

Design of Autonomous Garbage Collection Rover

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ABSTRACT: The world today faces major garbage crisis- the product of rapid economic growth, overcrowding, poor urban planning, corrosive corruption and political dysfunction. The present tried and tested methods of garbage collection have so far been proven ineffective. And the world today is looking at smarter ways of overcoming the garbage collection problem. This project presents the Garbage Collector robot and surveillance drone for foot path using microcontroller. The main purpose of this robot is to reduce use of man power and increase more of automation which is modern era trend. It will even help to reduce the load on economy to provide wages to each worker whereas same workforce can be used in recycling the waste which is very much needed in this modern era. The robot is designed to collect Garbage at foot path, public places (parks, schools and colleges), mostly cemented paths and beach. The robot cannot be used on muddy surfaces. The robot is built in such a way that, when it is started it will move on the path defined in the program. When it encounters the obstacle, depending on the conditions applied in the program the bot proceeds with further motion and then robot picks up the garbage.

The idea of garbage collection in a gated colony has immensely helpful in keeping the environment clean. The garbage gets collected from the resident's home at a specific time every day. This gives rise to a new set of problems. When the garbage collector comes, residents may not have enough garbage to be disposed or they may not be present in their home. Automated Garbage Collector Rover (AGCR) is a driver-less autonomous rover vehicle specifically designed to solve this issue. The residents will be able to place requests online, so that the AGCR reaches the specific homes to collect garbage. The AGCR is also equipped with a bin to collect the trash. Once the trash is collected, it would go back to its base position autonomously.

KEYWORDS: Robotic and automation, Image processing, I.O.T, Garbage collection, Sensors.

I. INTRODUCTION

Garbage is the major problem in urban areas of India. It is a major source of pollution. Indian cities alone generate more than 100 million tons of solid waste a year. (According to the last year's survey there is a record breaking 960 millions of tonnes solid waste is generated). In 2000, India's Supreme Court directed all Indian cities to implement a comprehensive waste-management programme that would include household collection of segregated waste, recycling and composting. These directions have simply been ignored. The problem that everyone is facing is that we are just collecting garbage rather than disposing and recycling it properly because we don't have adequate work force for that. No major city runs a comprehensive programme of the kind envisioned by the Supreme Court. It is not wrong to say that India is on verge of garbage crisis even though 1.96 lakh crore rupees are allotted for the Swachh Bharath Abhiyan.

There are already different type of garbage collection robots such as Robo-Dumbster which is used to dump a solid waste in dumping yard and dust card which is used to transfer solid waste. These robots which are in use have various disadvantages not designed to work in public places efficiently, like not user friendly and aims at only collecting filled dustbins but not on collecting mechanism, etc.

Also, Municipal solid waste workers or refuse collectors, universally expose too many work related health hazards and safety risks, notably allergic and other diseases of the respiratory system. This exposure to fatal health hazards need to be reduced in order to keep our employees safe because they are vulnerable to many disease and using this robot may help to achieve so.

Health impacts likes, gastro intestinal and infectious diseases as well as injuries caused by work-related accidents.

Hence to overcome this major problem of waste collection Autonomous Garbage Collection robot is developed. It aims at providing automatic control to collect the garbage. It differentiates between static and dynamic obstacle and move accordingly as it programmed. It basically consists of sensors at different levels to detect the dynamic obstacle. It also disposes the garbage to a pre-specified place. If the trash bin is filled, it will be detected and the garbage will be disposed. Our work is to make this robot more of user friendly and easy to handle so that we don't need much of skilled personal to operate it.

Objectives

1. This Rover is 4 Wheel drive having a garbage container with a dumping mechanism.
2. Its function is to transfer garbage from point to point, as instructed by the controller.
3. To increase the collection speed.
4. A large fraction of the work is repetitive and judicious application of automation will most certainly result in optimum utilization of machine and manpower. Basically our work will be to reduce man power and exposure to such deadly disease that people get collecting garbage.

II. LITERATURE REVIEW

Waste management are the activities required to manage waste from its collection to final disposal. This process includes collection, transport, treatment and disposal of waste. A waste can be solid, liquid or gas type therefore each type has different method of collection and disposal management process. Waste management deals with every types of waste including industrial, biological and household etc. According to the production of waste, waste management are different among countries, urban and rural areas, residential and industrial sectors therefore all take different approach.

Through out the history and current situation the amount of waste generated by the human is insignificant. This is because of increase in population, exploitation of natural resources etc. As well as increased industrial areas.

Therefore Indian cities alone generate more than 100 million tons of solid waste per year out of which 20% solid waste is treated and 50% is dumped in landfill sites but the main part is only 70% garbage get collected, therefore according to increase in percentage of garbage day by day the human power will not be efficient after some years the over populated countries like India, China etc. Their major waste management consists human power which will not efficient and effective in coming days therefore we have to adopt a new technology to control waste management.

In this paper propose of various aspect to design a Rover robot by considering various aspects with specification. The machine design explained clearly such that these Robots have a wide application in every field like industrial medical, defence etc. For transporting of materials. They can employ in places where accuracy and precision are required. Robots can also employed where human power is not helpful.

III. METHODOLOGY

In the project, the design of garbage collector robot uses engineering method. In sequence, the method is identification of the needs required. Then these needs are analyzed to get specific components. These components are later integrated to get the desired output.

The operation of the robot can be classified into three main categories. They are motion control the robot, garbage collection and disposal of garbage.

Garbage collector Rover, Programming hardware's for good communication, Garbage Container, Interpretation of disposal and tracking of rover, Conclusion and documentation. All this factors will work in sync with each other.

The system is fully automated therefore we don't need any human interference during the collection process. It reduces human power only surveillance can be done by humans which take less work at-least one if we thicken practically the system can cover more area in less amount of time with a precision

So we have combined the usage proximity sensors with image processing to accomplish our purpose, these are Infrared sensors (IR SENSORS) for path trajectory, ultrasonic sensors for obstacle avoidance as well as a level indicator, a camera for image processing which detects the location. The camera is mounted on a rover body which remains inactive until the request has come from the user through Wi-Fi by using I.O.T when location is detected by proximity sensors rover starts moving towards expected position following path trajectory by using IR sensors, when object get detected by proximity sensor camera capture a image and compile it with the request. If location get matched it stops if not it will move the advantage of this process is time, power and memory is saved. This is done with help of image processing concept once it detects the location the robot will stop on this place then it will start analyzing the level of

garbage inside the container during collection, this is done by using ultrasonic sensor if level is filled rover will get back to Home location for empty the container and again rover is ready to complete the process.

Now How System Works:-

The system starts from user as per their convenience and the robotic system respond it

As per the need, if user send his location to the rover by an app developed. Then this data is transferred to the rover at home location. As rover is path oriented it follows the path to its location.

After coming the location data from user the hardware inside the rover analyse the data and indicates the location from which it came from. Then the rover starts moving to its required position. The camera present on the rover start scanning the required place. When the place get matched with the data the rover stops it's motion and gives signal to the user, about it reaches the given location. Then user can put the garbage inside the container located on the top of the rover.

The garbage container have level indicator which shows the level of the garbage inside the container. If it completely fills or after the service the rover will come back to its home location. With the help of lifting mechanism it transfer garbage from one container to another. Like this it works.

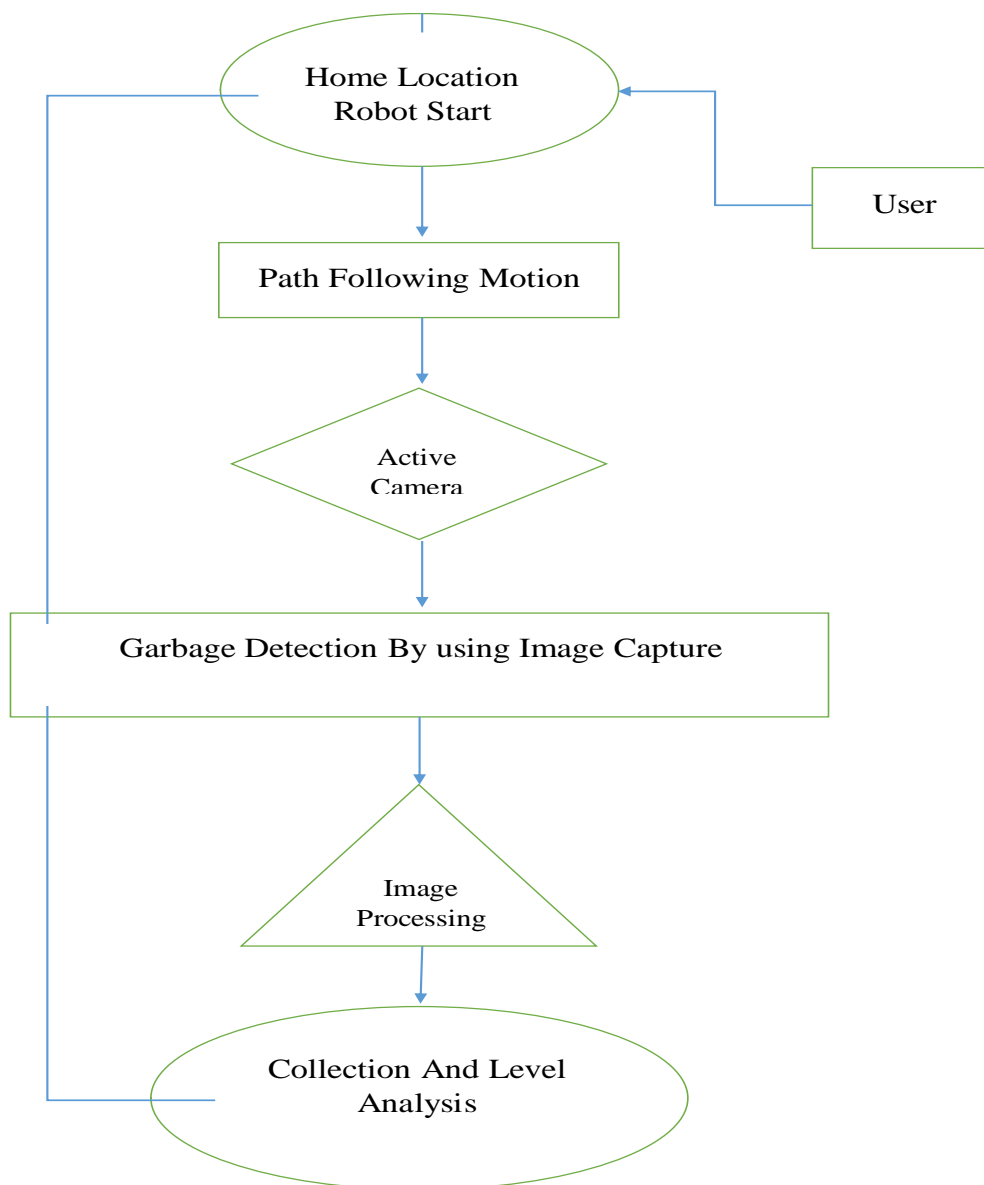


FIGURE 1- PROCESS LAYOUT

IV. EXPERIMENTAL RESULTS

The system is automatic, user friendly and simple to understand. This system shows how garbage from user home is kept and send to the location. Path following motion object detection, image processing and data communication were all performed successfully.

Whole system is based on the following segment

- 1) Communication system
- 2) Working of rover
- 3) Collection/interpretation of garbage

V. SYSTEM DESIGN

1) ROVER

The robot is made up of sheet metal of a Aluminium rectangular hollow chassis with four wheel drive on the top of garbage container with a dumping mechanism is mounted also a camera is fitted inside the rectangular chassis all circuitry is placed with all circuitry is placed with a hardware (Raspberry pi) and battery supply on the bottom I-R sensors are attached for the path following aspect also 12v dc motors are attach to attain motion for the robot.

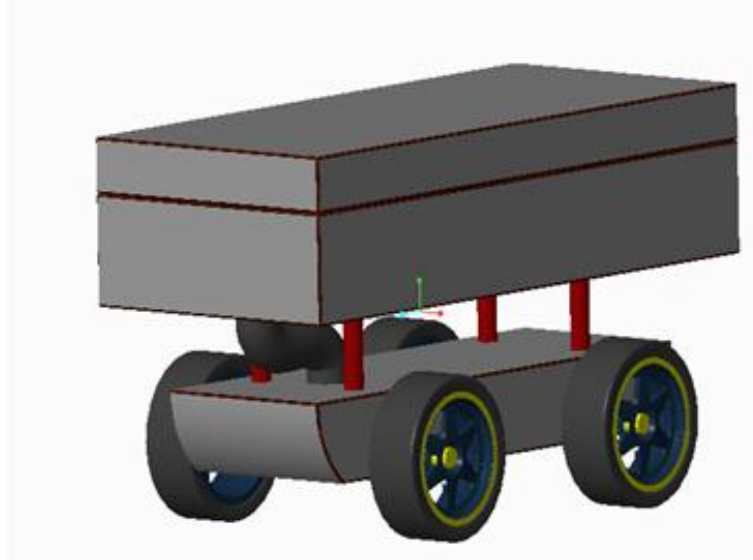


FIG-2 ISOMETRIC VIEW OF ROVER

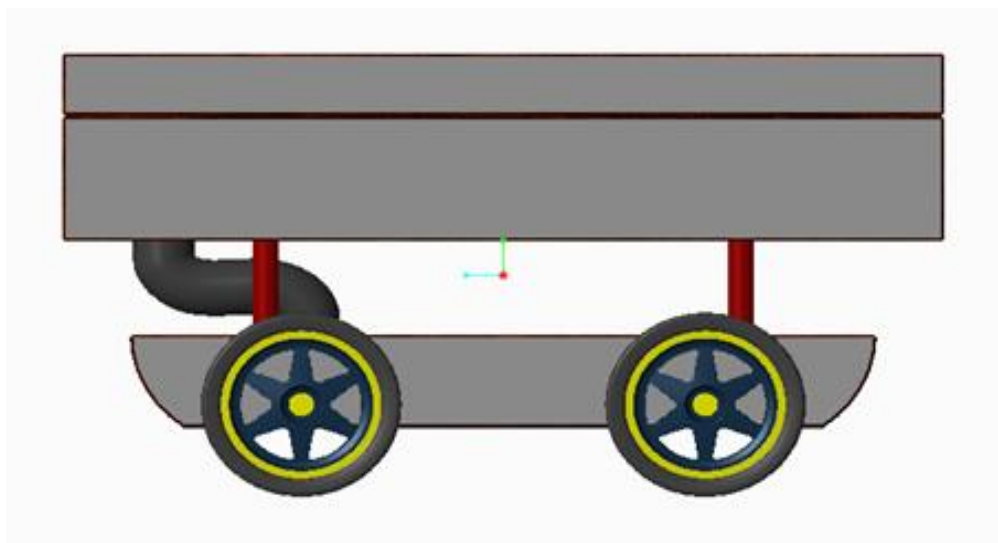


FIGURE 3- SIDE VIEW OF ROVER

2) CIRCUITRY ATTACHMENT

- The Robot is controlled by a hardware Raspberry pi with an Wi-Fi functionality
- The Rpi is connected to ultrasonic sensor, IR sensor, camera , motor drive module and dumping mechanism.
- Motor drive modules are each connected to 2 Dc motors to drive wheels.

3) NETWORK

The system is able to handle multiple robots with a Wi-Fi/I.O.T system. All robots are attached to ma central server through Laptop so that every robot is connected to a common hotspot. So as per the request the nearer robot can be activated to collect the garbage so that the Network is established.As per given in the following diagram.

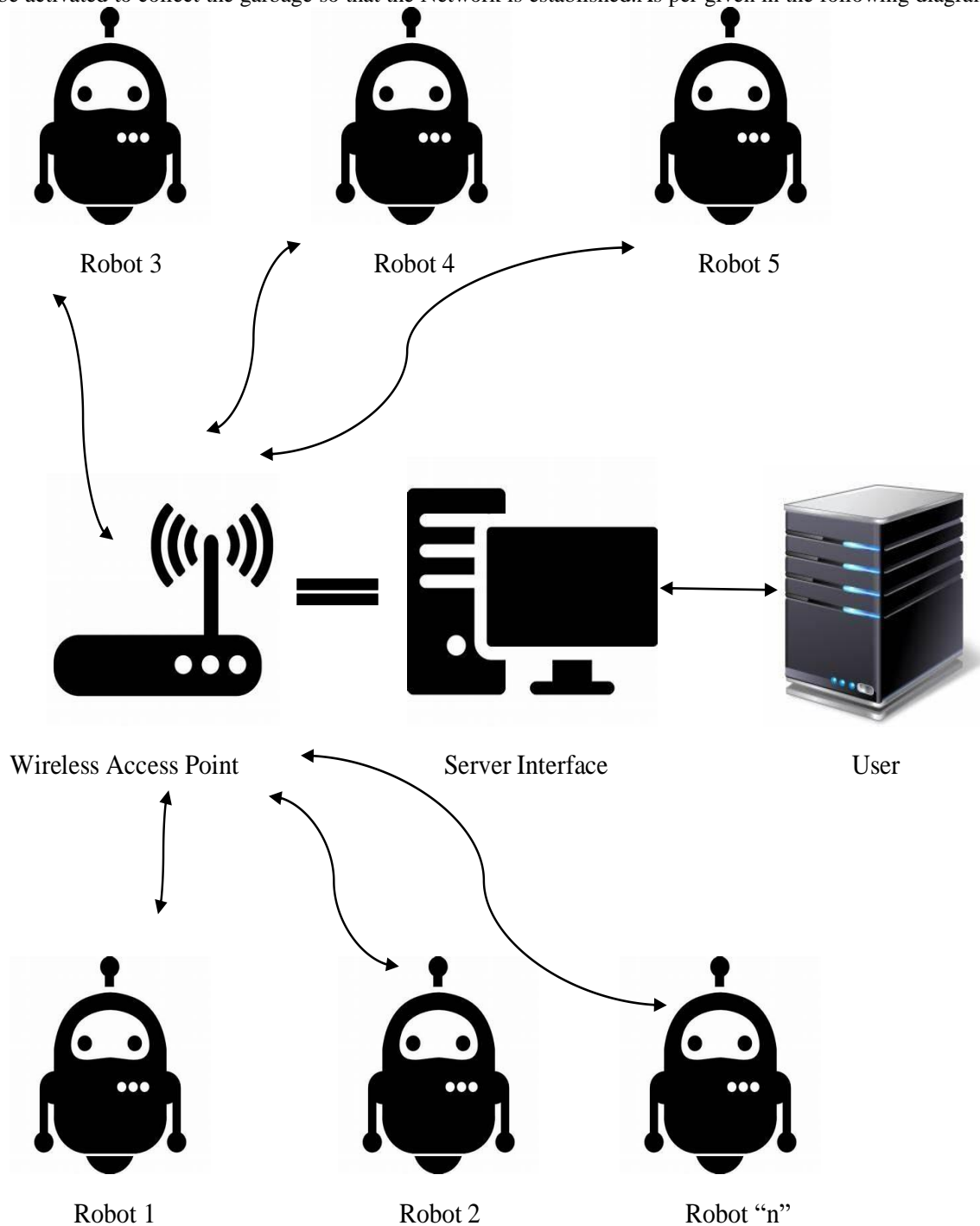


FIGURE 4- NETWORKING

VI. CONCLUSION

The proposed prototype has successfully been implemented, the adoption and implementation of existing tech. In a single integrated system can make it very efficient and smart to work this system optimize time, speed and power as it has a central server(I.O.T system) this can handle several robots for several tasks at a time, therefore it is helpful to increase the collection speed of the garbage by reducing human efforts. This system can be used in Defense, Medical and private sectors where humans presence is unsafe, this is primarily proposed for “SMART CITY”.

REFERENCES

1. Saravana Kannan G, Sasi Kumar S, Ragavan R, Balakrishnan M, “Automatic Garbage Separation Robot Using Image Processing Technique”, International Journal of Scientific and Research Publications, Volume 6, Issue 4, April 2016.
2. S.S. Navghane, M.S. Killedar, Dr.V.M. Rohokale, IoT Based Garbage and Waste Collection Bin, May 2016.
3. “Smart garbage management system” International Journal of Engineering Research & Technology (IJERT) ISSN: 22780181. www.ijert.org IJERTV4IS031175 Vol.4 Issue 03, March-2015.
4. Osiany Nurlansa, Dewi Anisa Istiqomah, Mahendra Astu Sanggha Pawitra, Member, IACSIT “AGATOR (Automatic Garbage Collector) as Automatic Garbage Collector Robot Model” International Journal of Future Computer and Communication, Vol. 3, No. 5, October 2014.
5. Hesham Alsaahafi, Majed Almaleky, “Design and Implementation of Metallic Waste Collection Robot”, SEE2014 Zone I Conference, April 3-5, 2014, University of Bridgeport, Bridgeport, CT, USA.
6. Marian Look, “Trash Plant: India”, earth911B.
7. Alexey Medvedev, Petr Fedchenkov, Arkady Zaslavsky, Theodoros, Anagnostopoulos Sergey Khoruzhnikov, Waste Management as an IoT-Enabled Service in Smart Cities I.
8. Dutta, A.K., ‘Sensor systems for robotic’, Ph.D Thesis, Jadavpur univ. Calcutta 1990
9. Albus, J.S., C.R. Mclean and M.L. Fitzgerald, “hierarchical control for robots in automated factory”, robots, 7, 1983
10. “Introduction to robotic process automation” Institute for robotic process automation and artificial intelligence, June 2015.
11. Anderw Burgess, “Robotic Process Automation & Artificial Intelligence” handbook posted on 7th June, 2017
12. Asatiani, A., & Penttinen, E. (2016). Turning robotic process automation into commercial success-Case OpusCapita. Journal of Information Technology Teaching Cases, 6, 67–74.
13. Lacity, M., & Willcocks, L. (2016a). Robotic Process Automation: The Next Transformation Lever for Shared Services. The Outsourcing Unit Working Research Paper Series
14. Le Clair, C. (2017). The Forrester Wave: Robotic Process Automation, Q1 2017. Forrester Research.
15. Kroll, C., Bujak, A., Darius, V., Enders, W., & Esser, M. (2016). Robotic Process Automation: Robots conquer business processes in back offices.