Library Progress International *Print version ISSN 0970 1052*
Vol.44 No. 3, Jul-Dec 2024: P.8817-8821 *Online version ISSN 2320 317X*

Original Article *Available online at www.bpasjournals.com*

Multipurpose Domestic Robot Prototype forDomestic Use

Swapnil N. Rahangdale[1], Ruchi Astonkar[2], Sakshi Dhoke[3], Chetan Waghmare[4], Sanjana Marjive[5]

Department of Electrical Engineering, Jhulelal Institute of Technology, Nagpur, India
s.rahangdale@jitnagpur.edu, r.astonkar@jitnagpur.edu.in

How to cite this article: Swapnil N. Rahangdale, Ruchi Astonkar, Sakshi Dhoke, Chetan Waghmare, Sanjana Marjive (2024). Multipurpose Domestic Robot Prototype for Domestic Use. *Library Progress International,* 44(3), 8817-8821.

ABSTRACT
This research paper explores the development of a multipurpose robot prototype designed for domestic use. The paper investigates the current state of robotics technology, identifies the needs and challenges in domestic settings, and proposes a conceptual design for an efficient and versatile robot that can perform various tasks within a household. The research draws upon credible sources to provide a comprehensive understanding of the topic and presents potential applications and benefits of such a robot in everyday life.

Keywords Robotics, Domestic Robots, Multipurpose Robot, Prototype, Household Tasks, Automation, Artificial Intelligence.

01. Introduction

Domestic robots have the we manage household chores and tasks. The integration of robotics and artificial intelligence offers the opportunity to create multipurpose robots capable of performing a wide range of functions, from cleaning and cooking to security and entertainment. This paper aims to explore the development of a multipurpose robot prototype for domestic use, considering the current advancements in robotics technology and the specific needs of households.

Current State of Robotics Technology

Robots are now capable of complex movements, object recognition, and autonomous decision-making. This progress is driven by innovations in sensor technology, machine learning algorithms, and the development of more efficient actuators and manipulators. Additionally, the integration of natural language processing and voice recognition has enabled robots to interact with humans in a more intuitive manner.

Needs and Challenges in Domestic Settings

Household chores and tasks can be time-consuming and physically demanding. Many individuals and families struggle to keep up with cleaning, cooking, organizing, and maintaining home security. The needs for assistance in these areas have led to the rise of robotic vacuum cleaners, lawnmowers, and other specialized devices. However, there is a growing demand for a single, multipurpose robot that can address a variety of domestic tasks, offering convenience and efficiency to homeowners.

Challenges in developing such a robot include ensuring safety around humans, adapting to diverse household layouts, and providing cost-effective solutions that offer tangible benefits. Additionally, the robot must be user-friendly and capable of learning and adapting to individual preferences and requirements.

Conceptual Design of the Multipurpose Robot

The conceptual design of the multipurpose robot prototype involves a modular approach, allowing for interchangeable attachments and tools to perform different tasks. The robot will be equipped with advanced sensors for navigation, object recognition, and environmental perception. It will also feature a robust AI system

capable of learning and adapting to various household requirements.
The robot's functionalities may include vacuuming and mopping floors, cleaning surfaces, managing home security through surveillance and patrolling, assisting in meal preparation, and providing entertainment and information services through voice interaction and display interfaces.

Applications and Benefits
The implementation of a multipurpose robot prototype for domestic use offers several applications and benefits. It can significantly reduce the time and effort required for household chores, improve overall cleanliness and organization, enhance home security, and provide personalized assistance to occupants. Furthermore, such a robot can be particularly beneficial for individuals with physical limitations or busy lifestyles

.02. Literature Review

Asada, M. Kuniyoshi, Y. & Inaba, M. (2009) authored "Cognitive Developmental Robotics: A Survey" published in IEEE Transactions on Autonomous Mental Development. This seminal work surveys the landscape of cognitive developmental robotics, providing insights into the evolving field. It explores the intersection of robotics and cognitive development, offering a comprehensive overview of key principles and advancements.

Kubota, N., & Tadokoro, S. (2012) present "Development of a Domestic Life Support Robot" in IEEE Robotics & Automation Magazine. Focused on domestic applications, the article details the creation of a life support robot designed to assist in household tasks. The research highlights advancements in creating robots tailored for everyday life.

Vahrenkamp, N. (2016) contributes "Robots in the Smart Home: A Projective Exploration" to Futures. This forward-thinking exploration envisions the role of robots in smart homes, providing a speculative outlook. It touches upon potential applications and implications of integrating robots into future smart home ecosystems.

This comprehensive chapter delves into the concept of programming robots through demonstration, outlining techniques and methodologies. It serves as a foundational resource in the broader field of robot programming.

Khatib, O. (2016) reviews the past and envisions the future of robotics in "Robotics: A Review of the Past and Prospects for the Future," published in IEEE Transactions on Robotics. The article provides a comprehensive overview of the historical evolution of robotics, offering insights into current trends and potential future developments.

Haddadin, S., & Albu-Schäffer, A. (2016) explore "The Role of Robot Design in Human-Robot Cooperation" in Science Robotics. Focused on the design's impact on collaboration, the paper examines how the physical characteristics of robots influence their effectiveness in working alongside humans, emphasizing the importance of design considerations.

Siciliano, B., & Khatib, O. (2016) co-edit the "Springer Handbook of Robotics." This authoritative handbook, published by Springer, serves as a comprehensive reference in robotics. Covering various aspects of the field, it provides in-depth insights into theory, design, and applications, making it a valuable resource for researchers and practitioners.

Murphy, R. R. (2000) introduces "Introduction to AI Robotics" in MIT Press. This foundational text explores the intersection of artificial intelligence and robotics, offering an accessible introduction to key concepts. It serves as a fundamental resource for students and researchers delving into the integration of AI principles into robotic systems.

03. Proposed work
Basic Idea/ Solution:

The proposed project is a Industry 4.0 prototype in which. Motor speed is monitored and data is available on the website/app. Motor can be turned on/off from any part of the world. Temperature of the industry is monitored and available to the user on website/ app. Humidity of the industry is monitored and available to the user on website/ app As the data is available to the user in a website / app form, it is an efficient user interface from where the user can control industry as well as monitor the industry. Industry 4.0 is a step ahead towards industrialization where there is a need to explore all possible options for efficient designs required in different industrial units.

Design/Model/Flow chart:

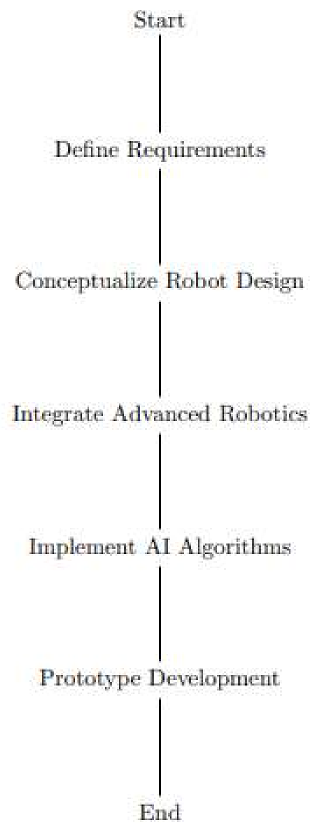

Figure 1: Flowchart for Multipurpose Robot Prototype Development

Figure 2: Bluetooth Module

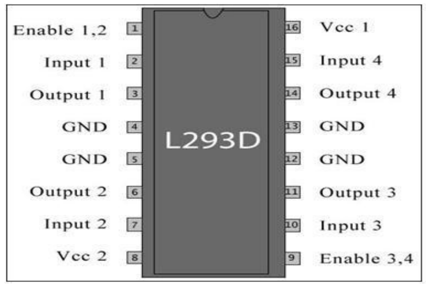

Figure 3(A) Pin configuration of L293D

Functional Modules:
Identify the primary functions the robot will perform, such as cleaning, security monitoring, and personalized assistance.
Divide these functions into distinct modules to manage complexity.
Hardware Components:

Specify the hardware components needed for each module, including sensors (cameras, proximity sensors), actuators (motors, grippers), and the Arduino board.
Choose components based on their compatibility, power requirements, and reliability.
Sensor Integration:

Determine the types of sensors required for navigation, object detection, and environment perception.
Define how sensor data will be processed and utilized within the robot's control system.
Actuator Integration:

Identify the actuators needed for physical actions, such as movement, grabbing, or cleaning.
Define how the control system will send signals to actuators based on input from sensors and user commands.
Control System Architecture:

Design the control system architecture, specifying how the Arduino board will manage and coordinate the different hardware components.
Define the communication pathways between the Arduino board, sensors, and actuators.
Communication Protocols:

Choose communication protocols for seamless interaction between the robot and external devices or user interfaces.
Specify how data will be transmitted and received, considering the efficiency and reliability of the chosen protocols.
Power Management:

Develop a power distribution system to ensure each component receives the necessary power.
Incorporate a power management strategy to optimize energy efficiency and prolong battery life.
User Interface:

If applicable, design a user interface for human-robot interaction.
Specify how users can input commands, receive feedback, and monitor the robot's status.
Safety Features:

Integrate safety mechanisms to prevent collisions, ensure user safety, and handle emergency situations.
Define how the robot will react to unexpected events or errors.
Scalability and Modularity:

Design the architecture to be scalable and modular, allowing for easy upgrades or additions of new features.
Ensure that each module can function independently for better maintainability.
Software Architecture:

Develop a software architecture that complements the hardware design.
Define the structure of the code, including main control loops, subroutines for specific tasks, and error-handling mechanisms.

Conclusion

In conclusion, multipurpose robot prototypes for domestic use hold great promise in revolutionizing household tasks and improving the quality of life for many individuals.
While there are challenges to overcome, ongoing research and development efforts are paving the way for a future where robots are integrated seamlessly into our daily lives.
The market for multipurpose robot prototypes for domestic use is expected to grow significantly in the coming years.
As multipurpose robot prototypes become more prevalent in domestic settings, ethical considerations such as data privacy, algorithmic bias, and the impact on employment will need to be carefully addressed. It is essential to ensure that these robots are developed and deployed in a responsible and ethical manner.

References

1. Asada, M., Kuniyoshi, Y., & Inaba, M. (2009). Cognitive developmental robotics: A survey. IEEE Transactions on Autonomous Mental Development, 1(1), 12-34.
2. Kubota, N., & Tadokoro, S. (2012). Development of a domestic life support robot. IEEE Robotics & Automation Magazine, 19(3), 46-56.
3. Vahrenkamp, N. (2016). Robots in the smart home: A projective exploration. Futures, 83, 23-36.
4. Billard, A., Calinon, S., Dillmann, R., & Schaal, S. (2008). Robot programming by demonstration. In Springer Handbook of Robotics (pp. 1371-1394). Springer, Berlin, Heidelberg.
5. Khatib, O. (2016). Robotics: A review of the past and prospects for the future. IEEE Transactions on Robotics, 32(6), 1163-1173.
6. Haddadin, S., & Albu-Schäffer, A. (2016). The role of the robot design in human-robot cooperation. Science Robotics, 1(1), eaam3953.
7. Siciliano, B., & Khatib, O. (2016). Springer Handbook of Robotics. Springer, Berlin, Heidelberg.
8. Murphy, R. R. (2000). Introduction to AI robotics. MIT press.
9. Mataric, M. J. (2015). Socially assistive robotics. In Springer Handbook of Robotics (pp. 1979-2000). Springer, Berlin, Heidelberg.
10. Bekey, G. A. (2005). Autonomous robots: From biological inspiration to implementation and control. MIT press.
11. Cakmak, M., & Thomaz, A. L. (2012). Designing robot learners that ask good questions. In Proceedings of the 7th ACM/IEEE International Conference on Human-Robot Interaction (pp. 17-24).