INTERNATIONAL SCIENTIFIC JOURNAL OF ENGINEERING AND MANAGEMENT ISSN: 2583-6129
VOLUME: 03 ISSUE: 05 | MAY – 2024 DOI: 10.55041/ISJEM01776
AN INTERNATIONAL SCHOLARLY | | MULTIDISCIPLINARY | | OPEN ACCESS | | INDEXING IN ALL MAJOR DATABASE & METADATA

MEDICAL WASTE DETECTION AND SEGREGATION USING ROBOTIC ARM

Aarsha S S, Akshay L S, Amrutha S S,Athira Raj R S
Electronics and Communication Engineering
(Students)
St.Thomas Institute for Science and Technology
TVM

Dr.Anju S
Electronics and Communication Engineering
(Asst.Professor)
St.Thomas Institute for Science and Technology
TVM
anju.ec@stisttvm.edu.in

***Abstract*— In the present world, the amount of waste material in hospitals and other commercial places is increasing. A large number of laborer's should be allotted for waste material segregation and collection. A huge amount of money needs to be spent on the equipment and salaries of the workers. The proper management of medical waste materials is critical for the sustainability of any modern city. Medical waste is very dangerous as it can give birth to serious diseases; therefore, It is a problem of global nature. Biomedical waste consists of human tissues, medicine, needles, masks, scraps, etc. In this project, we are proposing a robotic arm to segregate medical waste. The robotic arm identifies three objects (a medicine bottle, scissors, and knife). The segregation of medical waste materials is done by using the concepts of machine learning, image processing, and deep learning. The sorting and segregation of medical waste can be done using this arm, so physical contact with the waste materials can be avoided. And the number of workers in the hospital could be reduced. The waste materials that need to be segregated should be placed in a container at the arm's base. A camera will be placed in front of the container. The camera will identify the components, and the information will be passed to the system. Here, we use a laptop as the brain of the robotic arm. Then the robotic arm will take the waste material which will be segregated into the respective containers. The arm will be trained in such a way that the scissors will be segregated at an angle of 30 degree right, the samples will be placed 90 degrees and the medicine bottle will be segregated at an angle of 120 degree left and knife at 180 degrees left. The position of the segregated baskets will be identified by the robotic arm by the angle measurements. The robotic arm is a hardware and software system based on image processing using machine learning and deep learning for the execution of the model we use.**

***Keywords*— Machine learning and deep learning**

I. INTRODUCTION

Hospitals produce more than 5 million tons of waste in each year. In this annually 0.33 million tons of hospital waste is generated in India- in this, 10-25 % of the healthcare waste generated is hazardous and causes serious health problems. The improper management of biomedical waste poses a serious threat to human health and may lead to various health hazards like transmission of diseases. The biomedical waste may be containing the pathogens like HIV, Hepatitis B & C but also carries the risk of water, air and soil pollution there by adversely affecting the environment and community at large. Different countries have adopted different Strategies to manage medical wastes generated from healthcare facility. Segregation of waste plays a major role for improved biomedical waste management. The waste is segregate according to its type, such that Recyclable contaminated waste (bottles, tubes etc), Human and animal anatomical waste, chemical waste, waste sharps (needle, blades etc). Here we will use artificial intelligence to segregate the medical waste, so we replace manual sorting with robotic arm. Artificial Intelligence is a technique of getting machines to work and behave like humans. In recent past AI has been able to accomplish this by creating machines and robots that are being used in a wide range of fields including healthcare robotics, business analytics and many more. This waste segregation robot arm system is the first do input image capturing by using the camera. The object detection is based on the algorithms that already created and feed to the system and on detection the robotic arm picks and places objects in respective chambers. This system makes use of an onboard computer.

II. LITERATURE REVIEW

A. *Application Of Artificial Intelligence To Enhance Collection Of E-Waste: A Potential Solution For Household WEEE Collection And Segregation In India, Waste Management And Research (2021)*

AV SHREYAS MADHAV, RAGHAV RAJARAMAN, S HARINI, AND CINE C KILIROOR

In this paper, they focus to develop a rubout system for the collection of E-waste. The robot moves around taking individual photographs of the waste materials intended for disposal and identifies the electronic waste using deep learning. The identified electronic waste is collected and placed within the Robot's storage platform. At the end of the collection, the robot moves back into the truck and stores the collected waste in a selected space in the truck. Here CNN based identification system is used

B. Waste Segregation Robot – A Swachh Bharat Initiation, IJISET (2020)

SUNIL M, SHRAVYA CHAAND P K, BHAVYA GRANDE, AND HARIPRASAD S

This paper proposed system is a combination of hardware and software design. The embedded system uses image processing to segregate waste material and the use of a mechanical robotic arm to replace direct human involvement in the waste management process. The robotic arm is a programmable machine and it is controlled by Raspberry Pi. The sensors detect the objects and give information to the system then the robot pick and places the waste.

C. Automatic Segregation of Waste Using Robotic ARM, IJCRT (2021)

B.S SUSHA, RAHUL MADHUKARA SHANBOG, SHAIK HUSSAIN, SHREYAS H.K, SHREYAS S

They have tried to provide a waste segregation robot that can detect, pick and separate different kinds of waste and dump them into the respective dustbins It consists of an IR sensor to detect the waste materials, a robotic arm to pick and place the waste into the conveyor, moisture sensor to detect the wet waste and inductive proximity sensor to detect metallic waste and Ultrasonic sensor to detect the level dustbin.

D. ANDROID-BASED ROBOT USING RASPBERRY PI(2010)

JAYANT NIVRITTI PATIL, H. K. BHANGALE

This paper represents a method for controlling a robot using Raspberry Pi and an application built on the Android Platform. In this paper, a review of Robots controlled by mobile phones via moving the Robot upward, backward, left and right sides by the android application and Raspberry Pi is presented. The android phone and raspberry pi board are connected through Wi-Fi. A signal is generated from the android app and will be received by the raspberry pi board and the robot works according to a predefined program. The android app is the command center of the robot. The program is written in the python language on the raspberry pi board. The robot performs the same activity as the human hand works.

III. METHODOLOGY

A. SOFTWARE ARCHITECTURE

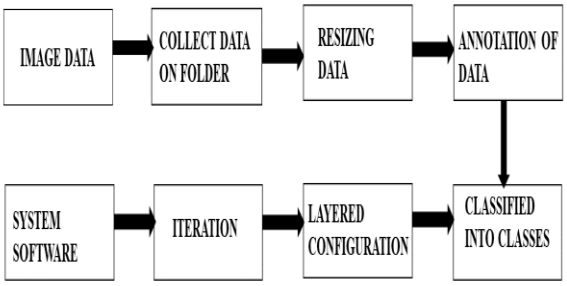

Figure2. Block Diagram of software architecture

In CNN, input may be an image or other data. Here we choose input in image format, such as jpg, png, etc. Then we collect the data from the folder in which the picture sizes are not identical. Therefore, we set a predefined size for the images, which is 255 x 255. That is why we resized the image. After that, the process of annotation begins. As a result of annotation, machine vision systems have a smaller search area for objects within images. In annotation, the picture that is taken is bounded by a bounding box, and the coordinates of the box are the features of the image, and those features are given for the generation of different classes of data. Here we have three types of objects to segregate, so we generate three classes for that. Layered configuration is done through incremental learning, previous data analysis, evaluation of classifiers, etc. Using the output of the layered configuration, iteration occurs. Iteration in a digital image means that all pixels of the image can be manipulated. The best way to do this is to iterate through all of the rows and columns of the image. Weight update, framing accuracy, tiring accuracy, etc. happen in iteration processes. Then the solutions are given to the system software.

B. HARDWARE ARCHITECHTURE

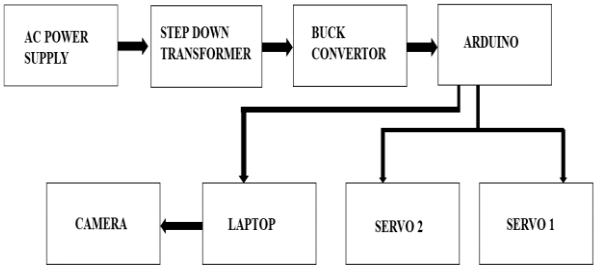

Figure2. Block Diagram of hardware architecture

Here, we use a 220-volt AC main supply as the initial input voltage. This 220-volt input AC voltage is applied to a step-down transformer. The step-down transformer will convert 220 volts of AC into 12 volts of DC. The output

INTERNATIONAL SCIENTIFIC JOURNAL OF ENGINEERING AND MANAGEMENT
VOLUME: 03 ISSUE: 05 | MAY – 2024
AN INTERNATIONAL SCHOLARLY | | MULTIDISCIPLINARY | | OPEN ACCESS | | INDEXING IN ALL MAJOR DATABASE & METADATA
ISSN: 2583-6129
DOI: 10.55041/ISJEM01776

from the step-down transformer will be 12 volts dc, but it contains some pulsating AC signals. which will be removed by the capacitor and the diodes that are placed between the step-down transformer and the buck converter. The output of the step-down transformer will be given to the buck converter, which converts 12 volts DC to 5 volts DC. This 5 volt DC will be given to two servo motors and the Arduino microcontroller. The two server motors are used for controlling the robotic arm. The Arduino will be connected to the laptop, and the camera will also be connected to the laptop. Image signals that are detected by the camera will be sent to the laptop. The Arduino, which is used for controlling the robotic arm, is also connected to the laptop. By analyzing the image signal from the camera, arm movements can be made. The robotic arm can be controlled, and the waste materials can be segregated.

IV. WORKING OF THE SYSTEM

The AC main supply provides 220 volts AC. This is then passed to the step-down transformer, which converts 220 volts of AC into 12 volts of DC. This 12-volt DC is then passed to the buck converter. It converts 12 volt DC into 5 volt DC. This 5-volt DC supply will be provided to the two servo motors and the Arduino microcontroller. The first servo motor is used for the rotation of the robotic arm, and the second servo motor is used for the closing and opening of the robotic arm. When an image is placed for detection, it will be captured by the camera, and the image signal will be given to the laptop. The system software will then identify

the object, and the trigger signal will be given to the Arduino microcontroller. Here the robotic arm will be segregating three objects(scissors, knife, and bottle). Initially, when the power is on, the servo motor will make an angle of 90 degrees. When scissor is dictated, servo 2 will make an angle of zero degrees for picking up the objects. And the servo 1 will make an angle of 30 degrees for segregating the objects. When the bottle is dictated, the servo 2 will make an angle of zero degrees for picking up the object, and the servo 1 will make an angle of 120 degrees for segregation. The servo 2 will move back to 30 degrees for releasing the object, the robotic arm will move back to its original position, and the servo 1 will move back to its initial position of 90 degrees. When the knife is dictated, servo 2 will make an angle of zero degrees for picking the knife, and servo 1 will move to an angle of 180 degrees. And the servo 2 will release the object, and the robotic arm will move back to its original position. This is the working of the robotic arm.

V. RESULTS & DISCUSSION

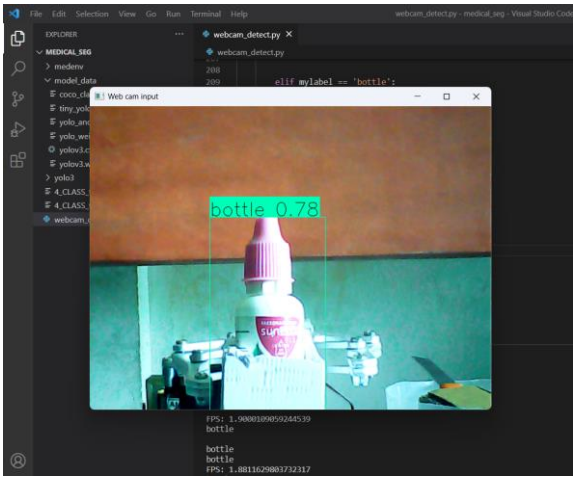

Figure3. Detection of bottle

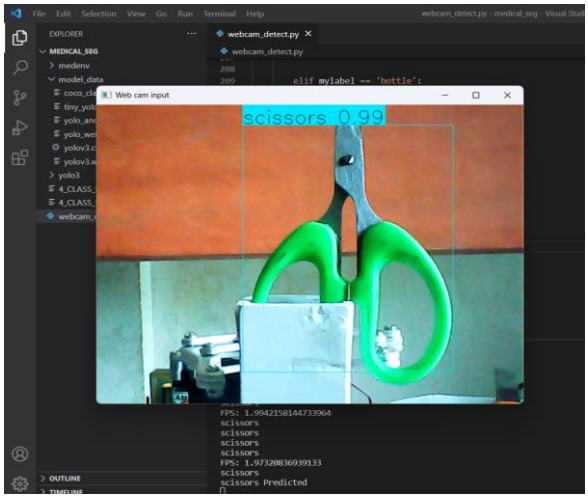

Figure 4. Detection of scissors

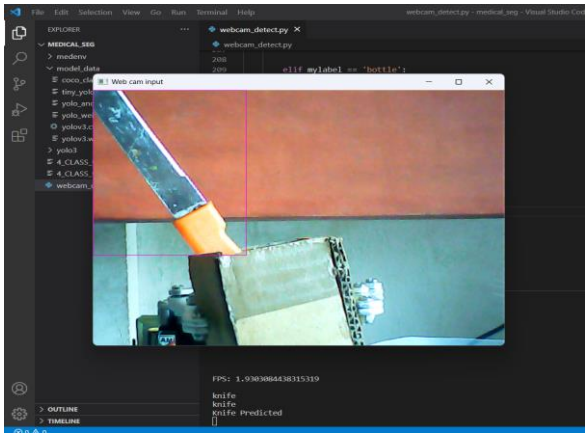

Figure 5. Detection of Knife

Our project's goal is to identify three objects, like a bottle, a scissors, and a knife. The system recognizes the things because the instructions to identify them are already provided, so first we set these objects to be separated with the aid of the camera. That is, while any object may be detected using image training, only these three objects can

be separated. Only three objects were used in the model training, so those three objects can be separated. These three items have been taught to divide into groups at angles of 30, 120, and 180 degrees. That is, the scissors are segregated at an angle of 30 degrees, the bottle at 120 degrees, and the knife at 180 degrees.

VI. MERITS AND DEMERITS

A. *Merits*

- Segregating your waste allows your business to recycle more items, preventing them from ending up in landfills.
- This, in turn, reduces your overall impact on the environment.
- Practice is highly lucrative.

B. *Demerits*

- By products are cost for site preparation and equipment, the lengthy treatment period, targeting final use of compost product, and environmental issues such as odors and dust.
- Some investment in equipment and site preparation is required or recommended.
- Process is not always cost effective.
- The resultant product has a short life.
- The sites are often dangerous.

VII. CONCLUSION

The squander materials that required to be isolated bought to be put in a holder at the arm's base. A camera would be put before the holder. Here, we used a tablet as the brain of the automated arm. At that point the automated arm would take the squander fabric which would be isolated into the individual holders. The arm would be prepared in such a way that the scissors would be isolated at an point of 30 degree right, the tests would be set 90 degrees and the medication bottle would be isolated at an point of 120 degree cleared out and cut at 180 degree cleared out. The position of the isolated bushel would be recognized by the mechanical arm by the point estimations. The mechanical arm was a equipment and code based on picture preparing utilizing machine learning and profound learning for the execution of the demonstrate we used.

ACKNOWLEDGMENT

We give thanks to the Lord Almighty, whose omnipotent hands directed us while we worked on this project. We would like to use this occasion to extend our sincere gratitude to everyone who contributed to the project's successful completion. Many people have blessed us and provided us with arduous support, and we are grateful to each and every one of them for their contributions to the successful completion of this project.

REFERENCES

[1] Application of artificial intelligence to enhance collection of E-waste: A potential solution for household WEEE collection and segregation in India AV Shreyas Madhav , Raghav Rajaraman, S Harini and Cinu C Kiliroor Waste Management & Research 2022, Vol. 40(7) 1047–1053 © The Author(s) 2021

[2] Waste Segregation Robot -A Swachh Bharat Initiation Sunil M PP 1 P, Shravya Chaand P KP 2 P, Bhavya GrandheP 3 P, and Hariprasad S AP 4 P 1, 2, 3, 4 PDepartment of Electronic and Communication Engineering, Faculty of Engineering and Technology, Jain (Deemed-to-be University) Bangalore, India,2020

[3] Application of artificial intelligence to enhance collection of E-waste: A potential solution for household WEEE collection and segregation in India AV Shreyas Madhav , Raghav Rajaraman, S Harini and Cinu C Kiliroor Waste Management & Research 2022, Vol. 40(7) 1047–1053 © The Author(s) 2021

[4] Waste Segregation Robot -A Swachh Bharat Initiation Sunil M PP 1 P, Shravya Chaand P KP 2 P, Bhavya GrandheP 3 P, and Hariprasad S AP 4 P 1, 2, 3, 4 PDepartment of Electronic and Communication Engineering, Faculty of Engineering and Technology, Jain (Deemed-to-be University) Bangalore, India,2020

[5] Automatic segregation of waste using robotic arm 1b.s susha,2rahul madhukara shanbog,3shaik hussain,4shreyas h.k,5shreyas s 1Assosciate Professor, 2,3,4,5UG Student 1Department of electronics and Communication Engineering, 1Dr Ambedkar Institute of Technology, Bengaluru, India, 7 july 2021

[6] Android Based Robot Using Raspberry Pi Jayant Nivritti Patil1 , H. K. Bhangale2 1G. H. Raisoni College of Engineering, Jalgaon 2G. H. Raisoni College of Engineering, Department of Electronics, Jalgaon 3, March 2017

[7] Artificial Intelligence in the Sorting of Municipal Waste as an Enabler of the Circular Economy Henning Wilts 1,*, Beatriz Riesco Garcia 2 , Rebeca Guerra Garlito 2 , Laura Saralegui Gómez 3 and Elisabet González Prieto 3,29 March 2021

[8] Artificial Intelligence Based Trash and Recyclable Sorting Robot ARM Balagam Keerthan1 , Tammina Nikhil2 , Thota Vijay Kinnera3 , Nitya Nimmagadda4 ECE students 1, 2 , CSE student 3 , EEE student 4 VNR Vignana Jyoti Institute of Engineering and Technology, Bachupally, Hyderabad, 500090 1, 2, 3, BITS Pilani K K Birla Goa Campus, Goa, 403726 ,2014

ISSN: 2583-6129
DOI: 10.55041/ISJEM01776

