SMART ROBOT FOR DISPOSAL OF HEALTH CARE WASTE

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Abstract

Hospital waste transport and waste handling is a time consuming, hazardous and infectious process as the staff is exposed to be in contact with medical and bio-hazardous waste. Some wastes generated by health care activities includes a broad range of materials, from used needles and syringes to soiled dressings, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices and radioactive materials. Poor management of health care waste potentially exposes health care workers, waste handlers, patients and the community at large to infection, toxic effects and injuries, and risks polluting the environment. It is essential that all medical waste materials are appropriately treated and disposed of safely. In order to avoid this we need to ensure regular and safe disposal of waste to help the hospital maintain a clean environment for the patients, staff and visitors. In this project we propose to create a Robotic Arm by using Raspberry Pi and Image Processing which can be operated automatically and helps to dispose the medical-waste without human exposure/contact. In the present era, we are making a robot capable of detecting and placing the pre-specified object. The code for detection of colour has been written in Python. For a hardware implementation, we are using raspberry pi which has Raspbian OS based on Debian which is Linux OS. The camera detects the pre-specified objects and disposes them based on colour (RGB) using Image Processing. The program includes controlling the robotic arm, capturing the object, image processing, identifying the RGB object and perform all task automatically using Raspberry (Mini Computer).

Keywords: Raspberry pi, Servo, Robotic ARM, Image Processing, Health Care Industries, Medical Wastes.

1. Introduction

Artificial Intelligent robots are a fairly recent development. They form a bridge between robotics and AI. In recent years, AI has become an increasingly common presence in robotic solutions, introducing flexibility and learning capabilities in previously rigid applications. These robots are controlled by AI programs. Robot is programmable virtual artificial agent and general purpose electromagnetic machines that have some characteristics like human that is guided by computer program. Robots can be guided by an external control device or the control may be embedded within i.e. semi-autonomous or autonomous.

Of the total amount of waste generated by health care activities, about 85% is general, non-hazardous waste. The remaining 15% is considered as hazardous material that may be infectious, toxic or radioactive. Every year an estimated 16 billion injections are administered worldwide, but all of the needles and syringes are properly disposed afterwards. Open burning and incineration of health care wastes can, under some circumstance, result in the emission of dioxins, furans and particulate matter. Hospital waste transport and waste handling is a time consuming, hazardous and infectious process as the staff is exposed to be in contact with medical and bio-hazardous waste. These are the some waste generated by health care activities that includes a broad range of materials, from used needles and syringes to soiled dressings, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices and radioactive materials. Poor management of health care waste potentially exposes health care workers, waste handlers, patients and the community at large to infection, toxic effects and injuries, and risks polluting the environment. It is essential that all medical waste materials are

appropriately treated and disposed of safely. In order to avoid this we need to ensure regular and safe disposal of waste to help the hospital maintain a clean environment for the patients, staff and visitors.

2. Related works

The author has incorporated the robotic arm controller based on the location and the object orientation. The x and y co-ordinate of the object is found by converting pixel co-ordinate in to real world co-ordinate The fundamental problem taken into account is the picking and placing of the objects which are placed under vision sensor [15]. Critical review on automation and robotics applications at a post disaster scenario is provided by the author. For effective use of the automation and robotics via mapping for best practices is provided in this paper [8].

Semi-autonomous robot vehicles design; containers and stations are presented by the author. Modification of the hospital infrastructure is need, which was analysed in the project. One of the earliest service robots that are commercially available is help mate robot [4]. For the recycling process where tasks are opportunistically assigned to a human-being or a robot human robot collaboration is presented [5].

A robot manipulator for real-time, fast and accurate industrial applications is presented by the author. The robotic arm function is analogous to the functions of a human arm. A specific advanced control language (ACL) controller is combined with software on PC through USB connection [3].

3. Proposed system

The smart health care waste disposal robot is used for medical-waste disposing. A robotic arm is created using raspberry pi and image processing technique. The robotic arm picks up and places only the pre-specified object autonomously. it cannot detect every single object. Detection of each object is a time consuming process. And moreover it is also cost-effective. The basic steps of the robot are shown below. The algorithm used is HSV algorithm which is used for converting the RGB values into HSV values for easy calculations.

3.1 Block diagram

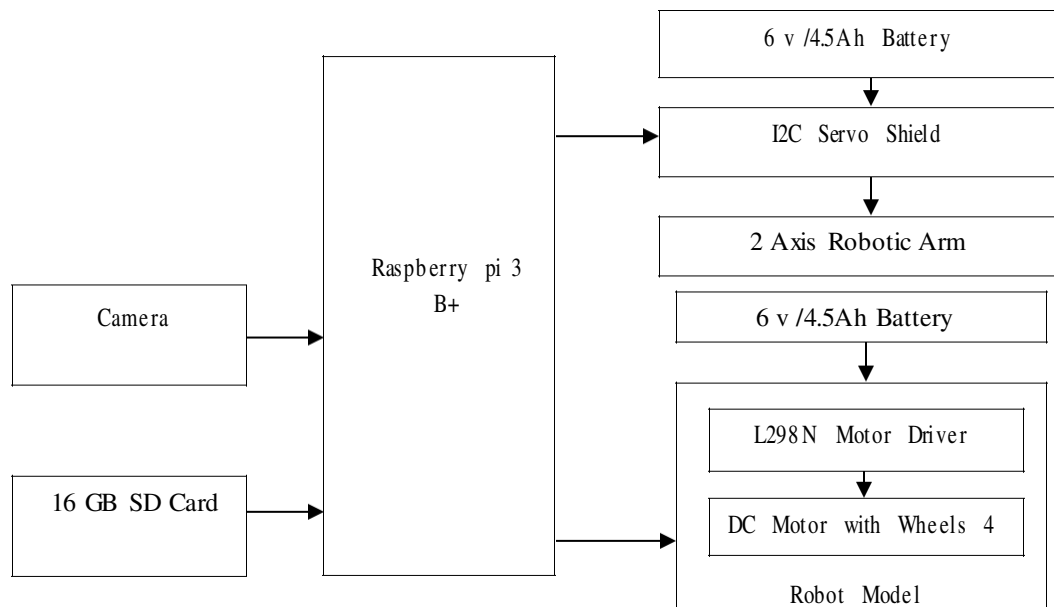The block diagram of the proposed system is shown in Figure 3.1.

Figure 3.1 Block diagram of the proposed system

3.2 Working

A robotic arm is created which is mounted on the robotic model. The robotic model has four wheels for the movement of the robot. The camera captures the image of the pre-specified object. The captured image is processed through image processing technique. The colour of the pre-specified object which is in RGB value is converted into HSV value using HSV algorithm. Then the distance of the pre-specified object is calculated by fixing the mid-point of the pre-specified object. Once when the robot reaches near the pre-specified object it picks it up and searches for the destination. When the destination is identified, the robot places the pre-specified object. The identification the destination also undergoes same process as that of the process for picking up of the pre-specified object. The code for the algorithm, fixing of the mid-point, movement of the robot is written in python IDLE.

4. Results and discussion

The image is captured by the camera. The captured image is processed using image processing. The RGB values are converted into HSV values. The mid-point and the distance of the image is calculated. The robot picks up the image and places in the destination.

4.1 Output

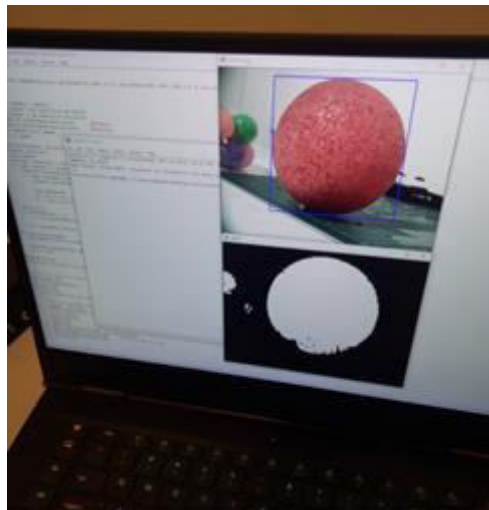The sample output of the proposed system is shown in Figure 4.1.

Figure 4.1 captured image and fixing of mid-point

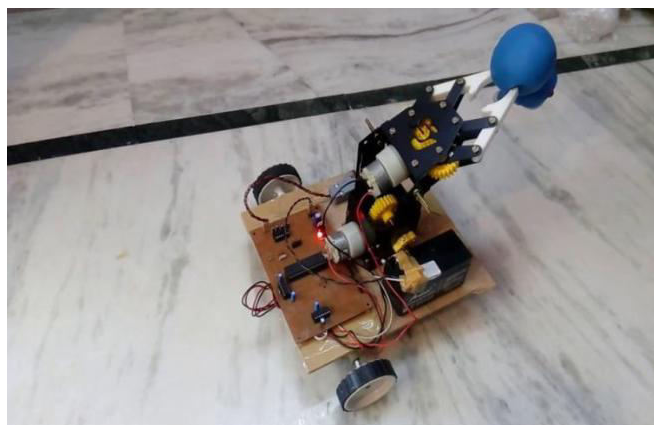The detected object is picked up by the robot which is shown in Figure 4.2.

Figure 4.2 Picking of the object

5. Conclusion

The smart health care waste disposal robot is overcomes the disadvantages of the regular health care waste disposal method. In regular health care waste disposal system humans are in direct contact with the hazardous waste which leads to spreading of the diseases. Thus the robot can be replaced instead of humans who are safer and also be used in situations like COVID-19. The proposed system is developed using Python and Raspberry pi.

6. Future Enhancement

Every proposed system needs an enhancement. The proposed system can be enhanced by using different algorithms like bug algorithm, motion planning algorithm and grid-based search algorithm. The robots can be trained and programmed to pick up each and every object from every corner of the entire building or an area. The robot can be mainly used in medical field for doing minute surgeries, taking care of the patients and in waste management which will be helpful in situations like COVID-19. It can also be used in automobile industries for placing the parts of automobiles.

References

1. Afifa Siddique, Chang Won Lee, and Zeashan Hameed Khan,'Robotics utilization for health care digitization in global covid-19 management,'international journal of environmental research and public health.

2. Agha Muhammad Furqan Durrani, and Arslan Farroq (2010) 'An Automated Waste Control Management System [AWCMS] by using Arduino,' IEEE.

3. Aizatk, Andanuaro, Md.Hazratali, Yerkhank, and Zhandost, 'Vision-based robot manipulator for industrial applications,'International conference on robotics and smart manufacturing (RoSMa 2018)

4. Ali Gurcan Ozkil, and Steen Dawids, Zhun Fan (2007) 'Design of a robotic automation system for transportation of goods in hospitals,' IEEE International Symposium on Computational Intelligence in Robotics and Automation.

5. Arantxa Renteria, and Esther Alvarez-De-Los-mozos, 'Human-robot collaboration as new paradigm in circular economy for WEE management,'29th international conference on flexible automation and intelligent (FAIM2019),june 24-28.2019,Limerick,Ireland.

6. Balaji Masanamuthu Chinnathurai, James M.Conrad, Ramakrishna Sivakumar, and Sushuruth Sadagopan,'Design and Implementation of a Semi-Autonomous Waste Segregation Robot,' IEEE

7. Daniela Pintoa, Dimitrios Chrysotomoub, Guilherme Mateusa,Jacob K.Sorensena,Jan K.Jorgensena, Jens F.Buhla,Rune Gronhoja, and Simon Boghb, 'Evaluation of barriers of health care waste management in india –a gray relation analysis approach,'29th international conference on flexible automation and intelligent manufacturing (FAIM2019),june 24-28,2019,Limerick,Ireland.

8. Dilathi Amaratunga, and Gayani Karunasena, (2008) 'Automation and Robotics in post Disaster Waste Management,'International Symposium on Automation and Robotics in Construction.

9. Dishant Pandya, and Vikrant Bhor, 'Real Time Bin Status Monitoring for Solid Waste,'

10. Fernando Carreira, (2009) 'A Mobile Robot to Deliver Meals inside Health Services,' IEEE International Symposium on Industrial Electronics.

11.   Gosavi Kriti, and Navale Pallavi, "Best Iot based Smart Waste Management System", 2007 IOSR Journal of Engineering.

12.   Jitendra Narayan Biswal, Kamala Kanta Muduli, Tushar Kantipanda, Suchismita Swain, and Sushant Atripathy, 'Service robots in hospitals: new perspective on nichie evolution and technology affordances,'5th international conference on Frontiers in intelligent computing theory and applications, advances in intelligent systems and computing.

13.   Keita Matsuo, (2012) 'Experimental evaluation of a waste management robot system,' IEEE sixth International conference on complex, intelligent and software intensive system.

14.   Michaela Sprenger, Robert Winter, and Tobias Mettler,(2017), 'A dual-armcollabrative systemfor the smart factories of the future,' European journal of information system.

15.   Pratiksha Andhare, and Sayalirawat, 'Pick and place industrial robot controller with computer vision,'