



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 5, May 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

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# Smart Shopping Trolley System using ATMEGA328P Microcontroller

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**ABSTRACT:** In supermarkets, a shopping trolley or a shopping cart is the necessary tools for purchasing. Traditionally, it is used by customers inside the store to transport goods to the cashier during shopping and designed not to leave the store. It is an inconvenience and time wasted for customers who want to find the desired product in the store by using the traditional shopping trolley. Our goal is to develop an automatic moving trolley with smart shopping devices to solve the problem. Our smart shopping trolley is based on a two-wheeled mobile robot. This project presents the hardware and software design of a smart trolley system. The trolley is modelled as a two-wheeled mobile robot. Sensors will control the robot by sending a signal to microcontroller. This system is also equipped with the sensors. Finally, the results of the testing on robot navigation are presented. The result is our smart trolley system based on sensors framework can move.

**KEYWORDS:** Smart shopping cart, Sensors, Microcontroller, DC Gear Motors.

## I. INTRODUCTION

Technology has been an enlightening path for innovative new ideas and connecting the world in which Modern world has brought us many possible ways of connecting people with technology such as IoT and industrial automation. Right from the start when innovations started in the world of technology the meaning was to reduce unnecessary hardship and increase the productivity of humans. One of the most important modern world leisure activities is spending time shopping in malls, shopping complexes etc.. Thus, an upbringing innovation in the field of shopping and retail stores can be the inclusion of smart shopping trolley systems. It automatically follows the customers without pushing the trolley. The Smart Shopping Trolley, equipped with an ATmega328 microcontroller at its core, represents a paradigm shift in the retail landscape. By integrating a myriad of sensors, communication modules, and data processing capabilities, this intelligent device offers a plethora of features designed to streamline the shopping journey for consumers while empowering retailers with valuable insights into consumer behaviour and inventory management.

## II. LITERATURE REVIEW

Self Driving And Human Following Trolley was proposed by Shaurya Rajput and Nikhil Tanwar.[1]. It was from Jaypee University of Information Technology(JUIT) and it was published in the year of 2021. The project is based on human following trolley using a Arduino. This trolley will automatically avoid an obstacle, and trolley follow particular person. This project will be helpful in various fields. It can be used as trolley in airports or malls , carrying vehicle in army , delivering medications etc.

Smart shopping cart was proposed by Midatani Mohansai.[2]. It was from Sathyabama Institute of Science and Technology and it was published in the year of 2021. This project an automated smart shopping system is formed by introducing the concept of IoT to connect all items in the grocery shop. In this system, an inexpensive RF-ID tag is embedded. This shopping cart is built with a system that enables customer to bill their products at cart itself without standing in long ques for billing.

Smart shopping trolley using RFID was proposed by Shubham Singh, Vaibhav Dwivedi, Shweta Kumari, Salony Gupta and Navneet Kumar.[3]. It was from Journal of Emerging Technologies and Innovative Research (JETIR) and it was published in the year of 2021. The project is the Internet of Things (IoT) based Smart Shopping Cart is proposed which comprises Radio Frequency Identification (RFID) sensors, Arduino application. The system design

anticipates the automation of the procurement process by combining different technologies such as Arduino Uno, UHF RFID and Android mobile applications.

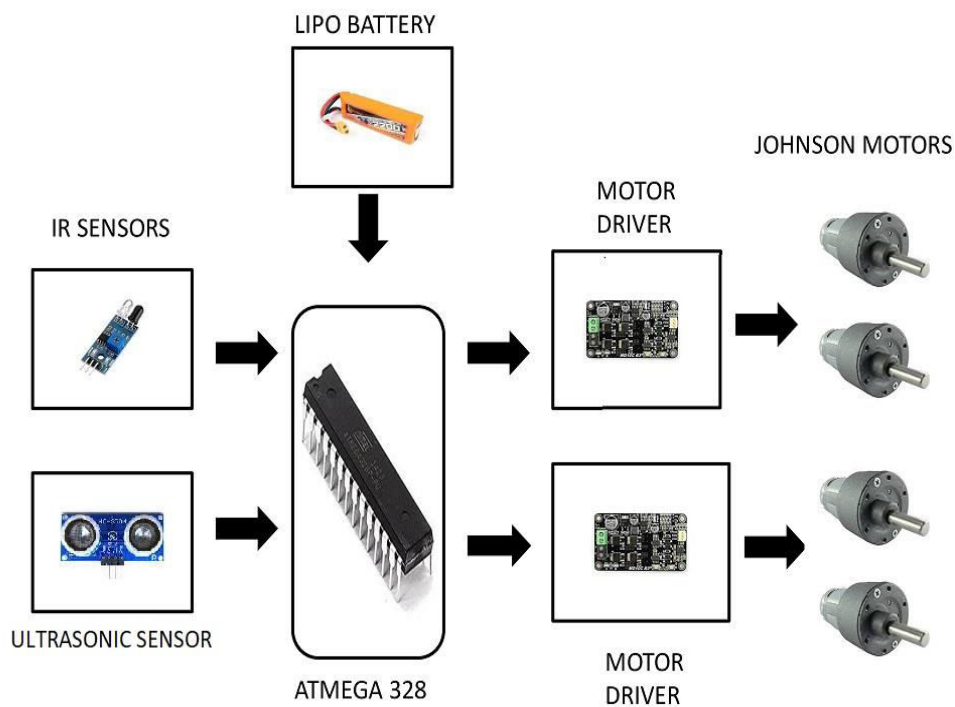
Smart shopping cart was proposed by Swetha. B, Abhishek, Ruthvik, Meghana. B, Narasimha Reddy and Gari Naresh.[4]. It was from Iconic Research and Engineering Journals(IREJ) and it was published in the year of 2020. In this project the intended system design for the automation of the shopping process by merging various technologies like Arduino Uno, RFID, and Android mobile application. This experimental prototype is designed to eliminate the time-consuming shopping process and quality of services issues.

Remote Controlled Smart shopping trolley was proposed by Tilak Parmar, Pranav Veerani and Varsha Rathod.[5]. It was from L.D. College of Engineering(LDE) and it was published in the year of 2017. The main aim of our project is to reduce the time spent during the wait in the queue at the billing counter. By using the RFID technology, we are able to scan multiple items at a given time. In this project the person can remotely control the cart. And this frees the customer of the burden to push heavy trolleys around the shopping mall.

### III. COMPONENTS AND MATERIALS, METHODOLOGY

#### 3.1. Components:

The following components are used in Smart Shopping Trolley System using ATMEGA328P Microcontroller:



**Ultrasonic sensor:** An ultrasonic sensor is a device that uses ultrasonic waves to measure distances and detect objects. It emits high-frequency sound waves (beyond the range of human hearing) and measures the time it takes for the waves to bounce back after hitting an object. This information is then used to calculate the distance to the object. Ultrasonic sensors are commonly used in robotics, automation, parking assistance systems, and many other applications where non-contact distance measurement or object detection is required.

**IR Sensor:** An IR (Infrared) sensor is a device that detects infrared radiation emitted or reflected by objects. It typically consists of an IR emitter (an infrared LED) and an IR receiver (usually a photodiode or phototransistor). When the emitter emits infrared light and it hits an object, some of the light is reflected back. The receiver detects this reflected

infrared light, and based on its intensity or presence, the sensor can determine the distance to the object or detect its presence.

IR sensors are commonly used for proximity sensing, object detection, motion detection, and remote control applications. They are found in various devices such as motion-activated lights, proximity sensors in smartphones, and remote controls for TVs and other electronics.

**LIPO Battery:** A LiPo (Lithium Polymer) battery is a type of rechargeable battery that uses a lithium-ion technology in a flexible, polymer electrolyte format. LiPo batteries are known for their high energy density, lightweight construction, and ability to be manufactured in various shapes and sizes. They are commonly used in portable electronic devices such as smartphones, tablets, drones, RC vehicles, and wearable devices due to their compact size and high energy storage capacity. LiPo batteries require special care during charging, usage, and storage to ensure safety and longevity, as mishandling can lead to swelling, overheating, or even fire hazard.

**ATMEGA328P:** The ATmega328P is a popular microcontroller chip manufactured by Atmel, now part of Microchip Technology. It belongs to the AVR family of microcontrollers and is widely used in various electronic projects and products. Here are some key features and characteristics of the ATmega328P.

**Motor Driver:** A motor driver is an electronic device or circuit that controls the speed and direction of an electric motor. It interprets signals from a microcontroller or other control system and provides the necessary power and voltage to drive the motor accordingly.

Motor drivers are commonly used in robotics, CNC machines, electric vehicles, drones, and various other applications where precise control of electric motors is required. They provide protection features such as overcurrent protection, overvoltage protection, and thermal shutdown to ensure the safe operation of the motor and the driver circuitry.

**DC Motor:** A DC motor is an electrical machine that converts direct current (DC) electrical energy into mechanical energy. It works on the principle of Lorentz force, where a current-carrying conductor experiences a force when placed in a magnetic field. DC motors are commonly used in various applications such as in appliances, automobiles, and industrial machinery.

A DC motor, or direct current motor, is a type of electric motor that converts electrical energy into mechanical energy. It operates using direct current electricity and consists of a stator (stationary part) and a rotor (rotating part). DC motors are commonly used in various applications, including robotics, electric vehicles, industrial machinery, and household appliances.

### 3.2. Algorithm:

**Step 1:** Start

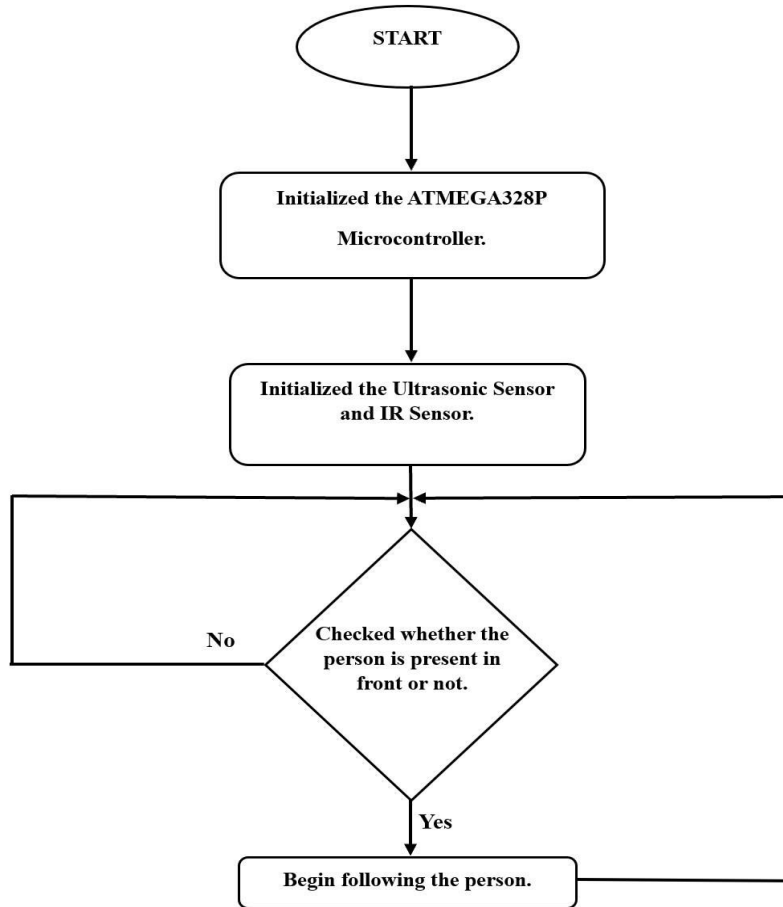
**Step 2:** Initialized the ATMEGA328P Microcontroller

**Step 3:** Initialized the Ultrasonic Sensor and IR Sensor

**Step 4:** Checked whether the person is present in front or not, If YES then begin following. If NO then keep checking

**Step 5:** Repeating the step 4 continuously.

**3.3. Flow Chart:**



The Smart Shopping Trolley is initialized by giving required power supply by using LIPO Battery. And then it starts the working of ATMEGA328P Microcontroller. After that it gives the respective commands to the various components. Then the Ultrasonic sensor and IR sensor starts working. Here we met the condition, it will check whether the person is present in front of it or not. Here we have two possible outcomes. If YES then begin following. If NO then keep checking. These two possible ways sensed by the sensors and give the data to the ATMEGA328P Microcontroller. And then it will give the instructions whether to follow the person or not. The conditional cycle will be repeatedly continue until the operation gets terminated.

**IV. RESULTS AND ANALYSIS**

We have successfully completed the making of smart shopping trolley by using ATMEGA328P microcontroller which is used to follow the customers. This trolley uses ultrasonic range sensors and Infrared sensors. The test was performed on the both ultrasonic sensor and infrared sensor that the sensor was working accurately within the range of 10 cm. An ultrasonic sensor is used to detect the customer whether he is present in front of it or not and Infrared sensor is used to track and follow the customer. And also these sensors are used to move the trolley in left and right direction accordingly. Then we test the serial communication of ATMEGA328P Microcontroller, motor driver, and various motors.

This trolley took a huge amount of time to complete this project. We were faced lots of problems regarding the fabrication of components, as there was lot of connections in the circuits. Which was very difficult for us to identify the errors. And finally the errors were rectified and project work successfully. Motors drivers connections got interchanged which was rectified and our trolley works perfectly fine. Finally, after the lots of effort and time our objective was achieved which was to implement a good Customer-Trolley interaction.



#### 4.1. Problem statement:

Now a days Old aged and physically disabled individuals often encounter significant challenges when navigating through retail environments, particularly when they require assistance with pushing or carrying a shopping trolley. In traditional shopping trolleys lack the necessary accommodations and features to cater to the unique needs of this demographic, resulting in a lack of accessibility and independence during the shopping experience. By addressing these key issues, this project aims to contribute to the development of innovative solutions for enhancing user experience and efficiency in traditional shopping trolleys.

#### 4.2. Solution Overview:

The smart shopping trolley aims to develop a smart shopping trolley equipped with sensors and microcontroller technology to autonomously follow customers as they move through the store which improves customer satisfaction. This innovative solution will enhance the shopping experience by providing convenience and reducing physical strain on customers. And this helps a lot to old aged and physically disabled persons. Additionally, the smart trolley will offer features such as Autonomous Navigation, Safety Features, Obstacle Avoidance, Real-time Tracking, long battery. Through this project, we aim to revolutionize traditional shopping methods and create a more efficient and enjoyable shopping experience for consumers.

### V. CONCLUSION

In the world the robotics generation is coming. In this smart shopping trolleys can change the future of robotics and automation. The implementation of smart shopping trolley that autonomously follows customers and offers significant advantages in terms of convenience, efficiency and enhanced shopping experience. By harnessing technology such as sensors and robotics, this innovation streamlines the shopping process, reduces physical strain on customers, and provides assistance and valuable data insights for retailers. As society continuous to embrace automation and smart solutions, integrating smart shopping trolleys into retail environments presents a promising opportunity to re define the future of shopping. Hence this will change the future of smart shopping experience. And finally we completed this project by believe that our project will be helpful in future and it will help old aged and physically disabled persons to overcome significant challenges.

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