

Garbage Management System using Line Follower Robot

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ABSTRACT

1. Abstract

Our project mainly concentrates on offering an easy, reliable solution to the common problem of inefficient garbage disposal faced in the society, so our system can be used in many places specially for the Municipal Corporation. For this, we have implemented a fully automated, line following garbage bin. In this system there are two sites. A garbage dumping area. The other device is the garbage collecting area where the robot will go and collect the garbage , which starts its process after receiving the parameters about the garbage level from the garbage collector. Here, the process includes the garbage collector moving through a road visiting each every dustbin, while stopping to collect garbage if it is allowed to do so. This is the main process of the system. The path followed by the garbage collector is marked in black, in order to pick it up easily by the IR sensors. When the garbage container becomes full, the container continues straight to its dumpsite. The dumping of garbage is automated as well. When we look at the system design, it is based on 2 parts which are, "the garbage collector" and "the garbage container". In the implementation of the system, we used "Arduino IDE" "Thingspeak" to program the microcontrollers and microprocessors. We also used "Thingspeak" "circuito.io" to design the circuit boards. We used Arduino Yun, motor driver board, DC geared motors,IR sensors

2. Introduction

In modern times, there are many problems which always disturbs us or induce us to make it get solved, one of the similar problem is the amount of garbage being disposed.this has become one of the major problems that the whole world has come to face today.

we know that how important it is to take our environment very clean atleast for our health. effectiveness of garbage disposal is very important. Now a days most of the garbage collection system works on the manually collecting the garbage which is both eneficient and slow.

This means that garbage disposal becomes a highly time-consuming and difficult process, and due to that most of the part and the area of the society is get affected. To suggest some ideas which can solve the above problem and convince that there are some ideas which are more efficient and time consuming which making it highly adoptive idea for disposing the garbage in the public places. It will save time and money both and without having separate man power to collect it. This is the motivation for our project. The thought of easing the task of collecting and

disposing garbage is highly motivating. We know collecting the garbage is the most difficult job that is where our motivation lies for this project.

3. Aim and Objectives

The primary aim for doing our project was to give an idea to introduce a way in which garbage can be collected and disposed in effective manner. To achieve this, the following objectives have to be completed.

- Studying the problem of garbage disposal at a school, restaurant, office, hotel, production plant or any other suitable location,
- Develop a solution to that problem,
- Designing and developing a system for solving the problem,
- Testing and maintaining the implemented system,

4. Solution

4.1. Users

This system, is mostly designed to reduce the overhead of the organisations like the municipal corporation, can be used and implemented by various other types of individuals as well. For example, in a hospital, hotel, garden or any other public place where the disposal of garbage occurs on a daily basis, this system can be used by the people frequenting such places, to effectively dispose garbage.

4.2. Inputs

Signals from the IR sensors,
Data from the thinkspeak system which is actually coming from the node mcu,
the main data is collected by the ultrasonic sensors.

4.3. Outputs

- we are fetching the data from the thingspeak and using it to analyse the level of the each garbage to take some important action on it.
- we are also making the use of data for moving our robot to the place where the garbage is full.
- finally as a output we are getting a solution to the problem we are getting in our society.

Fig. 1. Adiabatic exponent Γ_1 . Γ_1 is plotted as a function of lg internal energy [erg g⁻¹] and lg density [g cm⁻³].

4.4. Scope

- specially build for the public domain.
- designed to collect the garbage from the public area which area actually very big area.

4.5. Process

- First we have to boot all the system and then gradually all the components will start working as they have intended to.
- after that node mcu will send data to the system which is mounted on the line follower robot.
- this data is fetch by the arduino which is mounted on the line follower robot and it will get analyse by it.
- after the analysis of the data it will start moving to all the places where it is program to go and visit all the possible garbage container which are full.
- it will collect garbage from the container to the container which is mounted on the robot.
- after collecting the garbage the robot will come back to the garbage dumping area.

4.6. Technology

- arduinp Yun technology
- DC gearhead motor technology
- Morot Driver technology
- IR sensors technology
- ESP 8266

4.7. Features

- it will collect the garbage from the garbage which is need to be emptied as early as possible.
- The system is fully automated
- this prototype can be used for the very big space like public space.
- ability to monitor the system from the remote places accurately.

4.8. Summary

This section mainly focuses on the importance of our robot and how it really works and enhances the quality of human life, by reducing the wastage of time and money. Also, it describes the way we can use and implement it as a solution for a common problem affecting the whole world.

5. Technology Adapted

5.1. Introduction

The Automated Garbage Collector comprises of many technological advancements to achieve its purpose of automating the difficult task of collecting garbage. It consists of apparatus varying from electronic to mechanical, and technologies such as port programming. Hardware equipment such as DC gearhead motors, motor drivers, IR sensors etc. has made it possible to make this concept of automated garbage collection a reality. the different technologies used in this system are explained.

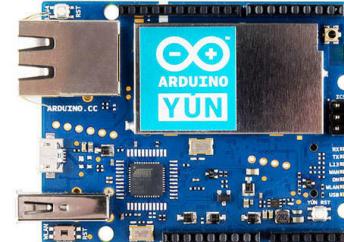


Fig. 2. Arduino Yun

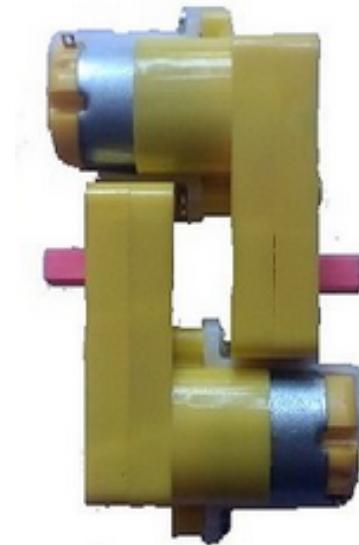


Fig. 3. DC Gearhead Motor

5.2. Technologies

5.2.1. Arduino Yun

The Arduino Yún is an Arduino board unlike any other. While programming it is very similar to the Arduino Leonardo and uses the same processor, the Atmel ATmega32U4, it also has an additional processor, an Atheros AR9331, running Linux and the OpenWrt wireless stack. Programming the 32U4 via USB is identical to the Arduino Leonardo. Once you've configured the Yún to connect to your WiFi network, you can program the 32U4 via WiFi as well.

5.2.2. DC Gearhead Motor

The DC gearhead motor is used to give the garbage disposer the ability of moving itself. The DC Gearhead motor is the simple advancement of the DC motor itself, with an added set of gears to enhance the output torque. When the coil (ironless winding) is powered, a magnetic field is generated. The permanent magnets housed inside the motor push away the respective side of the armature forcing it to rotate. This process happens repeatedly, as

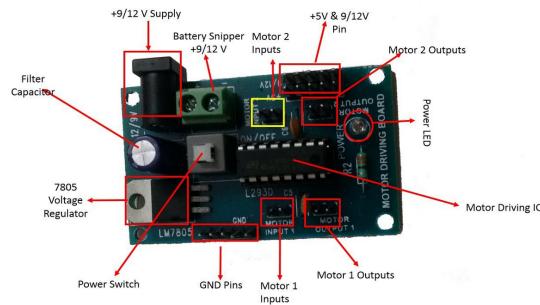


Fig. 4. IR sensors



mcu.jpg

Fig. 6. Node MCU



driver.png

Fig. 5. Motor Driver

the commutator reverses the direction of the current through the coil, causing the magnetic field to reverse its direction.

5.2.3. IR Sensor

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 measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor.

5.2.4. Motor Driver

Motor drives are circuits used to run a motor. In other words, they are commonly used for motor interfacing. These drive circuits can be easily interfaced with the motor and their selection depends upon the type of motor being used and their ratings (current, voltage). The major motor drive components for DC motors are: a controller, a motor driver IC or a motor driver circuit, the desired DC motor being used, power supply unit and the necessary connections to the motor.

5.2.5. Node MCU

NodeMCU is an open source IoT platform.[4][5] It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built



machine.jpg

Fig. 7. Servo Machine

on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS.

5.2.6. Servo Machine

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which runs through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Due to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.

6. Automation of Garbage Disposal

6.1. Introduction

The Automated Garbage Collector is a simple solution to overcome the difficulty of collecting garbage in places such as public gardens, municipal corporation, and for the smart city project as one of the features of the city,

6.2. Solution

The Garbage Collector gets its multiple inputs from the IR sensors, which are mounted on it for the movement to follow the path. The user can press the start button to start the system and after fetching the data the robot will start its work of garbage collection instantly.

IR sensors from the 2 IR sensors give the inputs for the PIC microcontroller to control the DC motors so that the Garbage Collector can precisely travel on the black line. The line is get crossed where that positions exactly under the middle 2 sensors . It notifies the garbage collector that it is at a place and forces it to halt for a moment and get ready for getting the garbage. The Garbage Container is positioned at the black line where it has a cross in the middle of the line so that the Garbage Collector is directly underneath it. Then the garbage collector will send the data to the node mcu and make it open its lead to pour the garbage in the garbage container of the robot. After collecting the garbage it will go back to the dumping area and Then the door to a side of the Garbage Container is opened, and the garbage is dumped into the Garbage Collector. Afterwards, the lid of the Garbage Collector. Then it moves onto the next class and repeats the process.

The Garbage Collector can dump the garbage in the garbage bin by itself. The Garbage Dumpsite is detected by the cross. There, the door which is positioned at a side of the Garbage Collector opens.

The Garbage Collector and the Garbage Container functions in the above manner in order to ease the traditional method. Yet the System cannot handle liquid waste material and overweight garbage.

6.3. Summary

The purpose of this section was to describe how the automated garbage collector and the garbage container are assembled, to perform its required functions.

7. Analysis and Design

7.1. Introduction

In this section, the design of system is discussed. In this system, several modules such as microprocessor unit, motor driver, , IR sensors, node MCU DC motors are included. The main part, which connects all these modules, are the arduino Yun.the brain of the system, performing all the processing between the inputs and the outputs.

7.2. Design

7.2.1. Garbage Dump

Garbage dump is located bit far from the society to keep the healthy environment clean. When the garbage collector reaches the garbage dump it will automatically dispose the garbage into the garbage pit.

7.2.2. Garbage Collector

Then we are going to program the garbage collector to go to each garbage container on pre-defined path finding it way on the black path. When it reaches a garbage container, it will receive garbage from the garbage container. after collecting garbage it will automatically go to the waste dumping site, drop off the garbage and will continue the garbage collection again.

7.2.3. IR Sensors

In this system, IR sensors are used for the movement of the robot. Since IR rays are absorbed by black surfaces, it can be used to

choose between black and other surfaces. We are using IR sensors that take 2 different inputs into the system.

- Detect the path of the black line, which marks the route of the garbage collector.
- Sense whether the garbage collector is located
- Signal the Garbage Container to drop garbage

To detect the black line and to determine, the route and where to stop,IR sensors are used. To sense whether the Garbage Collector is full or not the ultrasonic sensor and the IR LED of an IR sensor is used.

7.2.4. Garbage Level Checker

The garbage level is checked by an ultrasonic sensor, which is positioned inline, and on the correct level inside the Garbage Collector. When the garbage is over a certain limit, it obstructs the ultrasonic sensor, which is pointed at the floor of the garbage collector.

7.2.5. Garbage Container

Purpose of garbage containers is to hold garbage temporally until the garbage collector collects them. We are going to fix garbage containers in to the outside walls or poll of the each home or the area. So the garbage collector will take it when the garbage will open the leaver to put the garbage in the garbage collector..

7.2.6. Summary

There are two main components of this system. Garbage Containers, the Garbage Collector, that moves from garbage container to container. In this section the different modules of the system are described to give an overall idea of how the system is formed from the assembly of different components.

8. Implementation

8.1. Introduction

We are going to discuss how we implemented the system. We have assembled all the modules to automate the garbage collection. Here, we will discuss about the implementation of the modules, how they work together and perform logical decisions with the help of , flow charts and the coding of the microprocessor.

The line follower will be at dumping area,it will check the bin1 and bin2 values (i.e garbage container 1, and garbage container 2) from thingspeak which is send by node MCU to thingspeak.the line follower will calculates the values of flag1 and flag2 whether it has to be stopped in either places or not. Arduino Yun will fetch the bin values from thingspeak, if it gets bin1 garbage percentage more than 20 percent, it will set the flag1 value as 1 and send it to thingspeak, now the line follower moves forward, while the bin1 station comes, the line follower stops and send flgArrived1 value as 1 to thingspeak and further thingspeak sends the value of flagarrived1 to the bin1 place which is the garbage container 1, when node MCU sees that the flag1 value as 1 and flagArrived value as 1, node mcu opens the bin1 servo with some delay and gets closed. node MCU sets the bin1 garbage percentage as 0 percent because now there is no garbage in bin1 . the garbage is thrown out to the garbage collector (i.e the line follower) and now the line follower gets the garbage and sets the flag1 value as 0 and flagArrived1 value as 0

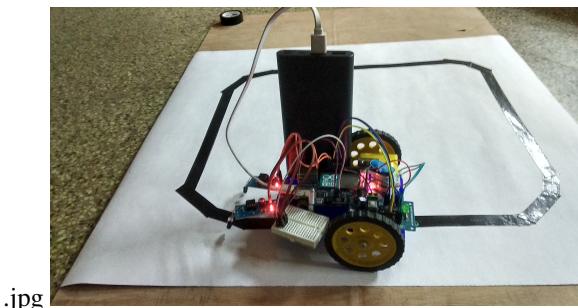


Fig. 8. Line Follower while testing



Fig. 9. a complete setup with it's components

and the values to thingspeak and set the value of flag as 1 because the garbage is collected in line follower that has to be dumped and then it precalculates the bin2 value similarly. now it moves for the bin2 station, same will happen like the the first case, after collecting gabage from bin2 the line follower will go to the dumping area and will see whether the flag value is 1 or not, if it is 1 it will open the servo and all the garbage will be dumped. and these operations keep on moving in the loop.

9. Conclusions

1. The primary aim for doing our project was to introduce a way in which garbage could be collected and disposed in an efficient and effective manner. By implementing the automated garbage collector (line follower robot).
2. the cleanliness of the surroundings is maintained with less effort using the technology we have discussed.
3. The ‘Automatic Garbage Disposal System’ can be used effectively and efficiently in real life scenarios. But the system has its limitations. The Garbage Container Units must be properly aligned with the white rectangle of the path before the usage. The collector maneuvers on the black line. Therefore, the black line has to be almost perfect.
4. Another limitation is the system is not designed to operate on multiple stories but it can collect garbage at a single level.

References

- [1] <https://www.arduino.cc/en/main/software>
- [2] <https://thingspeak.com/>
- [3] <https://www.circuito.io/>