some companies have developed a convenient shopping system for customers using connected devices. This has led to the need for self-driven and artificial intelligence shopping, which can be seen as a potential threat to humans.

II. RELATED WORK

The field of Arduino-based security and surveillance robots is rapidly evolving, and various research projects are exploring different functionalities and applications. Here's a detailed analysis of some noteworthy related works:

A. IOT-BASED SMART SHOPPING TROLLEY" © 2021

- Similarities: Both the trolley and your project utilize sensors for control and wireless communication for monitoring.
- Differences: The "IOT-based Smart Shopping Trolley" focuses on an underground transmission line while your project prioritizes overhead fault detection and the change in the Raspberry Pi as a microcontroller.
- Insights: The "IOT-based Smart Shopping Trolley" is built using the Atmega 328p.

B. RFID-BASED WIRELESS INTELLIGENT CART USING ARM7 June 2022

- Similarities: Both your project and the wireless cart system employ Atmega for control and fault control functionality.
- Differences: The "RFID-based Wireless Intelligent Cart" focuses on the pic microcontroller while your project prioritizes using the Arduino Atmega microcontroller and controlling fault.
- Insights: The wireless cart system is built using the ARM7.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, April 2024

C. "Design, Analysis, And Fabrication Of Smart Shopping Trolley" June 2013

- Similarities: Both your project and this trolley utilize Atmega control and wireless communication.
- Differences: This trolley uses GSM technology while your project focuses on object detection with a simple scanning process.
- Insights: Consider upgrading your power supply.

D. "Follow Me Multifunctional Automated Trolley" July 2017

- Similarities: Both your project and this trolley employ Atmega for sensor control and fault detection functionality.
- Differences: The "Follow Me Multifunctional Automated Trolley" focuses on the pic microcontroller while your project prioritizes using the Arduino Atmega microcontroller and controlling faults.
- Insights: The "Follow Me Multifunctional Automated Trolley" is also built using the Atmega 328p.

III. PROPOSED SYSTEM

The proposed Transmission Line Multiple Fault Detection System is based on Arduino and comprises the following key hardware components:

3.1 Hardware

1. Microcontroller:

The Arduino Uno serves as the central processing unit, controlling sensors, divider, and communication modules.

2. Sensors:

The system uses two types of sensors:

Ultrasonic sensor: It emits high-frequency sound waves and measures the time it takes for the sound waves to reflect off an object and return to the sensor. This helps detect the distance to nearby objects.

IR sensor: It detects infrared radiation emitted or reflected by objects in its vicinity. IR sensors detect changes in infrared radiation levels to sense the presence or absence of objects. They consist of an IR emitter and an IR receiver.

3. Communication Modules:

The system has an optional Bluetooth/Wi-Fi module that facilitates local communication with a remote control device or mobile app for manual navigation and monitoring.

4. Motor Drivers:

The system uses electronic devices or circuits known as motor drivers. Motor drivers control the speed, direction, and operation of electric motors and provide the necessary power and control signals to drive motors efficiently and safely. Motor drivers are essential components in a wide range of applications, including robotics, industrial automation, automotive systems, consumer electronics, and more.

5. Additional Considerations:

The system also includes:

Chassis: A sturdy base frame that provides a platform to mount all components and protect them from environmental damage.

Power Supply: A rechargeable battery or reliable power source to sustain the operation.

3.2 Software

The following text describes two software tools that are often used in electronics and robotics projects.

The first tool is the Arduino IDE, which is used to program the functionality of the project. This includes processing and interpreting the data from sensors for fault detection, controlling motors for precise movement and navigation,

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, April 2024

creating communication protocols for Bluetooth or WiFi data transmission, and setting up alarm triggers and notification mechanisms for fault detection.

The second tool is the Proteus software, which is a popular electronic design automation (EDA) software used for schematic capture, simulation, and printed circuit board (PCB) design. Engineers and electronics enthusiasts often use Proteus to design and test electronic circuits and PCB layouts. Proteus allows users to create schematics, simulate circuit behavior, and design PCBs within a single integrated environment.

3.3 Proposed Workflow

1. Product Selection and Adding to Cart: Once the parameters have been identified, suitable products can be selected and added to the cart.
2. Identifying Monitoring Parameters and Identifying Products: The monitoring parameters are identified for each product to ensure accurate data collection. Suitable products are then selected based on the identified parameters.
3. Communication: Depending on the environment and available connections, communication can be established in various ways.
4. User Response: Users can remotely track the product list, view bills, and pay through mobile to initiate appropriate actions.

IV. HARDWARE IMPLEMENTATION AND RESULT

1. Sensor Deployment:

- Install ultrasonic and IR sensors at regular intervals along with the motor drivers.
- Use high-accuracy sensors to measure electrical parameters.
- Consider using an ultrasonic sensor to monitor objects in between as they can cause collisions.

2. Data Acquisition Unit:

- Implement a Data Acquisition Unit (DAU) to collect data from sensors.
- Utilize analog-to-digital converters for converting sensor readings into digital data.
- Include a microcontroller or FPGA for processing and analysis.

3. Communication Module:

- Integrate an IoT communication module (e.g., GSM, LTE, or satellite) to transmit data in real time.
- Use secure protocols for communication to protect against cyber threats.

4. Communication Protocols:

- Bluetooth/Wi-Fi (optional): Test for range and reliability of data transmission to the device or app.
- Integrate an IoT communication module (e.g., GSM, LTE, or satellite) to transmit data in real time.

5. Testing and Results:

- Accuracy Results: Precision, recall, and F1 score values provide insights into the system's ability to accurately identify and classify different types of faults.
- False Positive and False Negative Rates: Examine the occurrence of false positives and false negatives during testing. Understand the reasons behind false alarms and missed detections, and refine algorithms to minimize these errors.
- Response Time Analysis: Evaluate the system's response time under various fault conditions. Short response times are crucial for timely mitigation measures.
- Communication: Measure the range and reliability of data transmission through Bluetooth/Wi-Fi connections. Analyze latency and signal strength in different environments.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, April 2024

6. Results and Summary:

The smart shopping trolley project has revolutionized the retail industry by utilizing technology to create a personalized and seamless shopping experience for customers, thus optimizing store operations and driving business growth for retailers. The smart shopping trolley system is a significant advancement in the retail industry, with the ability to improve efficiency, engagement, and customer satisfaction. The interactive features of smart shopping trolleys, such as personalized recommendations and loyalty rewards, have resulted in enhanced customer engagement and loyalty. Retailers can establish stronger relationships with customers through targeted promotions, rewards programs, and feedback mechanisms.

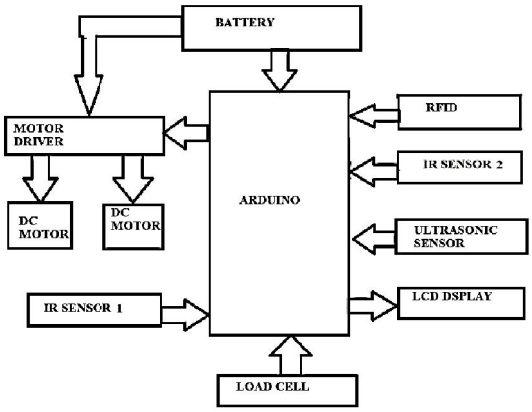
7. Discussion and Future Work:

- The Smart Shopping Trolley System, powered by IoT, is a significant advancement in the shopping industry that aims to provide reliable and efficient customer service.
- To improve the system's performance, it is necessary to optimize sensor calibration, control algorithms, and communication protocols.
- With the world becoming increasingly dependent on automation systems and AI, the system's real-time monitoring capabilities, facilitated by IoT technology and an array of sensors, offer a robust solution to manage vast transmission networks, harsh environmental conditions, and the quick detection of faults.
- As sensor technology advances, the system's data collection capabilities will improve, enabling it to monitor a wider range of parameters and detect subtle anomalies.
- The development of AI and machine learning algorithms will also enhance billing accuracy, predictive maintenance capabilities, and data analytics.

V. PERFORMANCE EVALUATION

- Smart Shopping Trolley requires a thorough analysis of various important aspects. Firstly, the accuracy of the system needs to be evaluated, which includes determining its ability to identify and classify multiple faults on the shopping cart. Standard metrics such as precision, recall, and F1 score should be used to quantify the accuracy of fault detection.
- To measure the time taken by the system to detect and respond to different types of comprehensions, Response Time is an important factor to consider.
- Additionally, two other important aspects need to be evaluated which are Data Analysis and Continuous Improvement, where data generated during the system's operation should be collected and analyzed.
- Communication Range and Reliability, where the reliability of communication between IoT devices and the central monitoring system should be assessed. These factors play a crucial role in ensuring the smooth operation of the system and making continuous improvements to enhance its performance.

VI. BLOCK DIAGRAM



IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, April 2024

VII. CONCLUSION

The smart shopping trolley project is an innovative solution that uses technology to create a seamless, efficient, and personalized shopping experience. Retailers can leverage this technology to enhance customer engagement, optimize retail operations, and promote sustainability, making smart shopping trolleys indispensable tools for thriving in an increasingly competitive market. As technology continues to evolve, smart shopping trolleys will play a pivotal role in shaping the future of retail by driving innovation and delivering value to both customers and businesses.

Key Achievements:

- Automated Cart: The automated cart, also known as a smart or robotic shopping cart, is a cutting-edge technological solution that revolutionizes the traditional shopping experience. It integrates advanced sensors, navigation systems, and connectivity features to provide customers with a seamless and efficient way to shop while offering retailers enhanced operational capabilities.
- Improved Reliability: The system identifies faults promptly, reducing downtime, preventing power outages, and enhancing the overall reliability of the power grid.
- Data Analytics: Data collected from IoT sensors can be analyzed to gain insights into the health of the transmission lines, helping utilities make informed decisions for maintenance and upgrades.
- Real-time Alerts: Operators can receive real-time alerts and notifications when faults occur, allowing them to respond swiftly and minimize the impact on the grid.

Future Potential:

- Advanced Sensor Technologies: Continued advancements in sensor technology will provide more accurate and diverse data collection capabilities, enabling the system to monitor a wider range of parameters and detect subtle anomalies.
- Edge Computing: Integration of edge computing will enable faster data processing and immediate local responses to faults, reducing dependence on centralized platforms.
- 5G Connectivity: The deployment of 5G networks will enhance data transmission speeds and reliability, allowing for even more real-time monitoring and control capabilities.
- Artificial Intelligence (AI) and Machine Learning: Further developments in AI and machine learning algorithms will improve fault detection accuracy, predictive maintenance capabilities, and data analytics.

REFERENCES

[1]. Mr. Suraj.S, Vishal Guruprasad, Udayagiri R Pranava, Preetham S Nag, "RFID Based Wireless Intelligent Cart Using ARM7," International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, Issue 8, 2016.

[2]. Komal Ambekar, Vinayak Dhole, Supriya Sharma, "Smart Shopping Trolley Using RFID," International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), Volume 4 Issue 10, 2015.

[3]. K.Gogila Devi, T.A.Kaarthik, N.Kalai Selvi, K.Nandhini, S.Priya, "Smart Shopping Trolley Using RFID Based on IoT," International Journal of Innovative Research in Computer and Communication Engineering. Vol. 5, Issue 3, 2017.

[4]. L.S.Y. Dehigaspege, M. K. C. Liyanage, N. A. M. Liyanage, M. I. Marzook, "Follow Me Multifunctional Automated Trolley" IJERT, 2017