2026 Volume: 02 Issue: 03 www.ijrpa.com ISSN 2456-9995 Review Article

International Journal Research Publication Analysis

Page: 01-08

BUDDY BASKET

***Manibharathi T. L., Muthusaram (A) Poojasri P., Nivetha S., Lekashri N.,**

UG Students, Department of Electrical and Electronics Engineering, P. A. College of Engineering and Technology, Pollachi, Tamil Nadu, India

Article Received: 18 February 2026
Article Revised: 08 March 2026
Published on: 28 March 2026

***Corresponding Author: Manibharathi T. L.**
UG Students, Department of Electrical and Electronics Engineering, P. A. College of Engineering and Technology, Pollachi, Tamil Nadu, India.
DOI: https://doi-doi.org/101555/ijrpa.5288

ABSTRACT

Buddy Basket is a mobile robotic system. designed to follow a person autonomously, keeping a fixed distance using ultrasonic sensing technology, the main objective of this project is to reduce manual effort for carrying loads and be cost-effective. For assistance in various environments such as shopping malls, airports, and healthcare facilities. The system is powered by a 12v battery. The location is achieved using two dc motors, which are controlled through a driver circuit will ensure reliable forward, reverse, and turning motions of the robot. The ultrasonic sensor continuously measures the distance between the robot and the human target, while the ESP32/ESP8266. The Microcontroller processes this data and generates the necessary control. signal to the motor driver. ESP32/8266 also offers the possibility of wireless connectivity and integration with IOT, making the system more flexible, modular and scalable for further developments. This design is enclosed in a compact chassis to protect the components and provide stability during motion. in general, the project contributes to the development of smart, interactive, and practical systems of robotics in everyday life applications.

1. INTRODUCTION

Robotics is an emerging field that combines mechanical concept of service robots has gained increasing attention due to their ability to assist humans in daily life activities, reduce manual effort, and enhance convenience. One such category is the human-following robot, which is specifically designed to detect and follow a human target automatically. These robots are equipped with sensors and controllers that enable them to maintain a safe distance while moving behind the user, thereby acting as a supportive companion. The importance of human-following Shopping trolley lies in their wide range of potential applications. In airports and shopping malls, they can function as intelligent trolleys, carrying luggage and goods for travelers or customers. In warehouses and industries, they can transport tools or lightweight materials from one point to another, improving efficiency. In healthcare, such robots can assist elderly people or patients by carrying medicines, food, or personal belongings. These applications highlight the growing demand for affordable, user-friendly, and efficient robotic solutions. Traditional systems such as manual carts, remote-controlled robots, or line-following robots have been used for similar purposes, but they are limited in flexibility and require constant human effort. More advanced systems like vision-based or tag-based tracking robots provide better accuracy but are costly and complex, making them unsuitable for small-scale or low-budget projects. To bridge this gap, the proposed human-following robot uses ultrasonic distance sensing technology combined with a simple motor control mechanism. The system is powered by a 12V rechargeable battery, ensuring adequate mobility and runtime. DC motors mounted on a wheeled chassis provide movement, while a motor driver regulates their operation. An ultrasonic sensor is used to continuously measure the distance from the human target, and an ESP32/ESP8266 microcontroller processes this data to generate control signals. This ensures that the robot can follow the user smoothly while avoiding collisions. Thus, the project aims to design a low-cost, portable, and effective robotic assistant that demonstrates the practical application of robotics in everyday life.

a) Literature review

Hihua Qiao , Junzhe Zhang1,Xiaoguang Quand Jiandong Xiong (Dynamic Self-Organizing Leader-Follower Control in a Swarm Mobile Robots System Under Limited Communication)-2020 The leader-follower model is found efficient for robot swarm exploration tasks. When a swarm of mobile robots collaboratively explore an unknown environment with limited communication, such as communication delay or even message loss, it is necessary to adaptively re-group robots according to the dynamic communication conditions and task goals. [1].

P. R. Bana, K. P. Panda,S. Padmanaban, L. Mihet-Popa, G. Panda (Observer-Based Leader-Following Formation Control for Multi-Robot With Obstacle Avoidance)-2020This paper focuses on the observer-based leader-following formation tracking control for multi-robot with obstacle avoidance. First, based on the leader-follower formation control method, setting the trajectory of the leader robot, then the follower robots track the leader robot.[2]. Junseok Boo; Dongk young Chwa(Fuzzy Integral Sliding Mode Observer-Based Formation Control of

Mobile Robots With Kinematic Disturbance and Unknown Leader and Follower Velocities)-2022 Fuzzy integral sliding mode observer (FISMO) based leader-follower formation control with the use of ceiling-mounted camera information is proposed for mobile robots with kinematic disturbance and no information of the velocities of leader and follower robots.[3]. Van-Phong Vu; Tu-Gia-Thinh Nguyen; Xuan-Sang Nguyen; Van-Tung Le; Duc-Hung Pham (ITSP/IMTSP-Based Path Planning for Multiple-Mobile Robot System)-2024The novel methods for determining the optimal moving trajectories and formation control of the Multiple Mobile Robot System (MMRS) are studied in this paper. The Ant Colony Optimization (ACO) algorithm combined with the A ∗ algorithm is employed to solve the Inner Travel Salesmen Problem (ITSP) and Inner Multiple Travel Salesman Problem (IMTSP) to obtain the optimal path for MMRS. [4]. Yandong Li; Ling Zhu; Yuan Guo Observer-based multivariable fixed-time formation control of mobile robots)-2020 This paper proposes a multivariable fixed-time leader-follower formation control method for a group of nonholonomic mobile robots, which has the ability to estimate multiple uncertainties. Firstly, based on the state space model of the leader-follower formation, a multivariable fixed-time formation kinematics controller is designed.. [5].

1. SYSTEM BLOCK DIAGRAM

The proposed human-following robot is designed as a low-cost, efficient, and user-friendly mobile system capable of autonomously following a human target. The robot is built on a wheeled chassis with two DC motors and motorized wheels for locomotion. A motor driver circuit controls the motors, enabling forward, backward, and turning movements based on control signals from the microcontroller. The system is powered by a 12V rechargeable battery, and voltage regulators are used to provide stable operating voltages for the ESP32/ESP8266 microcontroller and other electronic components. An ultrasonic sensor is mounted at the front of the robot to continuously measure the distance between the robot and the human target. The ESP32/ESP8266 microcontroller processes this distance data and generates corresponding motor commands through the motor driver to maintain a fixed safe distance from the user. The microcontroller’s high processing capability and optional Wi-Fi connectivity also allow future enhancements such as IoT integration or remote monitoring. This configuration ensures smooth following behavior, obstacle avoidance, and reliable operation in indoor environments. Compared to existing systems, the proposed design eliminates the need for tags or complex vision sensors, reduces cost, and offers a compact and portable solution suitable for applications like assisting elderly people, carrying luggage, or transporting materials in warehouses. The system demonstrates how basic components can be integrated effectively to achieve real-time human-robot interaction.

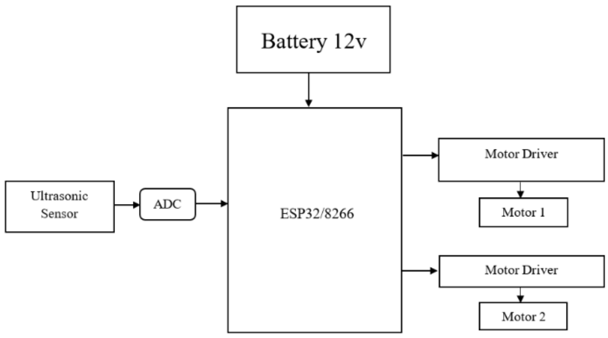


Figure 1. Proposed Block Diagram.

a) Circuit Design and its Explanation

For the Buddy basket, a compact inverter topology can be implemented to efficiently manage power from the 12V battery and supply stable voltage to the motors and electronics. The proposed system uses a DC-DC boost inverter topology, which steps up or regulates the battery voltage as required. The primary components include a MOSFET-based H-bridge circuit, a pulse-width modulation (PWM) controller, voltage regulators, and filter capacitors to ensure smooth output. The H-bridge configuration allows bidirectional control of the DC motors, enabling forward, backward, and turning movements. The PWM signals are generated by the ESP32/ESP8266 microcontroller, which also handles ultrasonic sensor input for distance control. Voltage regulators are used to supply stable 5V and 3.3V outputs for the microcontroller and sensors.

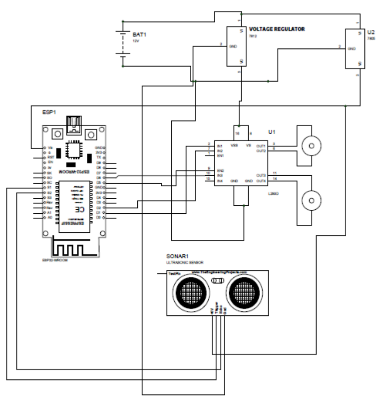


Figure.2 circuit diagram representation.

b) IOT Communication and Data Transmission Module

ARDUINO IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

BLYNK

Blynk is a platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5 mins. Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet Of Your Things.

2. SOFTWARE REQUIREMENTS

Blynk App: – It allows you to create amazing interfaces for your projects using various widgets which are provided. Blynk Server: – It is responsible for all the communications between the smartphone and hardware. You can use the Blynk Cloud or run your private Blynk server locally. It’s open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk Libraries: – It enables communication, for all the popular hardware platforms, with the server and process all the incoming and outcoming commands. Now imagine, every time you press a Button in the Blynk app, the message travels to the Blynk Cloud, where it magically finds its way to your hardware. It works the same in the opposite direction and everything happens in a blynk of an eye.

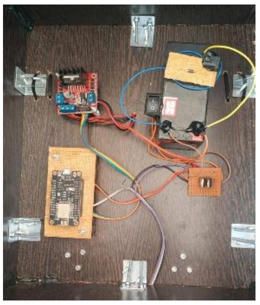
Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things. There are three major components in the platform:

Blynk App: – It allows you to create amazing interfaces for your projects using various widgets which are provided.

Blynk Server: – It is responsible for all the communications between the smartphone and hardware. You can use the Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.
Blynk Libraries: – It enables communication, for all the popular hardware platforms, with the server and process all the incoming and outcoming commands. Now imagine, every time you press a Button in the Blynk app, the message travels to the Blynk Cloud, where it magically finds its way to your hardware. It works the same in the opposite direction and everything happens in a blynk of an eye.

III. HARDWARE IMPLEMENTATION

g) Hardware Image



For the Buddy Basket a compact inverter topology can be implemented to efficiently manage power from the 12V battery and supply stable voltage to the motors and electronics. The proposed system uses a DC-DC boost inverter topology, which steps up or regulates the battery voltage as required. The primary components include a MOSFET-based H-bridge circuit, a pulse-width modulation (PWM) controller, voltage regulators, and filter capacitors to ensure smooth output. The H-bridge configuration allows bidirectional control of the DC motors, enabling forward, backward, and turning movements. The PWM signals are generated by the ESP32/ESP8266 microcontroller, which also handles ultrasonic sensor input for distance control. Voltage regulators are used to supply stable 5V and 3.3V outputs for the microcontroller and sensors. This topology ensures efficient energy usage from the 12V battery while providing the necessary control and protection for the motors. It is compact, cost-effective, and suitable for mobile robotic applications, making it ideal for indoor human-following operations. The design also allows future scalability, such as integrating higher-power actuators or adding IoT features.

IV. CONCLUSION

The Buddy Basket project demonstrates the successful integration of electronics, sensors, and microcontroller-based control to develop an intelligent mobile system capable of following a human target automatically. Using an ultrasonic sensor, the robot continuously detects the distance to the user and adjusts its movement through two DC motors controlled by a motor driver. The ESP32/ESP8266 microcontroller processes sensor inputs in real-time, generating precise motor commands to maintain a safe and consistent following distance. The 12V battery, combined with voltage regulators, provides a stable and portable power supply, making the system suitable for indoor applications. This project highlights the practical implementation of a low-cost, user-friendly solution that addresses the limitations of existing systems such as manual trolleys, line-following robots, and tag-based tracking devices

REFERENCES

1. Abujabal, N., Fareh, R., Sinan, S., Baziyad, M., & Bettayeb, M. (2023). A comprehensive review of the latest path planning developments for multi-robot formation systems. Robotica, 41(7), 2079-2104.
2. Baziyad, M., Saad, M., Fareh, R., Rabie, T., & Kamel, I. (2021). Addressing real-time demands for robotic path planning systems: A routing protocol approach. IEEE Access, 9, 38132–38143A. Prakash and P. Gupta, “Design of Smart Prepaid Energy Meter for Efficient Power Utilization,” International Journal of Innovative Technology and Exploring Engineering, vol. 9, no. 12, pp. 233–239, 2020.
3. Boo, J., & Chwa, D. (2022). Fuzzy integral sliding mode observer-based formation control of mobile robots with kinematic disturbance and unknown leader and follower velocities.
4. Fareh, R., Baziyad, M., Khadraoui, S., Brahmi, B., & Bettayeb, M. (2023). Logarithmic potential field: A new leader-follower robotic control mechanism to enhance the execution speed and safety attributes. IEEE Access, 11, 85451-85466.
5. Fareh, R., Baziyad, M., Rabie, T., Kamel, I., & Bettayeb, M. (2022). Sobel potential field: Addressing responsive demands for UAV path planning techniques. Drones, 6(7), 163.
6. Halder, S., & Afsari, K. (2023). Robots in inspection and monitoring of buildings and infrastructure: A systematic review. Applied Sciences, 13(4), 2304.
7. Jiang, Q., & Yan, H. (2022). Leader-follower motion control of two line following AGVs using PID algorithm. In Proc. IEEE 5th Adv. Inf. Manage., Communicates, Electron. Autom. Control Conf. (IMCEC), vol. 5, 445–449.N. Sharma and S. Verma, “IoT-Driven

Smart Energy Meter with Cloud-Based Data Logging," International Journal of Computer Applications, vol. 182, no. 25, pp. 1–7, 2019.

8. Yandong Li; Ling Zhu; Yuan Guo Observer-based multivariable fixed-time formation control of mobile robots)-2020
9. Simon, M. E., Baldissera, F. L., de Queiroz, M. H., & Cabral, F. G. (2023). Multi-robots coordination system for urban search and rescue assistance based on supervisory control theory. Journal of Control, Automation and Electrical Systems, 34(3), 484-495.
10. Tsiu, L., & Markus, E. D. (2020). A survey of formation control for multiple mobile robotic systems. Int. J. Mech. Eng. Robot. Res., 9, 1515-1520.