SMART ROBOTIC GARBAGE MANAGEMENT SYSTEM

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Abstract *:*"Swachh Bharat Abhiyaan" is a national campaign initiated by the Government of India, which covers 4,041 cities and towns, to clean the streets, roads and infrastructure of the country. The main motto of the mission is to cover all the rural and urban areas of the country. With increase in population, the scenario of cleanliness with respect to garbage management is degrading tremendously. The overflow of garbage in public areas creates the unhygienic condition in the nearby surrounding. It may provoke several serious diseases amongst the nearby people. It also degrades the valuation of the area. To avoid this and to enhance the cleaning, '**smart robotic garbage management system**' is proposed. The proposed automated robotic dustbin can sense human being approaching towards it and opens the upper lid and alerts the user to use the dustbin. If the waste falls outside the dustbin it can sense and alert the user.

IndexTerms -**Image processing, Machine Learning, IOT, K Means Clustering Algorithm, Waste Management**

I.INTRODUCTION

Waste management is a global issue but its consequences are more pronounced in developing countries. World is facing as well as enjoying Urbanization. In urban life waste is the major issue. How, where and when waste should be disposed is the burning issue. In India, solid waste management system has failed to keep pace with social and economic development in several regions. Solid waste management is one of the most challenging issues, which are facing a serious pollution problem due to the huge quantities of solid waste. The inefficiency in management of municipal solid waste can adversely affect public health, environment and our economy. Considering sustainability for the smart city concept, major issues faced by most of the smart cities will be enormous .

At various stage of Solid Waste Management process the problems which cities face today will be acute if not addressed in a smart manner due to the Urbanization pressure and its multifarious effects on the local as well as regional environment .The automated robotic smartbin can sense human being approaching towards it and opens the upper lid and alerts the user to use the smartbin. If the waste falls outside the smartbin it can sense and alert the user.

The automated robotic smartbin can segregate the wet and dry materials and put it in the respective chambers. Once a particular chamber is filled up the bottom lid opens up and dumps the waste in the lower part of the smartbin. The robotic smartbin comes with a HD camera that monitors the nearby area and processes the captured images and detects if any waste is there. If waste is detected the robotic smartbin moves towards it and picks it up.

Robotics is related to electronics, mechanics, and software technology. Today research on robotics is focused on developing systems which exhibit modularity, flexibility, redundancy, fault-tolerance. A general and extensible software environment and seamless connectivity to other machines are some of the characteristics some researchers focus on completely automating a manufacturing process or a task. Robots are normally designed by providing sensor based intelligence to the robot arm, while others try to solidify the analytical foundations on which many of the basic concepts in robotics are built.

II.PROBLEM STATEMENT

In our daily life we face many difficulties while moving on the streets,walkinginside the park, walking on the roadside, market areas due to improper management of waste materials. Most of the time not only human beings even street dogs tend to scatter the waste because of which the diseases spread easily. Few reasons for this kind of situation are improper management of the waste material, improper adequate installation of the dustbin in various areas, as well as the untimely collection of waste which leads to unhygienic surroundings such as bad smell and spread of diseases.One more important cause is the inherent habit of the humans to dump the waste due to lack of dustbins in the neighborhood. This leads to decomposition of the waste for prolonged time leading to certain chemical reactions in the environment. Lack of knowledge about proper waste management.

While doing the research work and interviewing the common people and the government authorities associated with the garbage management (Municipal corporations) of various places, few very common things turned up : A nation always possess rules , regulations and technologies but the matter of grave concern is that the linking factor is missing, faithful following of duties by the officers and low grade workers is nowhere to be seen. Here arises a urgent need of developing a system which can handle the situation intelligently before it's too late. There is a tendency for accuracy to vary greatly as well as delay in readings. Those problems may be enlarged in real time applications.

An efficient waste management is a pre requisition for maintain a safe and green environment as there are increasing all kinds of waste disposal which is lacking in the environment. In most of the system, waste separation is done according to the type of the waste i.e. dry or wet. Similarly, the waste separation is done also on the basis of the type of garbage bin located at various locations.Over the last few decades, plenty of remedial ways were suggested dispensing with filled level detection of garbage vehicle, though it is still a tough challenge /arduous task. The detection of the fill-level for different garbage collection vehicle presents many difficulties due to the various irregularities of the bin-filling process, such as the irregular shape and the variety of the included materials .

PROPOSED SYSTEM

To solve the problems, IR, Ultrasonic Sensor, Camera and robotics technologies could be used to reduce cleaner's workload and assure a clean environment. The Camera can rotate and capture image. The captured image is processed and detect the waste product or material and put a laser light beam to it. The LDR follows the light and reach the waste material. The robotic smartbin can capture the waste and put it into the bin. The robotic smart bin can detect the dry and wet material put into it and dump it into the respective chamber.

III.RESEARCH METHODOLOGY

3.1 Modules Description

1. Controlling Lids

The robotic smartbin has two lids, one on the top and another in the bottom.When it detects that someone is approaching towards it, the upper lid of the smartbin opens up so that we can dump the waste inside the smartbin.When the upper chamber of the smartbin fills up with waste, the lower lid opens up and dumps all the waste into the lower chamber and sends a message to the care taker to clean the lower chamber.PIR sensor is used to detect the motion of the people coming to the garbage bin with trash while the bin is at full status and block adding of any more garbage to the bin through informing them by speaker. An individual PIR sensor detects changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor.Objects of similar temperature but different surface characteristics may also have a different infrared emission pattern, and thus moving them with respect to the background may trigger the detector as well.When an object, such as a human, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature, and then back again.

2. Segregate the wet and dry waste

There are two chambers(partitions) in the smartbin.One chamber is for wet waste and another one is for dry waste.When we dump waste into the smartbin, it can detect what type of the waste i.e wet or dry.If wet waste is detected then the upper lid will rotate towards the wet chamber and dump the waste. If dry waste is detected then the upper lid will rotate towards the dry chamber and dump the waste.Moisture sensors measure the volumetric water content in the waste.The Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium.In waste, dielectric permittivity is a function of the water content.The sensor averages the water content over the entire length of the sensor.There is a 2 cm zone of influence with respect to the flat surface of the sensor, but it has little or no sensitivity at the extreme edges.Moisture sensors typically refer to sensors that estimate volumetric water content.The dielectric constant of a certain volume element around the sensor is obtained by measuring the speed of propagation along a buried transmission line.The moderator properties of water for neutrons are utilized to estimate waste moisture content between a source and detector probe.Measuring how strongly the waste resists the flow of electricity between two electrodes can be used to determine the waste moisture content.The amount of water present can be determined based on the voltage the waste produces because water acts as an electrolyte and produces electricity. The technology behind this concept is the galvanic cell.

3. Moving in a Path

The robotic smartbin can move on the specified path in the park. On the move if it detects any obstacle then it stops, changes its direction and then continues moving. It helps us to get the smartbin near to us most of the time.A stepper motor or step motor or stepping motor is a brushless DC electric motor that divides a full rotation into a number of equal steps.The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.Stepper motors effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The main idea behind it is a programmable robotic vehicle with a dustbin having recyclable and non recyclable compartments on it.The bots can be placed on different designed locations in an area where they will behave as normal dustbin for collecting the waste , once the compartments of dustbin are full it will move to the dumping site by following a painted path and will return back to its location after dumping .The dumping of waste at the dumping sites can also be timed such that it matches with the time at which municipal waste collector vehicles will arrive at the dumping site to collect the waste (it can also have a default dumping time). The additional features such as proximity sensor that will open the dustbin lid automatically when someone try to put waste in the dustbin and some praising mechanism either a gesture or through some digital means will attract the public to use this dustbin. Moreover there are limitless additional features that can be added depending upon the place where the bot is being used.

4.Detect and collect waste

The smartbin is installed with a HD camera. While moving, it keeps on monitoring the surrounding and captures images. The captured image is processed and if any waste packets are detected, it targets the waste, moves towards it, picks up the waste packet and dumps inside it.Ultrasonic sensors measure distance by using ultrasonic waves .The sensor head emits an ultrasonic wave and receives the wave reflected back from the target.Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings.An IR sensor can measure the heat of an object as well as detects the motion.These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor.

5. Automatic alert

The smart bin has an additional functionality of updating the status of the bin. The smart bin is connected to an application through a Bluetooth device.The application has the capability of detecting the amount of waste filled in the smart bin. The ultrasonic sensor attached to the smart bin helps with this functionality. The application sends an alert to the user as well as the garbage collector as soon as the smartbin is filled. A notification prompt is sent to the registered mobile phone and the user can monitor the waste filled in the smart bin. Bluetooth is a wireless technology standard for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific and medical radio bands, from 2.400 to 2.485 GHz, and building personal area networks (PANs).Bluetooth is a packet-based protocol with a master/slave architecture.One master may communicate with up to seven slaves in a piconet.All devices share the master's clock. Packet exchange is based on the basic clock, defined by the master, which ticks at 312.5 µs intervals. A master BR/EDR Bluetooth device can communicate with a maximum of seven devices in a piconet (an ad-hoc computer network using Bluetooth technology), though not all devices reach this maximum. The devices can switch roles, by agreement, and the slave can become the master.Android software development is the process by which new applications are created for devices running the Android operating system.Some languages/programming tools allow cross-platform app support, i.e. for both Android and iOS.Through the Bluetooth device, a notification prompt is sent to the mobile device and a message stating the smart bin is filled will be achieved.The garbage collector can hence come and pick up the waste.
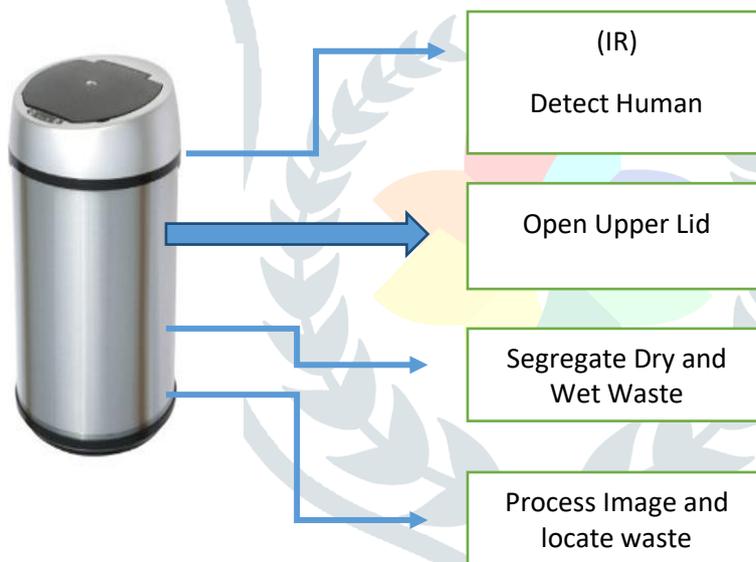
IV.RESULT AND DISCUSSION

The system presents a parallel approach, based on robotics and image processing to construct a smart robotic garbage management system, with the aim of improving the cleanliness of the society. In this proposed system, IR, Ultrasonic Sensor, Camera and robotics technologies could be used to reduce cleaner's workload and assure a clean environment.The Camera installed to the smartbin can rotate and capture images. The captured image is processed and detect the waste product or material and put a laser light beam to it. The LDR follows the light and reach the waste material. The robotic smartbin can capture the waste and put it into the bin. The robotic smartbin can detect the dry and wet material put into it and dump it into the respective chamber. The accuracy is 90% and can enhanced in the future with more technology.This proposed model is a great step forward to clean the environment contributing towards the campaign "Swacch Bharat Abhiyan". It provides a smarter way of handling garbage by collecting and segregating the different types of wastes. There will be proper monitoring of workers and all the work is done in a systematic way. The automatic alert feature also avoids the unnecessary travel done by the workers to collect the waste. Thus, it is a good initiative towards #CleanIndia.

V. ACKNOWLEDGMENT

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