DESIGN AND DEVELOPMENT OF GARBAGE COLLECTING ROBOT

Article · August 2023

CITATIONS
0

READS
1,122

6 authors, including:

Bazani Shaik
Ramachandra College of Engineering
42 PUBLICATIONS **31** CITATIONS

SEE PROFILE

DESIGN AND DEVELOPMENT OF GARBAGE COLLECTING ROBOT

Dr. Bazani Shaik [1],K. Tej Dheer[2*], B. Jaya Durga prasad[3], Ch. Bala Subramanyam[4], Ch. Sujith[5,] Dr.V.Srinivasar Rao[6]

[1,6] Professor, Ramachandra college of engineering, Mechanical department, NH-16 Bypass Road, Vatluru(V), Eluru District, Andhra Pradesh,534007, INDIA.

[2,3,4,5] Students of Ramachandra college of engineering, Mechanical department, NH-16 Bypass Road, Vatluru(V), Eluru District, Andhra Pradesh,534007, INDIA.

ABSTRACT

The main objective is to present a method for waste collection. We have created a model that can be controlled manually or by commands using Bluetooth and Arduino modules. Software is able to manage the robot, instructing the robotic jaw to gather immobile garbage and dry contents. We will build a flat metal plate in front of this robot to clear the mud content on the floor. This robot has a robot arm with links in which it can pick and dispense waste into the waste collecting bin. This robot may be used for both dust cleaning and rubbish collection tasks. The camera is mounted on the front of the chassis and will assist the administrator in monitoring the robot as it collects garbage and the path it takes. This robot has batteries fitted to prevent the use of additional fuels (or) power to execute the task. The Dc motor and gear mechanism are used to manually drive the robot arm. There are two degrees of freedom on this robot arm.

KEYWORDS: Arduino, Garbage collection, Robot arm, Dc motor, Gear mechanism, Camera.

1. INTRODUCTION

Waste management is a major problem that requires substantial attention on a global scale. In India, waste and rubbish are not properly managed, which puts public health, cleanliness, human safety, and the safety of wildlife at risk. In the majority of locations where human intervention is necessary, the manual rubbish collection system is still in use. Although manual waste management and garbage collection are good ways to create jobs, there are drawbacks, such as the occasional days-long shortage of manual labour for tasks like repairing railroad tracks. When dangerous gases are present, human safety is a major concern. The cost of producing the autonomous or semi-autonomous garbage collection unit may be considerable, but the cost of maintenance is generally lower.Before digging in to create our own solution, we need to first study the previous research and work done in the sector in order to grasp the requirement for a compact, cost effective, and scalable system. Several garbage collecting systems, autonomous robots, and waste segregators have

been prototyped. In this part, we present a quick evaluation of these current works, which include mobile robots, garbage collectors, and IoT-based devices for comparable use cases. A garbage collecting system was proposed. Wireless communication is used by a robot on the beach. The major goal of this study was to clean up rubbish on shoreline beaches. A shovel to sweep up rubbish, a trash box to dump the waste obtained, a solar cell (which may help use another source of power), an IP Camera to relay live feed to the user, and a Bluetooth module for wireless communication comprise the mobile robot system. It can take up large trash items such as plastic bottles, packs, and so on. The robot has tank wheels, making it suited for usage not just on the beach, but also in other difficult situations. It is a manual, environmentally friendly, and inexpensive solution.

2. LITERATURE REVIEW

Garbage collecting robot using iot Kavya.C, Kokila.C, Kowsalya.M, Maha.A, MUTHARASU.S, Waste collection and management is a subject undergoing extensive study, and solutions are being proposed meticulously. Thanks to an exponential rise in population, there is an increased production of waste, and also a significant amount of litter consisting of plastic, paper, and other such products carelessly thrown about and scattered in public. Thus, the need for a more robust waste management strategy is essential. Presently, waste management techniques either lack efficiency, or incur high costs. Collection of the unorganized and scattered garbage is the preliminary and most vital step of waste management, following proper segregation and disposal. This paper proposes, explains, and implements an original concept of making a modular, scalable and cost-effective system for garbage collection.

Deep Learning Based Robot for Automatically Picking up Garbage on the Grass Jinqiang Bai, Shiguo Lian, Member, IEEE, Zhaoxiang Liu, Kai Wang, Dijun Liu, this paper presents a novel garbage pickup robot which operates on the grass. The robot is able to detect the garbage accurately and autonomously by using a deep neural network for garbage recognition. In addition, with the ground segmentation using a deep neural network, a novel navigation strategy is proposed to guide the robot to move around. With the garbage recognition and automatic navigation functions, the robot can clean garbage on the ground in places like parks or schools efficiently and autonomously. Experimental results show that the garbage recognition accuracy can reach as high as 95%, and even without path planning, the navigation strategy can reach almost the same cleaning efficiency with traditional methods. Thus, the proposed robot can serve as a good assistance to relieve dustman’s physical labor on garbage cleaning tasks. Waste Management by a Robot- A Smart and Autonomous Technique Shikha Parashar1, Pankaj Tomar2 MTech Student (Robotics and Automation), IGDTUW, Delhi, India Now-a-days, management of waste from its collection to dumping and disruption has become one of the greatest challenging and arduous chore for municipal corporations, all around the globe.

To make this tedious job facile, a new concept of Smart Dustbin has been taken into consideration for Smart buildings, hospitals, schools and railway stations. The Smart garbage collector thought is an advancement of traditional garbage collector by levitating it to become smart inculcating sensors and some form of logics. This smart collector is a revolutionary idea of application of line following garbage car and pole fixed garbage part on predesigned locomotive path. The fixed bin makes use of ultrasonic sensors for level of garbage detection and updates the coeval level of the bin to the garbage car, using RF Module. This is thereby a fully automated system, making small contribution towards the theme of Clean India Green India.

OBJECTIVES:

A manually controlled garbage collection robot may have the following goals:

- **Efficient waste collection:** The robot must be capable of gathering trash and debris from a variety of locations, such as streets, parks, and public areas.
- **Reduce manual labour:** By utilizing a robot to collect rubbish, it is possible to reduce the need for human labour, which can save money and increase safety.
- **Improved sanitation**: By frequently collecting trash and discouraging littering, the robot should be made to contribute to the upkeep of a clean and hygienic environment.
- **Environmentally friendly:** The robot should be made of materials that are beneficial to the environment, and its carbon emissions should be kept to a minimum.
- **Versatility**: The robot should be capable of adjusting to different waste kinds, including recyclables, organic garbage, and hazardous waste, and be able to collect them safely and efficiently.
- **User-friendliness**: The robot should be user-friendly, and its operation should be simple and easy to understand
- **Cost-effectiveness**: The robot should be designed to be cost-effective, with low maintenance and operational costs, making it an appealing option for waste management organizations.
- **Time-saving**: The robot should be designed to collect waste quickly and efficiently, saving time for waste management personnel.

3. METHODOLOGY

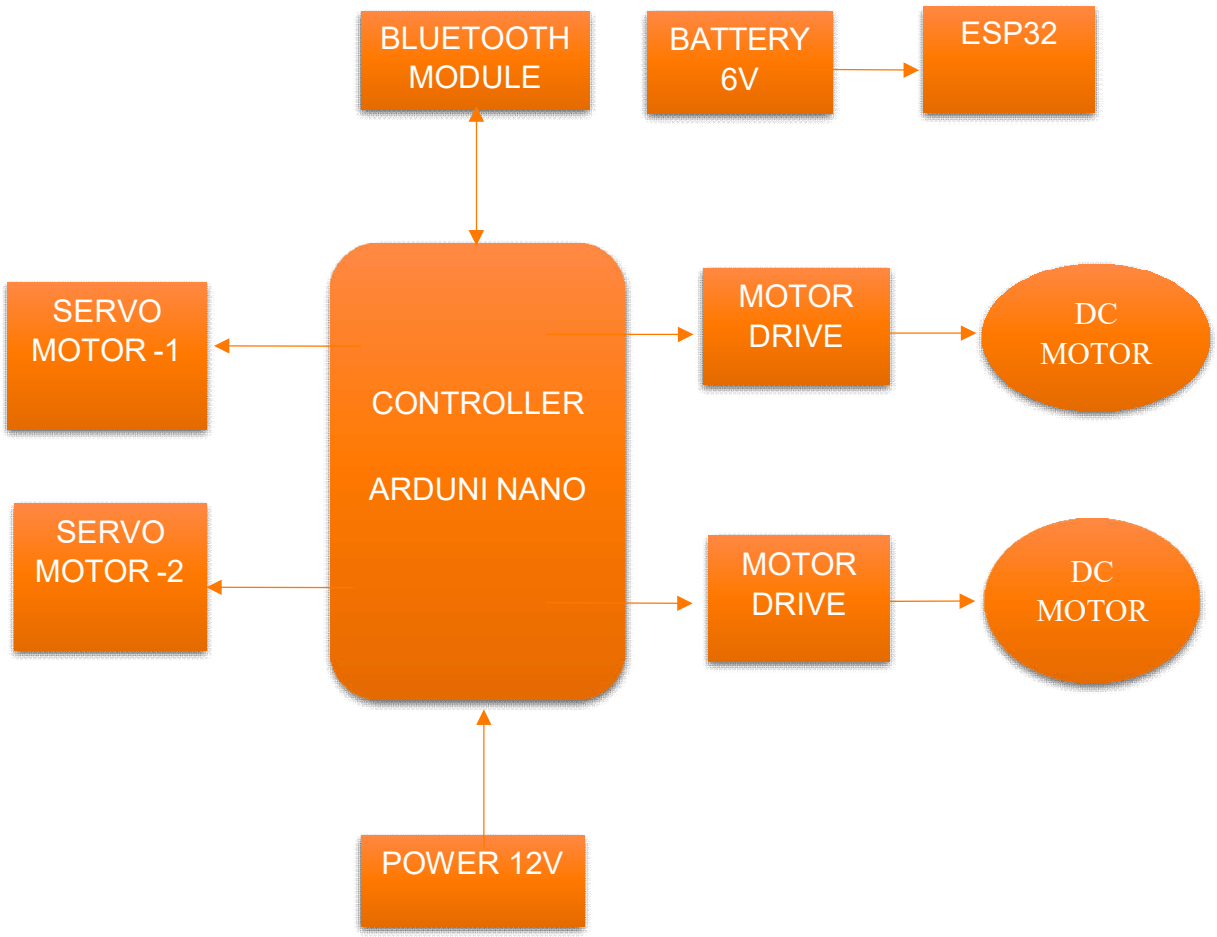


Figure 1. METHODOLOGY OF GARBAGE ROBOT SYSTEM

The system is totally user-friendly, and the project is built on a low-cost solution. For the wireless connectivity between the robot and the cellphone, we employed a single Bluetooth module. The cellphone produces the command and sends it over Bluetooth to the Arduino microcontroller, which reads it and performs the appropriate action. One robotic hand is mounted on the robot and will pick up waste and deposit it in a basket mounted on the robot.

The robot has two DC gear motors which specifications are as below:

Voltage = 12V

maximum Current at no load = 300mA

Current at full load = 1.2A the robot. In robotic hands, servo motors are utilized to move the robotic hand in four degrees of freedom. In this project, we utilized an Arduino-based microcontroller with 14 digital and 6 analogue pins. The ATMEL Family ATMEGA328 microcontroller in the Arduino Nano has an instruction execution time of one machine cycle per instruction. We utilized the L298N motor driver, which has two built-

in motor drivers in one chip. We connected two drivers in parallel to enhance the current because our motor driver current consumption is higher and one motor driver does not effectively manage these motors.

4. WORKING

The following components are we used to make this prototype,

L2938 motor drive	2	**Bluetooth module HC-05**	1
Johnson 100 rpm Dc motors	2	**Switches**	2
Controller At mega 328	1	**2v lithium batteries**	4
Servo motors	2	**Batteries holder**	2
Plastic wheels	4	**plastic gears**	3
Wheel belts rubber	2	**bin**	1
Plastic motor gears	2	**Jumper wires**	-
Esp. 32 Camera	1	**Dura cell batteries 1.5 v**	4

A human would normally manage the movement and rubbish collection mechanism of a manual-operated garbage collecting robot. The following is a general operating process for a manually controlled garbage collection robot:

Begin the robot: Turn on the robot and check that all of its components are working properly.

Control the motion: To control the robot's movement, the operator would utilise a remote control or a joystick. The robot could travel around on wheels or tracks, and the operator would guide it around the region where rubbish has to be collected.

Detect waste: The operator must keep an eye out for garbage and direct the robot towards it. This robot has a camera.

Trash collection: When the robot finds rubbish, the operator starts the garbage collection system. The mechanism might consist of mechanical arms, suction equipment, or any other garbage-picking gear.

Trash storage: Following collection, the robot's container would be used to store the rubbish. In order for the robot to continue collecting trash, the operator would need to make sure the container doesn't fill up.

Garbage disposal: After the robot has gathered enough trash or the collecting area has been completely covered, the operator would need to get rid of the trash. This can entail moving the trash to a bigger container or moving it physically to a specified disposal location.

End operation: Once the garbage has been disposed of, the robot can be turned off and put away until the next use. It's important to note that the working procedure can vary depending on the specific design of the manual-operated garbage collecting robot. The steps outlined above provide a general guideline for how such a robot could work.

Figure 2. Bluetooth android application

A microcontroller must be installed in place of the car's stock control circuit. This requires programming. The programme allows you to use your smartphone to operate a microcontroller and a Bluetooth-enabled RC car. For the code and control circuit, go to https://sites.google.com/site/bluetoothrccar/. The software allows you to drive the automobile using virtual buttons or the phone's accelerometer. If your car's control circuit has a slider bar, you can alter its velocity. There are also front and back light buttons. A blinking is when the phone is linked to the automobile, a light illuminate, and arrows illuminate, indicating the car's driving direction. This application is secure and available in google play store.

How to connect the bot to android application.?

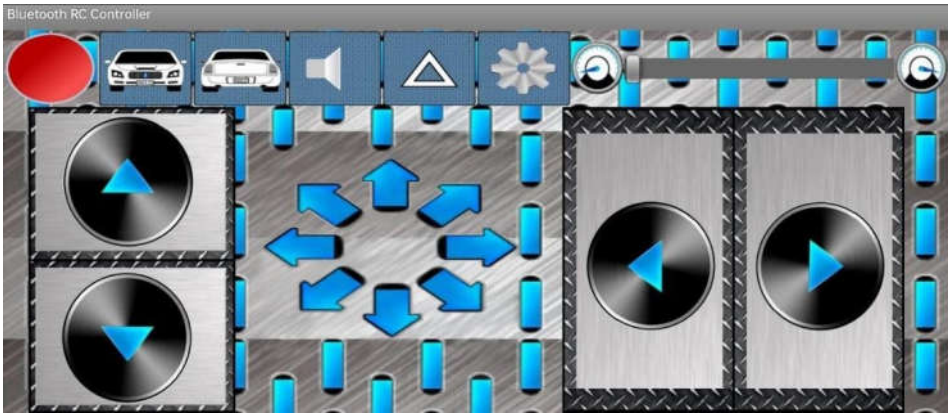
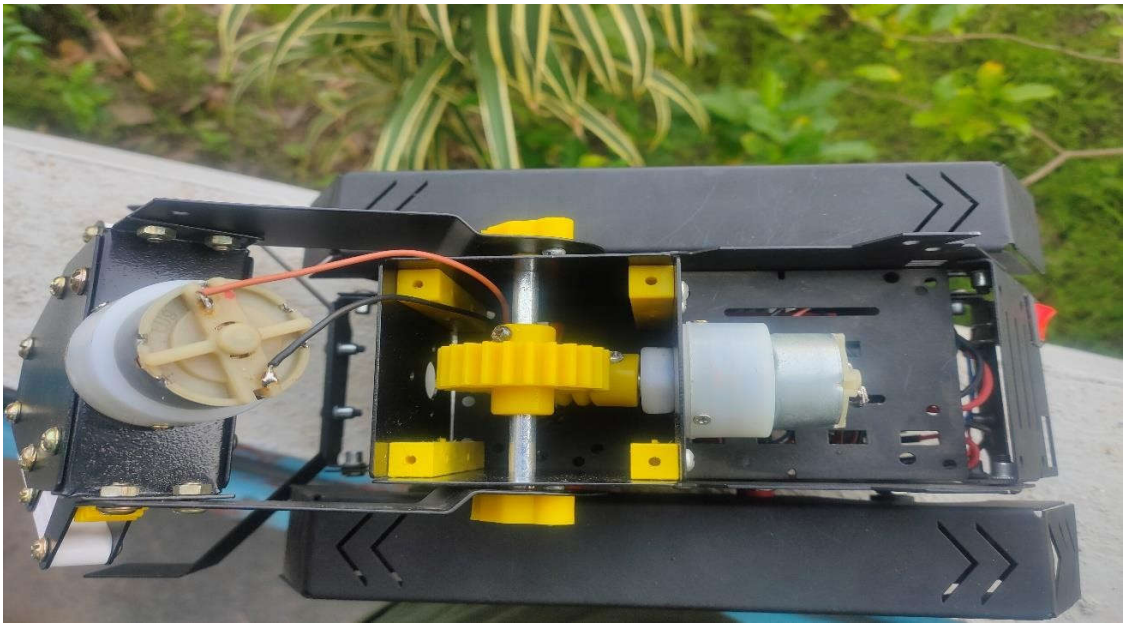


Figure 3. Android application

The above figure shows android application interface. The bot is totally controlled by the above commands. Firstly, tap on the setting option and it shows option menu then click on the first option to connect the Bot, before that make sure that Bluetooth option is enabled in android. Hence the robot is connected a green light is blinked at left top corner.

Side view

Front view



Top view

Figure 5. Garbage Collector Robot with different Views

ADVANTAGES OF MANUAL OPERATED ROBOT OVER AUTONOMOUS GARBAGE ROBOTS.

- **Price:** Compared to autonomous robots, manually controlled garbage collection robots are often less expensive. They don't need the sensors, CPUs, and other parts necessary for autonomous operation, and they only need less complicated gear and software.
- **Flexibility**: Compared to autonomous robots, manually controlled garbage collection robots are more adaptable in their movement and functioning. They are subject to the control and direction of the operator, who has the ability to modify the robot's trajectory and path as necessary. Autonomous robots, on the other hand, frequently adhere to a predetermined course or programme.
- **Human judgement**: A human being who is capable of making decisions and adapting to changing situations controls a manually driven garbage collection robot. They are able to recognise and pick up trash that an autonomous robot would not be able to, including items that are as objects that are partially hidden or obstructed.

- **Maintenance**: Compared to autonomous robots, manually controlled garbage collection robots require less maintenance. They don't require software updates or calibration, and they have fewer parts that may malfunction. Autonomous robots, on the other hand, need constant upkeep, software upgrades, and calibration to function properly.
- **Safety**: Unlike autonomous robots, manual garbage collection robots can operate in potentially dangerous or difficult conditions. The operator has the flexibility to adjust to shifting circumstances and act quickly to maintain safety. Robots that are autonomous might not be able to change their behaviour as rapidly, which could be dangerous.
- **Adaptability**: Robots for manually collecting trash have a great degree of adaptability and may be utilised in a variety of settings. They can be utilised in regions with difficult terrain.

APPLICATIONS OF MANUAL GARBAGE COLLECTING ROBOT

- **Public Spaces**: Parks, streets, walkways, and beaches may all be cleaned by hand-operated garbage-collecting robots. They may maintain a clean and secure environment for the general public by collecting garbage, debris, and litter.
- **Industrial Facilities:** Industrial facilities including factories, warehouses, and distribution centres can utilise manually operated garbage collection robots. They may gather rubbish, particles, and other things, lightening the strain on the cleaning crew and enhancing productivity.
- **Hazardous trash**: Sites for the disposal of hazardous trash might utilise manually driven garbage collection robots. They reduce the danger of exposure to human operators when collecting and transporting hazardous waste products including chemicals, radioactive materials, and medical waste.
- **agriculture:** Manually operated garbage collecting robots can be employed to gather waste and debris from fields, orchards, and farms. They can increase garbage collection efficiency and minimise agricultural worker workload.
- **Recreational Vehicles:** Manually operated garbage collecting robots may be employed in recreational vehicles such as RVs and boats to gather rubbish and keep the atmosphere clean and sanitary. They can eliminate the requirement for manual garbage disposal while also improving the overall user experience.

- **Airports:** Waste and debris may be collected from terminals, concourses and runways using manually controlled rubbish collection robots. They have the potential to enhance garbage collection efficiency while also lowering the danger of worker harm.

5. CONCLUSION AND FUTURE SCOPE

At the end of our project, we conclude that, garbage-collecting robots are a creative approach to the issue of waste management. They can move across various locations, gather and sort various waste materials, and lessen the amount of human effort needed for garbage management. These robots are getting more intelligent, effective, and economical thanks to technological breakthroughs. They have the power to fundamentally alter how we handle garbage, improving its sustainability and environmental friendliness. But there are other difficulties and restrictions to take into account, such as the requirement for appropriate upkeep, the price of an investment, and the potential effects on employment.

Future scope: The future scope for manual garbage-collecting robots is promising, as these robots are becoming increasingly sophisticated and versatile. With advancements in technology, manual garbage-collecting robots are expected to become more efficient, cost-effective, and user-friendly, offering a more sustainable and effective solution for waste management. One area of future development for manual garbage-collecting robots is in the field of artificial intelligence and machine learning. By incorporating machine learning algorithms and AI technologies, these robots can become more intelligent and better able to adapt to changing environments. This could help to improve their ability to navigate through complex environments, to identify different types of waste, and to sort them accordingly. Another area of future development is in the design of these robots. As the technology improves, manual garbage-collecting robots are expected to become more compact, portable, and easier to use.

REFERENCES

1. Jeelani, S., et al., Robotics and medicine: A scientific rainbow in hospital. Journal of Pharmacy & Bioallied Sciences, 2015. 7(Suppl 2): p. S381-S383
2. Aliff, M., S. Dohta, and T. Akagi, Simple Trajectory Control Method of Robot Arm Using Flexible Pneumatic Cylinders. Journal of Robotics and Mechatronics, 2015. 27(6): p. 698-705.
3. Aliff M, D.S., and Akagi T, Control and analysis of simple-structured robot arm using flexible pneumatic cylinders. International Journal of Advanced and Applied Sciences, 2017. 4(12): p. 151- 157.
4. Aliff, M., S. Dohta, and T. Akagi, Control and analysis of robot arm using flexible pneumatic cylinder. Mechanical Engineering Journal, 2014. 1(5): p. DR0051-DR0051.
5. M. Aliff, S. Dohta and T. Akagi, Trajectory controls and its analysis for robot arm using flexible pneumatic cylinders," IEEE International Symposium on Robotics and Intelligent Sensors (IRIS), 2015, pp. 48-54
6. .M. Aliff, S. Dohta and T. Akagi, Trajectory control of robot arm using flexible pneumatic cylinders and embedded controller, IEEE International Conference on Advanced Intelligent Mechatronics (AIM), 2015, pp. 1120-1125.
7. C. Xin, D. Qiao, S. Hongjie, L. Chunhe and Z. Haikuan, Design and Implementation of Debris Search and Rescue Robot System Based on Internet of Things, International Conference on Smart Grid and Electrical Automation (ICSGEA), 2018, pp. 303-307.
8. Yusof, M., and Dodd, T., Pangolin: A Variable Geometry Tracked Vehicle With Independent Track Control, Field Robotics, pp. 917-924.
9. [9] Day, C.-P., Robotics in Industry—Their Role in Intelligent Manufacturing. Engineering, 2018. 4(4): p. 440-445.
10. J. Lee, G. Park, J. Shin and J. Woo, Industrial robot calibration method using denavit — Hatenberg parameters, 17th International Conference on Control, Automation and Systems (ICCAS), 2017, pp. 1834-1837.
11. Sani, N. S., Shamsuddin, I. I. S., Sahran, S., Rahman, A. H. A and Muzaffar, E. N, Redefining selection of features and classification algorithms for room occupancy detection, International Journal on Advanced Science, Engineering and Information Technology, 2018, 8(4- 2), pp. 1486-1493.
12. Holliday, J. D., Sani, N., and Willett, P., Calculation of substructural analysis weights using a genetic algorithm, Journal of Chemical Information and Modeling, 2015, 55(2), pp. 214-221.
13. Holliday, J. D., N. Sani, and P. Willett, Ligand-based virtual screening using a genetic algorithm with

data fusion, Match: Communications in Mathematical and in Computer Chemistry, 80, pp. 623-638.

14. SamsiahSani, N., Shlash, I., Hassan, M., Hadi, A., and Aliff, M, Enhancing malaysia rainfall prediction using classification techniques, J. Appl. Environ. Biol. Sci, 2017, 7(2S), pp. 20-29.

15. Dr. Bazani Shaik, Ch. Devi sai pavan, G. Kiran Nagendra, Ch. Yaswanth, D. Nagendra,Design and development of human prosthetic robotic hand by using 3d printing technology.Page No : 644-655, DOI:10.0014.MSJ.2023.V11I04.0086781.114265.