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Smart Trash Collecting and Segregating Robot

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***Abstract*— The Earth is not a garbage can to litter everywhere. Pollution is a serious issue that goes alarming every now and then. Pollution increases subsequently with increase in population. Garbage has to be strictly discarded to avoid pollution. Here on emphasizing land pollution, "Garbage Collecting Robot" can clean up all the garbages that are thrown on the roads using Raspberry Pi. This robot will be built on a metallic base and powered by a battery and contains a Pi cam to segregate wastes on image processing. The bot will contain a sensor for obstacle detection and hence has a good path determination. On implementation, manual requirement can be avoided and thus prevents people from sanitary issues.**

Keywords*— *Image processing, Raspberry Pi, Recycling, Robot, Ultrasonic Sensor.

1.INTRODUCTION

"Swacch Bharat Abhiyan", a need for a clean India is a dream that is yet to be fulfilled. Land pollution is one of the major problems that we face especially in cities, malls and even places like railway stations and airports. Sanitary workers who clean up the garbages are tend to be exposed to various skin ailments and health issues. Hence these manual workers must be replaced by a bot which can be in turn controlled by the workers to ensure employment doesn't fail.

2.LITERATURE REVIEW

2.1) In a system that collects garbage automatically through line. For which we are designing an arena so that the machine will follow the specific path and also manually by using Arduino and Bluetooth module. The machine can be controlled by software which will give command to the robotic jaw to collect the stationary waste. It also has the characteristic to get controlled by voice command which makes the robot to collect the garbage according to the given command. Findings: We have designed a semi-autonomous garbage collector robot which can do multiple functions. This robot has one robotic arm in which it can pick the garbage and dispense it in main basket attached to the robot. The camera placed on robot helps the administrator to remotely monitor the robot while collecting garbage. The prototype has an electronic mechanism by which the robot can dispense it collected garbage to the dispensing point. This robot has installed batteries in which there is no fuel or electricity required to complete the operation.

2.2) 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. When an object is detected, the camera captures a single image and sends it to the server for image processing classification to detect it as garbage or non-garbage. The advantage of this method is that a lot of time, memory and power is saved by performing processing on a single image, rather than continuously performing processing on every frame of a live video feed. Thus we can solve this purpose by using low end processors and hence the hardware cost shall be substantially reduced. For classification of the image, we can use two approaches: A. Perform image processing on the robot processor itself: This will require a moderate cost processor to be on the body of the robot. There may be some lag in output since processor won't be as high end. But because of the same reason, the cost will be less. B. Send images from multiple robots on a central server: The central server will use a high end processor while the robot processors can be extremely low end. The robots will simply capture images and send them wirelessly to the server.

2.3) The robot Garbage collection system consists of a set of a ARM connected to the motors. The mechanism will not operate for entirety of the vehicle operation and will rotate only for predetermined set of conditions. The main aim of the mechanism is to collect garbage which is of similar dimensions to that of juice cartons, crushed papers, and all light items whose height is between 5 to 10 cms. Mechanism is mounted on the front side of the base with an appropriate ground clearance. When the sensor detects an obstacle, the image processing is used to categorized the object as garbage or any living organism .The object detection is specifically used for safety of animals ,so that they don't get harm . The garbage is pick and drop into a bin which is placed right behind the mechanism. The robot keeps collecting the garbage until it reaches certain height in the bin. Once the bin is filled the collected garbage is disposed to a selected place.

3.PROPOSED SYSTEM

The bot can travel in any land terrain and operates on a battery. Commercial stainless trash cans are used to dump the waste. It will also contain a scrubber at the bottom to sweep along the way it travels. The motion of the bot is controlled by Python programming and Raspberry Pi 3b+. The bot platform is controlled by a 24v DC geared motor and rubber wheels for smooth motion. The bot is trained to segregate bio and non-bio degradable wastes separately on different trash cans using image processing. Precision long range ultrasonic distance sensors can be used to know the distance from obstacles around so that the robot can autonomously navigate around. A GPS module on board can be used for getting the accurate location of the robot. This helps to find the main garbage bin in which the location of it is pre saved. These robots can have a load cell along with a proximity sensor to tell the amount of waste in the trashcan.

3.1 COMPONENTS :

i) Raspberry Pi 3b+ :

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The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT. The Raspberry Pi is a low cost, **credit-card sized computer** that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

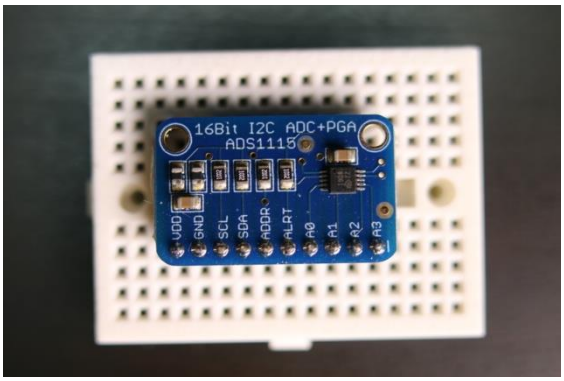
ii) Ultrasonic Sensor:

The ultrasonic sensor measures the distance using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Hence the distance to the target can be measure by measuring the time between the emission and reception. Hence it is much effective in detecting an obstacle that is encountered on the path of the bot.

Distance L = ½ x T x C

iii) ADC ADS1115 Module :

The ADS1115 are great analog to digital converters that are easy to use with the Raspberry Pi using its I2C communication bus. The the ADS1115 is a higher precision 16-bit ADC with 4 channels. It has a programmable gain from 2/3x to 16x so you can amplify small signals and read them with higher precision.



iv) Proximity Sensor:

Proximity sensors are sensors that detect presence of objects without physical contact and relay that information captured into an electrical signal. Proximity sensors are suitable for damp conditions and wide temperature range usage, unlike your traditional optical detection.

v) GPS Module:

GPS module has four connection pins, namely: Vcc, GND, TX and RX. It requires a power input 5V 100mA ,which can be provided using any suitable supply source. The RX pin of **Pi**, i.e the 10th GPIO pin on the **RPi** board, should be connected to the TX pin of the **GPS module.**

4. BLOCK DIAGRAM

The bot will move on the terrain and ultrasonic sensor will alert on encountering any obstacle. The bot will then identify if the object is trash and also classify it as bio degradable and non-bio degradable based on a pre-trained model which is trained images using tensor flow and keras. 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 non-bio wastes. The bio- degradable wastes can be further collected in a separate bin totally for manure use. GPS

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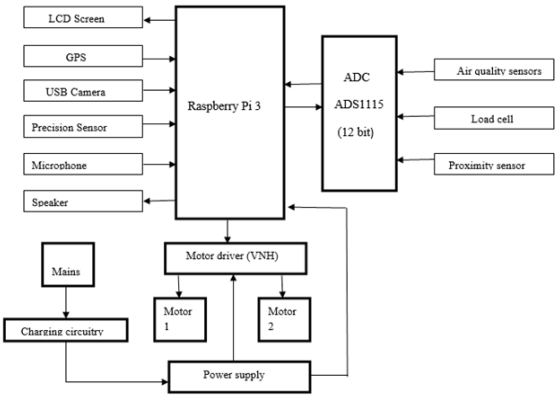
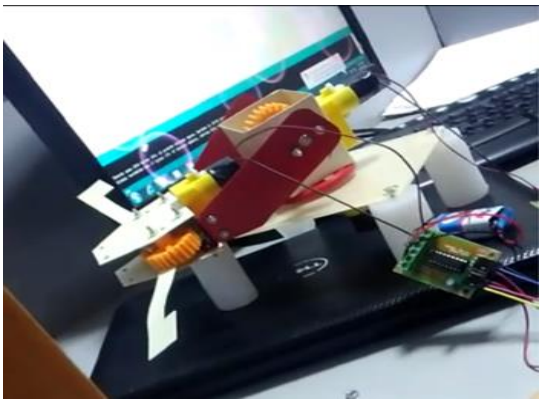
module in the robot will be used to monitor the location of the bot.



5.CONSTRUCTION AND OUTPUTS

5.1) Construction :

Actuation of bot in progress



5.2) Outputs:

The system showed good accuracy and could work its best on the trained objects. The motion of the bot is also good and its path determination seemed to be good. The novelty of this paper lies in the concept of a cost-effective system that uses IoT to optimize the working of a network of garbage collectors.

SR. No	Command	M1a	M1b	M2a	M2b
1	Forwards	ON	OFF	ON	OFF
2	Backward	OFF	ON	OFF	ON
3	Left	ON	OFF	OFF	OFF
4	Right	OFF	OFF	ON	OFF
5	Stop	OFF	OFF	OFF	OFF
6					

```
In [18]: data.show_batch(rows=4,figsize=(10,8))
```

6. 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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