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E-Waste Monitoring System for Smart City

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Abstract: India facing a major problem in e-waste management. Somee-waste management systems are there likeonce anyone come to dispose the waste it collect that waste, it allowed all types of wastes and when the dust bin is filled it will inform to the particular waste collection workers they will come and collect it. Soit's difficult to segregate e-waste from the normal garbage wastes. These systems maintenances is carried out overflowing garbage bins from which the garbage spills on to the streets. In this project, we will be developing a hardware module using a raspberry pi processor and a servo motor. We will be using deep learning concepts of effective object detection techniques for E-waste detection. When E-waste is detected the servo motor is activated to open the dustbin. When no E-waste is detected the dustbin is closed. A microcontroller setup will be used for controlling the dustbin.

Keywords: Raspberry Pi, servo motor, deep learning.

I. INTRODUCTION

E-waste causes a serious public health and environmental issue in India. India is the one of the largest electronic waste producer in the world, approximately two million tons of electronic waste are generated annually and an undisclosed amount of electronic waste is imported from the other countries around the world..E-waste is generated when an electronic devices or products has reached the end of it's working time period. The e-waste is hazardous and it contains a toxic chemicals. People they dispose e-waste in which they used for normal garbage waste dispose.So all types of wastes are combined and it's difficult to sperate that e-waste from the normal waste.Which results in the environmental damage and health problems. The main objective of this project is to design an E-Waste Monitoring System that will provide an efficient solution to e- waste collection. This system first it will detect either is it e-waste or not by using pretrained object detection model mobile netssd. If it is e-waste then the raspberry pi processor send open dustbin command to then microcontroller then it will open then the dust bin with help of servo motor. If itis non e -waste then the dustbin will left closing.

II. RELATED WORKS

This system is design and development of electronic waste monitoring to support green city[1], The main objective of this system is to design e-waste monitoring system that will provide an efficient solution to electronic waste collection and generation data. The hazardous components of electronic waste have potentially adverse impacts on ecosystems and human health if not managed and monitored properly. So, the importance to constantly monitor the condition of the e-waste bin. This system measure and delivers up-to-date information to the system's administrator on the waste level and bin's current temperature in real-time. In case of fire, the system will give intimationthrough the flame indicator. Agile Model methodology is used as it offers an adaptive approach in respect to what features need to be developed. The system consists of Ultrasonic sensor to measures the waste level, a temperature sensor that detects the temperature inside the dust bin, flame sensor is used to sense if any fire occurs inside the dustbin, raspberry pi processor used as a microcontroller and prebuilt web application thingspeak is used to share the data. This thingSpeakof stores data and send to the user when the dust bin is filled. The e-waste and the gases coming from the e-waste are hazardous. So if the temperature increases there may chance to fire happen inside the dustbin. if the temperature increases, the temperature sensor detect the temperature inside the dustbin and it send to the uses through thingspaeak web platform.

In this method [2]Studies have explored consumers environmentally responsible intentions regarding many industries and products however, research on the sustainability of smartphones is limited. This article develops an integrated cross- level model to assess the factors that foster environmentally responsible consumer

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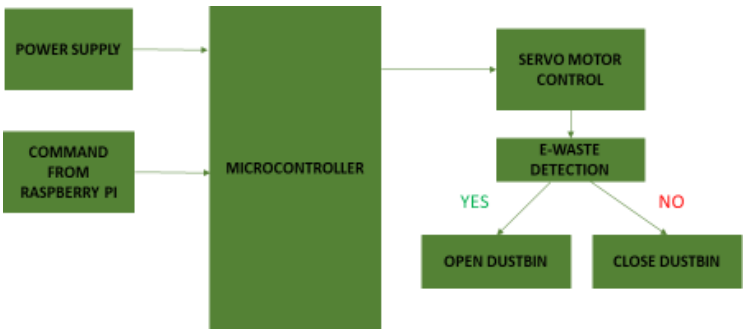
behavior, which is demonstrated by the willingness to recycle smart phones. Data from 358 consumers were collected and analyzed using hierarchical linear modeling and the decomposed theory of planned behavior, which take into account antecedent factors. The outcomes provide a better understanding of consumer attitudes on mobilephone recycling, such that expedient engineering and public policies can be put in place to facilitate it.

In image information automatic extraction, analysis, and understanding [3],The object detection HSRIs (high spatial resolution remote sensing images) is an important part. In high spatial resolution remote sensing object detection the ROI (region of interest) scale of object detection and the object feature representation are two vital factors. Respect to these two issues, this article presents a novel high spatial resolution remote sensing images object detection method based on CNNs (convolutional neural networks) with suitable object scale features. The suitable region of interest scale of object detection is obtained first by compiling statistics for the scale range of objects in high spatial resolution remote sensing images. After that for object detection a convolutional neural networks framework in high spatial resolution remote sensing images is designed by using a suitable region of interest scale of object detection. The object features obtained using a convolutional neural networkshave good universality and robustness. After that, a convolutional neural networks framework with a suitable scale of object detection is trained and tested using the WHU-RSONE data set, the proposed method is compared with the faster region- based convolutional neural networks framework. The practical results shows that the proposed work outperforms are the Faster-RCNN framework and provides a better object detection results in. high spatial resolution remote sensing images.

Object detection is benefiting [4], From the development of Convolutional Neural Networks (CNNs).Based onFCNs (Fully Convolutional Neural Networks) Semantic segmentation and salient object detection algorithms are developed. There is still a large room for improvement over the generic fully connected network models that do not specifically deal with the scale-space problem. For edge and boundary detection the HED(Holistically-Nested Edge Detector) gives a skiplayer structure with deep supervision, but the performance gain of holistically-nested edge detector on saliency detection is not clear. In this article, present a new salient object detection method by initiate short connections to the skip-layer structures within the holistically-nested edge detector architecture. The framework takes the advantage of multi-level and multi-scale features extracted from fully convolutional neural networks and provide more advanced representations at each layer, a property that is needed to perform the segment detection. The method provides state-of-the-art results on fiveextensively tested salient object detection benchmarks,



advantages in terms of efficiency and the effectiveness compared to existing algorithms. Apart that, conduct an exhaustive analysis on the role of training data on performance. Practical results give a more powerful training set for future research and fair comparisons.

This work discusses [5], the position of electronic waste in India and the problem causes with it and method used to manage the electronic waste in India.This follows an analytic methodology based on a dependent review of the environmental and social aspects in the area of electronic waste sector.

III. METHODOLOGY

The objective of this project is to developing a hardware module using a raspberry pi processor and a servo motor. We will be using deep learning concepts of effective object detection techniques for E-waste detection. An object detection technique such as mobilenetssd is been used to determine the objects present in front of the camera. Among those objects certain e-wastes are been identified and the command is sent to the microcontroller using the UART

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communication to open the dustbin in case of e-waste detection as well as keeping it close when no e-waste is been detected. When E-waste is detected the servo motor is activated to open the dustbin. When no E-waste is detected the dustbin is closed.A microcontroller setup will be used for controlling the dustbin.

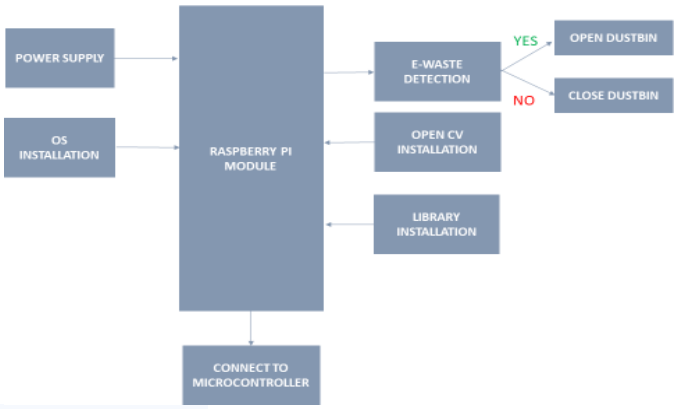

Figure 2

The block diagram consists of a raspberry pi4 processor, Atmega328 microcontroller, power module, servo motor, camera and a dustbin. Raspberry pi processor is like a processor which we have in our laptops, that also need operating system installation in order to perform the operations. In raspberry pi operating system we need tensorflow, keras, scikit learn and some other object detect library installation for detecting the camera. The open cv installation is required for camera prediction, reading the image from camera. Power supply will needed. E-waste detection will take place, if it is e-waste then open dustbin command will send to the microcontroller or else close dustbin command will send to the microcontroller. The servo motor will connect to the dustbin setup. If the e-waste detect it will open the dustbin or else the dustbin will keep closing.

For detecting e-waste we are going to use pretrained model mobilenetssd algorithm. It has been 80 classes in built which is trained. It will contain many layers wheneverwe are giving input it goes through the all layers and then it will provide the output. When we give image as an input first it will go to the convolution layer, the convolution layer main process is learnrgb value of the image and it passes to the global cooling layer. What this layer doses is it will remove the unwanted layers and noises coming from convolution layer. After that it passes to the fully connected layer. Each and every object has its own features, so this fully connected layer clusters those features into group and allot that this particular feature belong to this object like that after that it passes to the softmax layer. The softmax layer set a threshold so my output model will have efficient enough to predict the obeject. What that mobile net ssd does is already has many objects trained inside trained it. Camera will connected to this, the camera will detect phone or any object shown in front of camera. The camera captures that image, and we write coding inside it to get the image from camera module and predict what image is it. If it matches with e-waste then dustbin will open or else it will keep closing.

IV. Results And Discussion

The below figure 3 shows the complete hardware set up of the project:

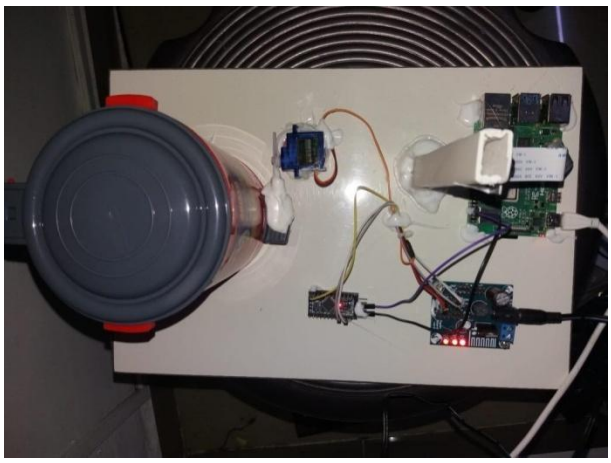

Fig.3Hardwaresetupoftheproject

On initiation of the hardware setup of the project, the camera initiates the object detection. When a non-E waste is

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detected then the dustbin is left close and does not open for disposal. The below image shows the detection of a bottle which is not an E-waste:

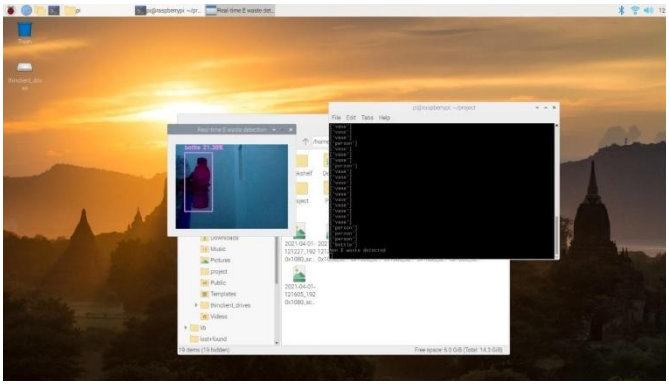

Fig.4 Non e-waste detection

On non e-waste being detected the dustbin is left closed and does not open for disposal as seen in the figure5.

Fig5. Dustbin is left closed.

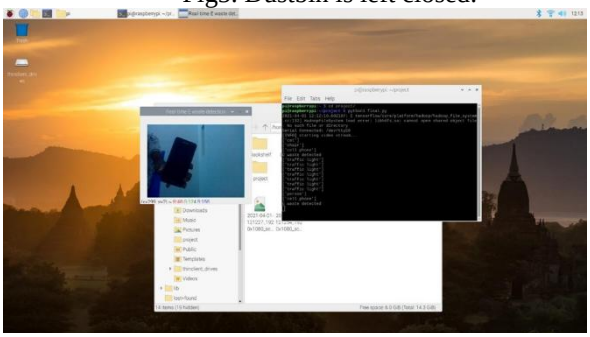

Fig.6 E-waste detection

On E-waste being detected, the dustbin is authorized for opening as seen in the figure7.

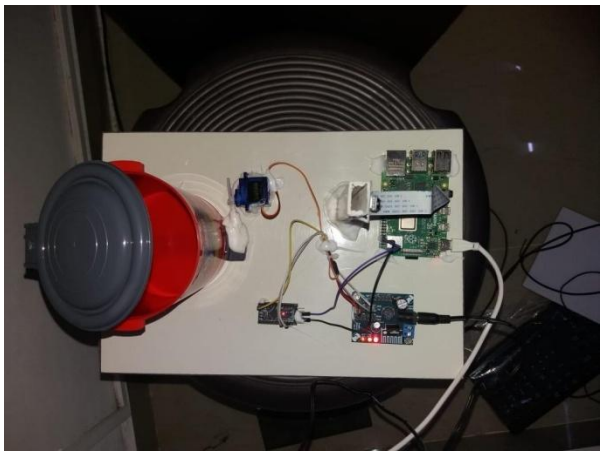

Fig.7 Dustbin opening

V. CONCLUSION

The project is successfully implemented that ensures a dustbin detected for accepting only E-waste such as mobile phone and other electronic gadgets using a processing module. The project is completely automatic does not require any human intervention. So, this project, improves the rate of recycling E-waste in the coming future.

VI. FUTURE WORK

In the coming future, we review the application of the E-waste dustbin technology in the recycling industry and it can promote for advancement in E-waste management technology with more accuracy. In this field they are more chance to develop or convert this project in many ways. Thus, this project has an efficient scope in coming future where this idea can be converted to computerized production in a cheap way.

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