iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

ARDUINO BASED SMART TROLLEY

Mr. BIJAY KUMAR MUNI
Assistant Professor, J.B Institute of Engineering and Technology,
Moinabad, RangaReddy, Telangana

SYED ISMAIL
MOHD RIYAN SHOIEB
UG Student, J.B Institute of Engineering and Technology,
Moinabad, RangaReddy, Telangana

ABSTRACT
The rapid advancement of technology, the retail industry is constantly evolving to enhance customer convenience. The traditional shopping experience often involves long queues at billing counters, causing customer dissatisfaction. To address this issue, this paper presents a Smart Shopping Trolley using RFID technology integrated with an Arduino controller, an LCD with I2C interface, and a servo motor for automated basket operation. The system allows customers to scan items using RFID tags, automatically updating the total bill displayed on the LCD. The servo motor ensures secured item placement by controlling basket access. This innovation aims to streamline the shopping process, reduce checkout time, and enhance the overall shopping experience.

Keywords:
Arduino-Based Smart Trolley, RFID Technology, Automated Billing, Smart Shopping, Retail Automation, LCD Display, Servo Motor Control, Checkout Time Reduction, Wireless Shopping System, Embedded Systems in Retail.

INTRODUCTION

In conventional shopping systems, customers need to manually collect items, check prices, and wait in long queues for billing. This process is time-consuming and often frustrating. Smart shopping trolleys incorporate RFID technology to automate item detection and billing, thereby reducing human effort and errors. This paper discusses the implementation of a Smart Shopping Trolley that uses an RFID reader to detect products, an Arduino microcontroller for processing, an LCD display for real-time bill updates, and a servo motor to regulate basket access. The proposed system enhances shopping efficiency, minimizes waiting times, and improves customer satisfaction.

LITERATURE SURVEY

Several research studies have explored smart shopping systems. Past implementations include barcode-based shopping carts and mobile app-based self-checkout systems. However, these solutions require manual scanning or user intervention, which can be inefficient. Recent advancements in RFID technology have enabled automated item detection without manual scanning. Studies have demonstrated the effectiveness of RFID in reducing checkout times and improving inventory management. This research builds upon previous works by integrating RFID technology with automated basket control for enhanced security and user experience.

METHODOLOGY

The Smart Shopping Trolley system aims to overcome these limitations by implementing RFID-based item detection and automated basket control using a servo motor. The key components of the system include:

1. **RFID Reader & Tags**: Each product is equipped with an RFID tag that contains its unique identification details. The RFID reader, attached to the trolley, scans these tags to retrieve product information.
2. **Arduino Controller**: The Arduino processes the scanned data, calculates the total price, and updates the display in real-time.
3. **LCD with I2C**: The LCD screen provides a user-friendly interface, displaying scanned items and the total bill.

4. **Servo Motor-Controlled Basket**: The servo motor ensures that the basket only opens when a valid item is scanned, preventing unauthorized item placement.
5. **Billing System**: At checkout, the trolley transmits the final bill to a centralized payment system, allowing customers to pay directly without requiring manual barcode scanning.

IMPLEMENTATION

The system is implemented using Python and runs on a Raspberry Pi. An external camera captures hand gestures, and OpenCV libraries process image frames. The entire process follows these steps:

1. **Audio Input & Processing**: The user speaks into a microphone, and speech is converted into text using Vosk.
2. **Gesture Mapping**: Text is mapped to ASL gestures using a pre-trained model.
3. **Gesture Recognition**: Real-time hand gestures are classified using CNNs.
4. **Output Display**: Translated gestures are shown on a **laptop screen** and converted into speech for non-sign language users.

Remote Access & Monitoring: Using **Advanced IP Scanner**, users can detect and manage the Raspberry Pi's network connections, while **Real Viewer** allows real-time visualization of the system's output from a remote device.

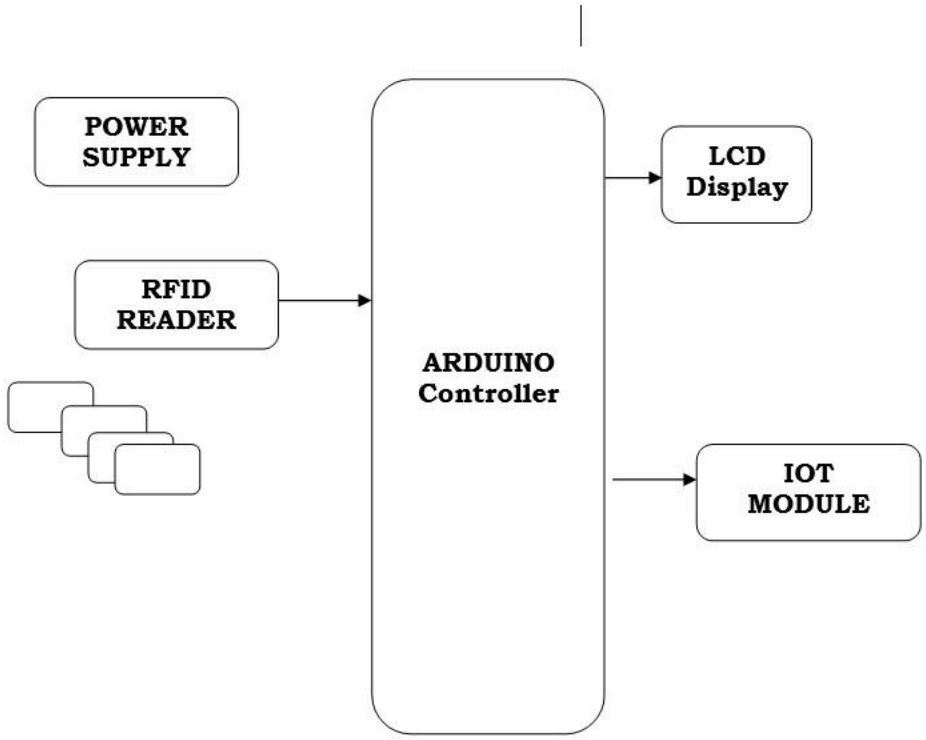

Figure 1 Block Diagram

RESULTS AND PERFORMANCE EVALUATION

The prototype of the Smart Shopping Trolley was successfully implemented and tested. The key findings include:

1. **Reduced Checkout Time**: The RFID-based system significantly reduced the time spent at billing counters by automating item detection and pricing.
2. **Improved Accuracy**: The automated scanning process eliminated errors associated with manual barcode scanning.
3. **Enhanced Security**: The servo motor-controlled basket prevented unauthorized product addition, ensuring accurate billing.
4. **User Satisfaction**: Customers found the system intuitive and time-saving, improving their shopping experience.

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

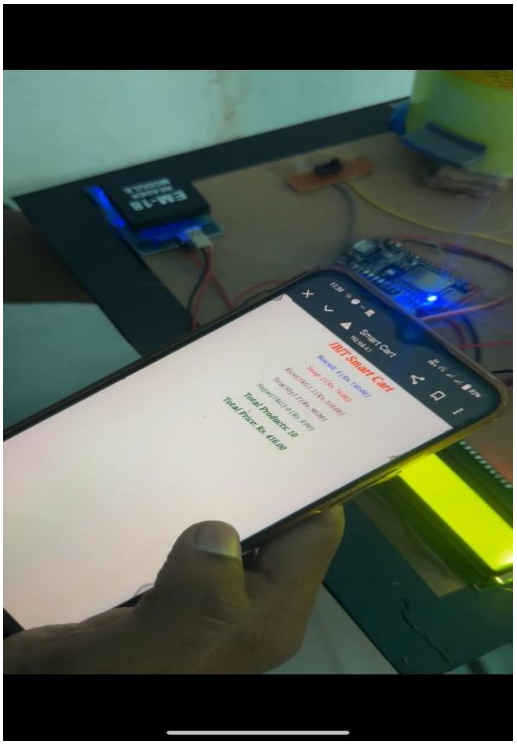

Figure 2 Web page

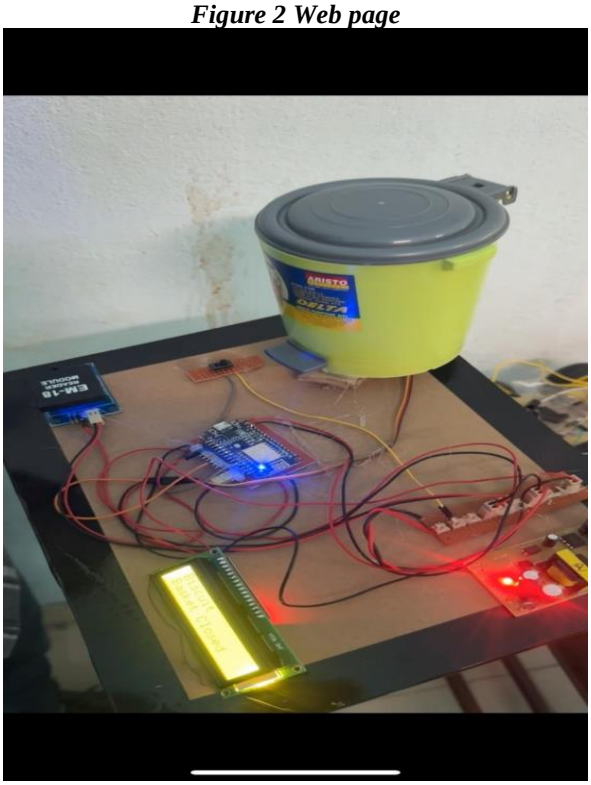

Figure 3 Working

FUTURE SCOPE

- AI-Powered Product Recommendation – By integrating AI and machine learning, the trolley can suggest products based on a customer's shopping history and preferences, enhancing the shopping experience.
- Self-Navigation Using IoT and Sensors – Implementing IoT, ultrasonic sensors, and computer vision can enable the trolley to autonomously navigate through aisles, guiding customers to their desired products.
- Cloud-Based Inventory Management – Retailers can leverage cloud computing to keep track of inventory in real time, reducing stockouts and improving supply chain management.

.

CONCLUSION

The Smart Shopping Trolley enhances the retail experience by integrating RFID technology, Arduino processing, and automated basket control. This system effectively reduces checkout time, improves billing accuracy, and enhances security. Future developments may include IoT-based inventory management and mobile payment integration for a seamless shopping experience.

REFERENCES

I. Smith, J., & Brown, K. (2022). "RFID-based Smart Shopping Systems: A Review." *International Journal of Retail Technology*, 18(3), 45-60.
II. Lee, M., & Wong, H. (2021). "Automated Retail Billing using RFID and IoT." *Journal of Smart Systems*, 12(4), 102-115.
III. Gupta, R., & Patel, S. (2020). "Enhancing Shopping Efficiency with Smart Trolley Systems." *IEEE Transactions on Consumer Electronics*, 66(2), 90-101.
IV. Kumar, V., & Singh, P. (2019). "Smart Cart: A Step Towards Intelligent Retail." *Journal of Embedded Systems and Robotics*, 10(1), 22-35.