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Debris Assortment Rover Using IoT & Video Processing

Solid Dry Waste Collector

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Abstract : **— In today's world, one of the major environmental problems is the collection and management of waste. Solid waste management is a key and challenging issue of environment in the whole world. Hence, there is a need to develop an efficient system which can eliminate this problem or reduce to a minimum level. The proposed system is an automated dry waste collector which scans specified area and assorts in a given location.**

Keywords— Raspberry pi 3b+ , Ultrasonic Sensor, Li-on Battery, Switch, Motor Driver, DC Motor.

I. INTRODUCTION

The waste management system predominantly corroborates the disposal and treatment of different types of waste. Thus, it safeguards human beings, animals, and surroundings. Approximately 1.9 billion tons of waste is generated manually, with a minimum of 35% that is not treated securely. As per the reports, the waste generated per person per day varies from 0.17 to 4.67 kilograms. The most effective solution to overcome the problem of environmental pollution is the use of the Internet of Things- (IoT-) based waste management system. These technologies can provide real- time information about the waste, reducing the cost and time for the overall process. The issues faced by current waste management systems are improper scheduling; that is, the waste collectors do not know that they had to pick the waste.

II. LITERATURE SURVEY

Srilatha Madhunala, Hemalatha Rallapalli, Yashwanth Kumar T [1] Abstract—Garbage Collection and Dumping is the major Part of waste management, which has become a crucial issue to Be handled in order to ensure healthy environment. In Traditional method, garbage bins are placed at public places to Collect the garbage, which is usually collected by the garbage Collection truck with the help of employed personnel and will Be sent to the dumping yard to dump the collected garbage. These bins overflowed frequently before the routine Maintenance takes place, which leads to bad order and Unhygienic environment causing various life-costing diseases. As this problem is increasing day-by-day, an automated system for effective waste management system is desired which can Collect garbage timely without human involvement is proposed And is implemented using NI my RIO, Arduino UNO and NI LabVIEW software. The proposed system consists of two main Sub systems- Big Bin and small bin. Big bin moves in a regular Predefined path marked as black line in regular time intervals to collect garbage from Small Bins placed in different Locations. The proposed system is a novel approach and is Capable to automate the entire garbage collection dumping Process to ensure healthy environment.

Sengupta, V. Varma, M. Sai Kiran, A. Johari, Marimuthu R [2] 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. Several Governmental as well as Non-Governmental Organizations have made efforts to clean public spaces. 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. Making an efficient use of Internet of Things to maintain a constant connection between a central server and a network of garbage processing and collecting, independent, autonomous robots, we rely upon such a system to produce accurate results, as well as considerably reduce the cost, hence providing a feasible solution to minimize human effort and costs during waste collection. It provides a

gateway towards implementing garbage collecting robots in smart cities. Rather than describing the design of a single robot, we propose an entire system of robots interconnected in a network, to optimize time, energy and overall speed. There is always a trade-off between accuracy, efficiency and cost of garbage collection, especially when robots get into the picture. Our purpose is to find the perfect balance between these factors.

Mohammad Akidul Hoque, Mrittika Azad and Md. Ashik-Uz-Zaman [3] In the perspective of a developing country like Bangladesh, the problem of garbage management is becoming a major issue as the overpopulation of the country is producing a lot of wastes per day and does not have any proper treatment system for these wastes. For the better living of the people of a country, it needs to solve the problem related to garbage management and treatment. Overflow and improper dumping of garbage can cause different exaggerated diseases for neighbouring people, and if the garbage is not treated properly it can also cause some serious environmental pollution. This paper proposed a system of garbage management which can monitor the garbage level, the humidity, the temperature and can sense the response of flame. To ensure the clearance of the garbage, radio frequency identification (RFID) system is installed and with the help of Internet of Things (IoT) all the system can be monitored from the server by the authority. Two types of communication protocol are used here one is Message Queuing Telemetry Transport (MQTT) protocol, and the other is Long Range Wide Area Network (LoRaWAN) technology which is used as a backup. After collecting all the garbage from individual bins, they have to be dumped centrally, and machine learning model is used here to segregate the garbage into biodegradable and non- biodegradable. The whole procedure is ensuring a smart garbage system with proper treatment and green and pollution-free environment which is crying need for the people of Bangladesh.

Kishore N, Naveen Kumar T, NaveenRaja J P, Sreeram G, Methini M [4] The Automated trash collector is a normal dustbin modified with the help of an embedded system which collects trash and traces its path back to the starting point. Also, it monitors the garbage level all the time and gives information. If the threshold level is reached, a warning message is sent to the concerned authority via SMS. The trash collector finds its path to the desired location using the Infrared sensor and the whole setup is connected to RF transceiver. The ultimate aim is that people need not carry the trash and search for bins. Instead, the bin comes to the user's location. A switch and IR sensor are fitted in a cabin. When the user presses the switch, a signal is transmitted via the RF transmitter to a receiver placed in the bin. This signal triggers the motor to start and the robot moves towards the desired cabin along the line. When the robot moves towards the cabin, the IR sensor in the cabin detects the robot and sends a Stop signal to the robot through PAN. Now the robot checks if the switch is ON or OFF. If the switch is ON, it stops else it passes through and goes to the next cabin. After collecting the garbage, it goes to the starting point and stops. The above-depicted model of smart trash is cost effective and can be implemented in malls, airports, schools and colleges.

Miss. Megha S. Chaudhari,Mrs. Bharti Patil,Mrs. Vaishali Raut .[5]As of late, it is seen that dustbins set at a different spots like open places, for example, healing centers, instructive Institutes and Industries are flooding. This flooding of refuse canisters, make unhygienic condition which can spread the sicknesses & also fast increment in populace squander offer ascent to inappropriate waste administration. To maintain a strategic distance from this circumstance, we proposed new framework "Smart City Garbage Collection and Monitoring System". In the recent decades, Urbanization has increased tremendously. In the meantime, there is an expansion in waste creation. Waste management has been a pivotal issue to be considered. This paper is a way to deal with achieve this incredible inspiration. In this paper, smart bin is built on a microcontroller-based platform Raspberry pi Uno board which is interfaced with GSM modem and Ultrasonic sensor and also the weight Sensor which is used for calculating the weight of the dustbins. The weight sensor is placed at the bottom of the dustbins which will measure the weight of the dustbins and also The Ultrasonic sensor is placed at the top of the dustbin which will read the status of the dustbin. The threshold limit is set as 10cm. Raspberry will be programmed in such a way that when the dustbin is being filled, the remaining height from the threshold height will be displayed. When the junk achieves the limit level ultrasonic sensor will trigger the GSM modem which will persistently caution the required expert until the trash in the dustbin is squashed. As indicated by the area, expert will send the message to the separate administrator; waste vehicle can gather the refuse, which is finished with the assistance of robot component.

III. EXISTING SYSTEM

Several researches are done about autonomous garbage collecting robot with one common goal which is to pick trash and deposit it to its appropriate recycle bin . The design methods and implementation of these robots may vary depending on the application.

In an existing system, they have combined the usage of proximity sensors with computer vision to accomplish our purpose. The camera, mounted on the chassis of the robot, remains inactive until an object is detected by the proximity sensor.

It is to be noted that while most of the recent findings only determine the amount of trash collected. A study is presented, a line following mobile garbage collector that will gather wastes from three bins, then deposits the waste in an automatic sorter system. The system was implemented using PIC microcontroller interfaced with line following sensor, H-bridge motor drive and DC motors. The robot completed the task of collecting and delivering the trash in 4 minutes and 36 seconds. Line following robots are simple to implement but have slow speed and instability with different line width or stiff angles.

Another PIC-based robot was developed for collecting the garbage at the beach. Bluetooth and Adhoc wireless communication technologies were applied to the robot for remote controlled operation at an average speed of 0.5 m/s on the sand. The trash collector robot can be easily controlled using push button switch or mobile phone using Bluetooth technology, but the user can only operate it at a limited distance.

An automatic garbage collector named AGATOR was developed to limit the accumulation of wastes in a river under weak or no water flow condition. The system uses ATMega16 as master robot controller, while ATMega8 read signal from ultrasonic sensor

to determine the position of the garbage and communicate serially with the master controller for necessary trash collecting operation This system is not capable of tracking the location of AGATOR when working on the river, so the use RFID as a monitoring tool was recommended by the researchers.

IV. PROPOSED SYSTEM

Proximity Sensors combined with computer vision to avoid obstacles on the way, mounted with camera to detect waste within the range. Fully automated rover to patrol the selected area using GPS. The rover moves using DC motor and wheels, it is mounted with a Mechanical arm to carry the detected dry waste to a specified location. The arm can carry upto 500g of weight as of now.

4.1 System Architecture

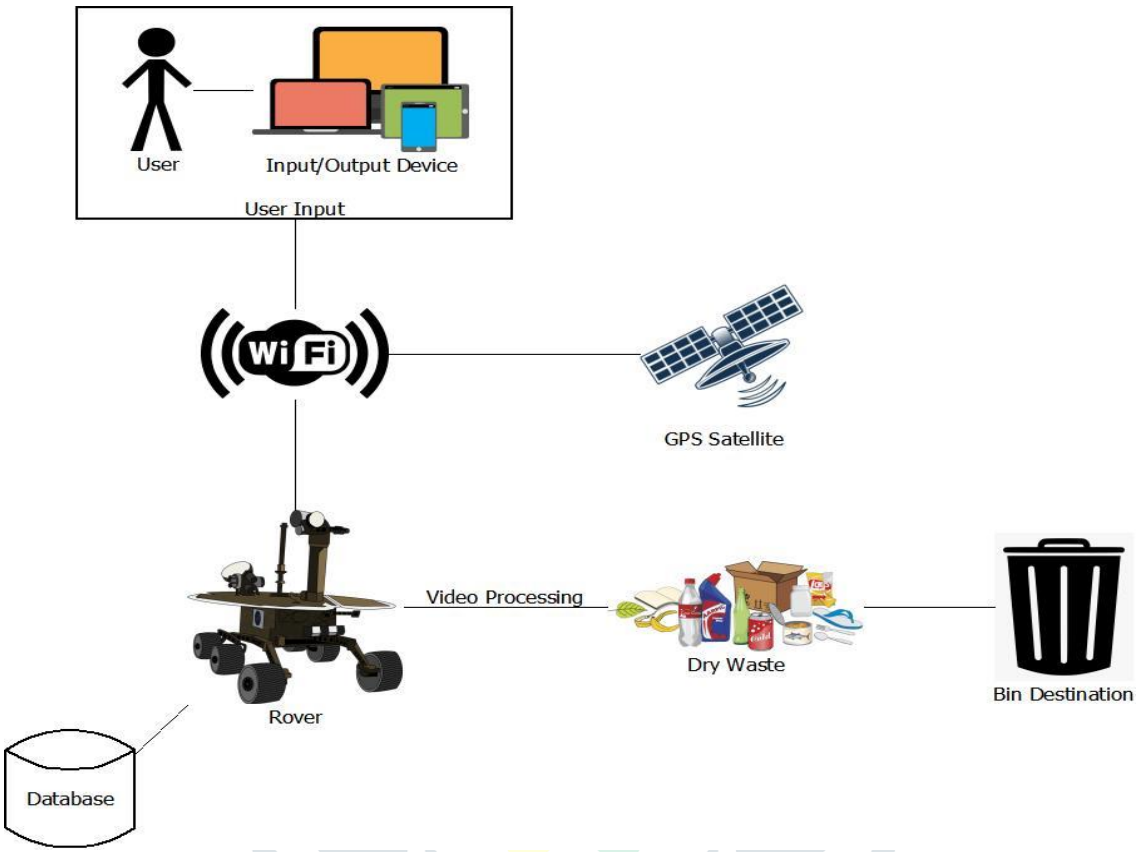

Fig 1 System Architecture of Debris Assortment Rover

The Debris Assortment Rover is a four/six wheeled automobile used to assort dry waste(can, plastic, materials, paper etc) in the selected area, the rover uses camera combined with object sensor to detect objects in its path, it is mounted with a mechanical arm to lift the detected object and carry it to the specified location, the mechanical arm is implemented using 5/6 micro servo motors consuming upto 6V supply, the movement is achieved using DC motor controlled by a motor driver and raspberry pi 3b+,the motors can consume upto 9V supply and Raspberry pi 3b+ upto 5V. The Rover uses GPS module for tracking location and scanning a specified area, it uses wifi to communicate with the user through any device such as mobile, laptop and computer. The Rover runs on a power supply of 4V-9V.

4.2 Algorithm Used- Deep Neural Networks (DNN)

A DNN is a collection of neurons organized in a sequence of multiple layers, where neurons receive as input the neuron activations from the previous layer, and perform a simple computation (e.g. a weighted sum of the input followed by a nonlinear activation).

$$Y1 = \sigma(w1x1 + w2x2 + w3x3) \quad (4.1)$$

$$Z1 = \sigma(v1y1 + v1x3 + v1y3 + v1y4) \quad (4.2)$$

Neural networks are functions that have inputs like x1,x2,x3…that are transformed to outputs like z1,z2,z3 and so on in two (shallow networks) or several intermediate operations also called layers (deep networks).
The weights and biases change from layer to layer. 'w' and 'v' are the weights or synapses of layers of the neural networks.
The best use case of deep learning is the supervised learning problem. Here, we have large set of data inputs with a desired set of outputs.

4.3 Block Diagram

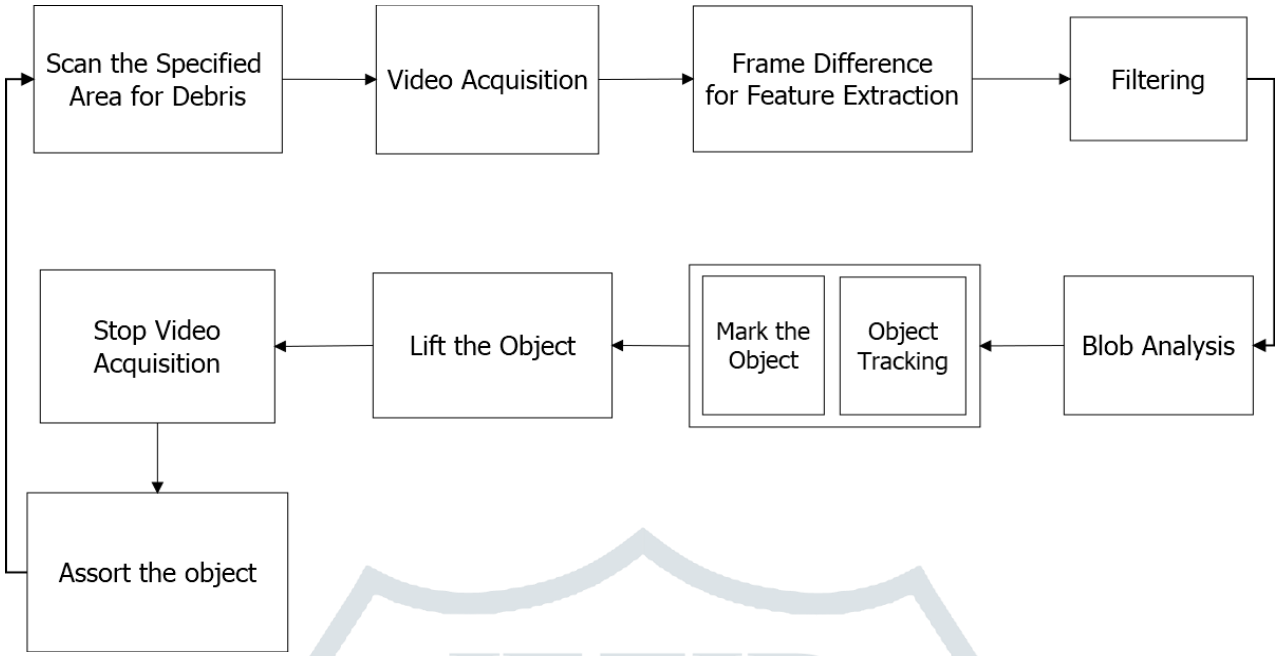

Fig 2 System Flow

The bot will move on the terrain and Object sensor will alert on encountering any obstacle. The bot will then identify if the object is trash The robotic arm of the bot will then pick up the trash and put in the corresponding trash can. Proximity sensors which are fitted on the top the bin will alert once the can is full and the bot will immediately move to the nearby common bin to discard the wastes. The wastes can be further collected in a separate bin totally for manure use.

Following are the components used for development of Debris Assortment Rover.

Sl.No	Components	Specification
1	Processor	Raspberry pi 3b +
2	Sensor	Ultrasonic Sensor (HC-SRO4)
3	Power	Li-on Battery 14.8V -16.8V
4	Camera	Pi-Cam (5MP)
5	Motor	12V DC Motor 100 RPM
		Servo Motor MG995
		Micro Servo Motor SG90

Table 1 Hardware Requirement Specifications

V. IMPLEMENTATION

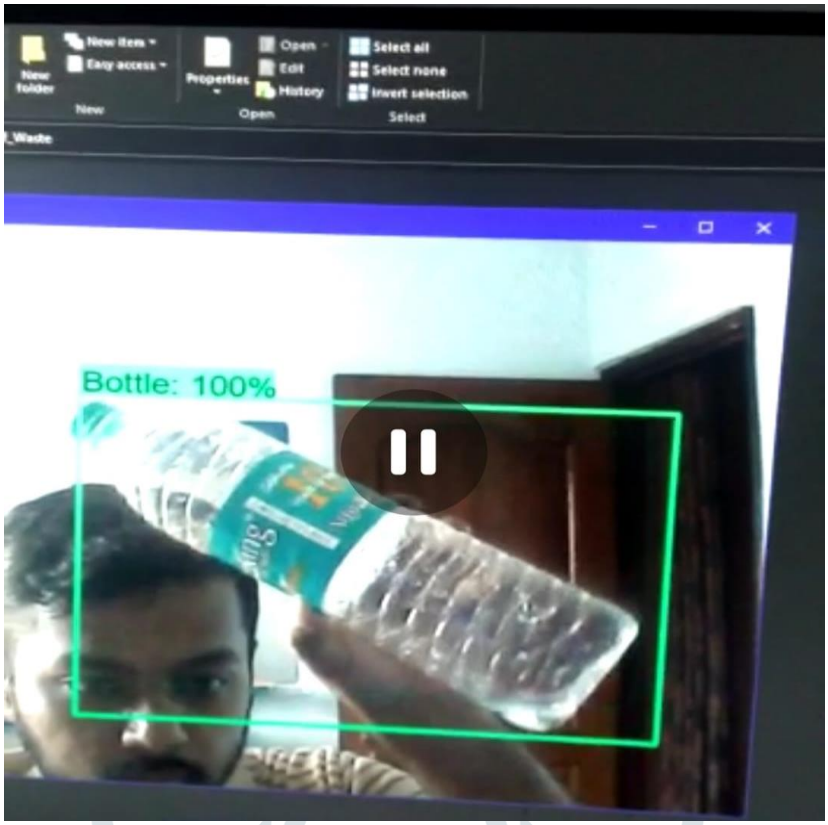

Fig 3 Object Detection

The DNN(Deep Neural Networks) Algorithm is trained to detect plastic bottle, as shown in the above figure the plastic bottle is being detected, the algorithm has a threshold of 80% and above.

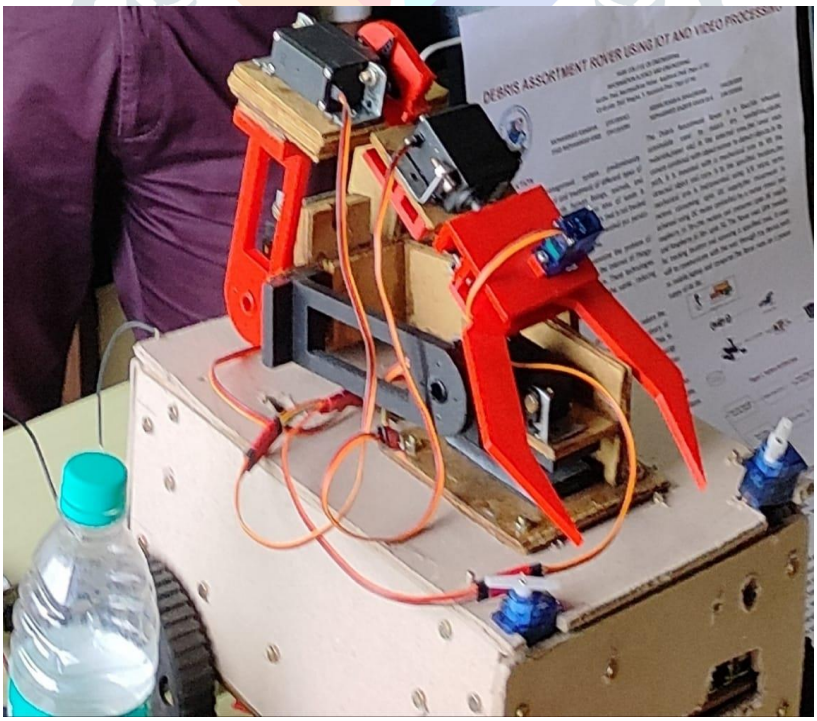

Fig 4 Complete Setup

The arm is mounted with an ultrasonic sensor, once the object is detected using the camera ,the rover approaches the object and the sensor confirms the presence of the object and the claw lifts the object.

VI. CONCLUSION

It helps the humans working in that field to relieve from the health problems and can be prevented from cancer, etc.
The sensor network that can help the robot manipulate and isolate wanted material means that this pure yield will amount to a better price in the market.
This would be an added advantage to the Swacch Bharath Abhiyaan by our Prime Minister.

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