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# Autonomous Garbage Collector Robot

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***Abstract :*** *As we know that the clean environment is most important in our daily life. Due to requirement of foods, goods and electronic devices need of plastic and cardboard is increasing in whole world. After purchased many items peoples throw items packing material on roads, park and other places from which our environment will be polluted. It highly affect on wild animals, health security and children. In rural and urban areas garbage collection is big issue in now days so we make "Autonomous Garbage Collector Robot". It is user command basis robot which is made of many electronic components like Arduino UNO, Servo Motor, Bluetooth module HC05, four Dc geared shaft motors, Motor driver shield l293d and jumper wires. All project components are fabricated on 36cm×15cm plane plywood. Autonomous garbage collector robot will be operated by the application Arduino Automation App which is necessary to install every user Smartphone. This robot needs 12v power supply for the working. It has four wheels for the movement of robot and also jaw which is made of cardboard. The jaw type lifter attached with servo output shaft it is capable to move in any angle between $0^{\circ}$ to $180^{\circ}$. Four wheels of robot is controlled by motor driver shield l293d. The Servo Motor and Motor driver shield working when it receives the command of Arduino UNO because it contains main code for movement of robot. HC05 Bluetooth module Txd and Rxd pin is connected to Rxd and Txd pin of Arduino Uno respectively. When the user send the command like f , b , r , l , s and c through mobile then HCO5 Bluetooth module receive the command and send to Arduino Uno if user command will be same to command of main code then robot will start working. When user command* ***"f"*** *then robot move in forward direction, when user command* ***"b"*** *then robot move in backward direction, when user command* ***"l"*** *then it move left direction, when user command* ***"r "*** *then robot move in right direction, when user command* ***"s"*** *then robot will be in stop condition and when user command* ***"c"*** *then servo motor lifting the garbage at angle 90 degree and throw into bin. This project is physically demanding in rural and urban areas and its future scope is better according to now days.*

***Keyword - Arduino UNO, Bluetooth Module, Arduino Automation App, User, Garbage Collection***

## I. INTRODUCTION

Garbage collection is that the big issue globally and it needs serious attention. There's no proper management of waste and garbage in rural and concrete area in India, which can cause threat to health security, hygiene, human safety and wild life safety. Presently thel garbage collection system exists in most places, where human intervention is involved. Manual garbage collection and garbage collection is the good source to generate employment but there are some issues associated with it, like some time there is unavailability of manual labor for days such as in maintaining railway tracks. There is a big concern of human safety when harmful gases exist. Garbage is the major problem not only in cities but also in rural areas of India. It is a major source of pollution. Indian cities alone generate more than 100 million tons of solid waste a year. In 2000, India's Supreme Court directed all Indian cities to implement a comprehensive waste-management programmed that would include household collection of segregated waste, recycling and composting. These directions have simply been ignored. No major city runs a comprehensive programmed of the kind envisioned by the Supreme Court. It is not wrong to say that India is on verge of garbage crisis even though 9000 crore rupees are allotted for the Swachh Bharath Abhiyan.

There are already different type of garbage collection robots like Robo-dumpster which mainly aims at collecting garbage from full cans and dispose it designated area and Dust cart which is designed to navigate through urban areas avoiding static and dynamic obstacle and waste door to door. These robots which are in use have various disadvantages like high implementation cost, not user friendly and aims at only collecting filled dustbins but not on collecting mechanism, etc.Also, Municipal solid waste workers (MSWWs) or refuse collectors, universally expose too many work related health hazards and safety risks, notably allergic and other diseases of the respiratory system. Health impacts could also entail musculoskeletal, gastro intestinal and infectious diseases as well as injuries caused by work-related accidents. Hence to overcome this major problem of waste collection Autonomous Garbage Collection robot is developed. It aims at providing automatic control to collect the garbage. It differentiates between static and dynamic obstacle and move accordingly as it programmed. It basically consists of sensors at different levels to detect the dynamic obstacle. It also disposes the garbage to a pre-specified place. If the trash bin is filled, it will be detected and the garbage will be disposed.

## II. METHODOLOGY

In the present paper, the design of garbage collector robot uses technical method. In sequence, the method is identification of the needs required. Then these needs are analyzed to get specific components. These components are later integrated to get the desired output. The basic methodology is as shown in figure .The operation of the robot can be classified into two main categories. They are motion control of the robot and garbage collection.

### A. Locomotion of Robot

The robot can travel in the randomly path by using a combination of motors, drivers, and connected to the Arduino. This system consists of four shaft motors of 150 rpm each, motor drivers. The Bluetooth module act as input to the Arduino. The motors are connected to the output of the Arduino through the drivers. The motors are made to rotate based on the preprogrammed instructions in the Arduino.

### B. Garbage Collection

The robot Garbage collection system consists of a set of rotating blades mounted on a shaft 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, plastic bottles, crushed papers, and all light items whose height is between 5 cms. Mechanism is mounted on the front side of the base with an appropriate ground clearance. Two motors are mounted on the two sides of the shaft and is connected to Arduino to perform rotating mechanism. The collection mechanism is built is such a way as to suit public places like gardens, bus stands, footpaths. When the user sends the message through Bluetooth via detects, the mechanism rotates and the garbage is pushed into a bin which is placed right behind the mechanism. The robot keeps collecting the garbage until it reaches certain height in the bin.

### C. Hardware Requirement

1. Arduino UNO
2. HC05 Bluetooth Module
3. Servo Motor
4. DC Gear Motor
5. Arduino Shield Motor l293d

***Arduino UNO***

The Arduino Uno which is shown in fig. 1.1 is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits is shown in figure 1.1.

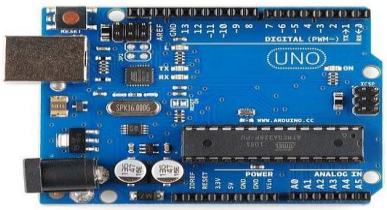



Figure 1.1

***HC05 Bluetooth Module***

HC-05 Bluetooth Module which is shown in fig1.2 is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC.

Figure 1.2

***Servo Motor***

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.Which is shown in fig 1.3.


Figure 1.3

***DC Gear Motor***

A Direct Current (DC) motor is a rotating electrical device that converts direct current, of electrical energy, into mechanical energy. An Inductor (coil) inside the DC motor produces a magnetic field that creates rotary motion as DC voltage is applied to its terminal which is shown in figure 1.4.

Figure 1.4

***Arduino Shield Motor l293d***

L293D shield is a driver board based on L293 IC, which can drive 4 DC motors and 2 stepper or Servo motors at the same time. Each channel of this module has the maximum current of 1.2A and doesn't work if the voltage is more than 25v or less than 4.5v.

Figure 1.5

**D.** ***Circuit diagram***

According to circuit diagram we used seven electronic components which are Arduino UNO, Motor Driver Shield l293d, HC05 Bluetooth Module, Dc gear Shaft Motors, 12 v Battery, Servo Motor and Jumper Wires etc. In the below figure 3.2 give 12 v power supply to Motor driver Shield l293d its name is shield because of it is shield on Arduino UNO. HC05 Bluetooth Module TXD and RXD pin connected to 0 and 1 pin of Arduino UNO. Four Motors connected to motor driver shield at M1, M2, M3 and M4. Servo motor has three wires red, yellow and Brown in which red indicates positive terminal, brown indicates negative terminal and yellow indicates signal pulse. The Signal pulse wire of servo motor is connected or sold with 11 pin of Arduino UNO which is shown in figure 1.6.

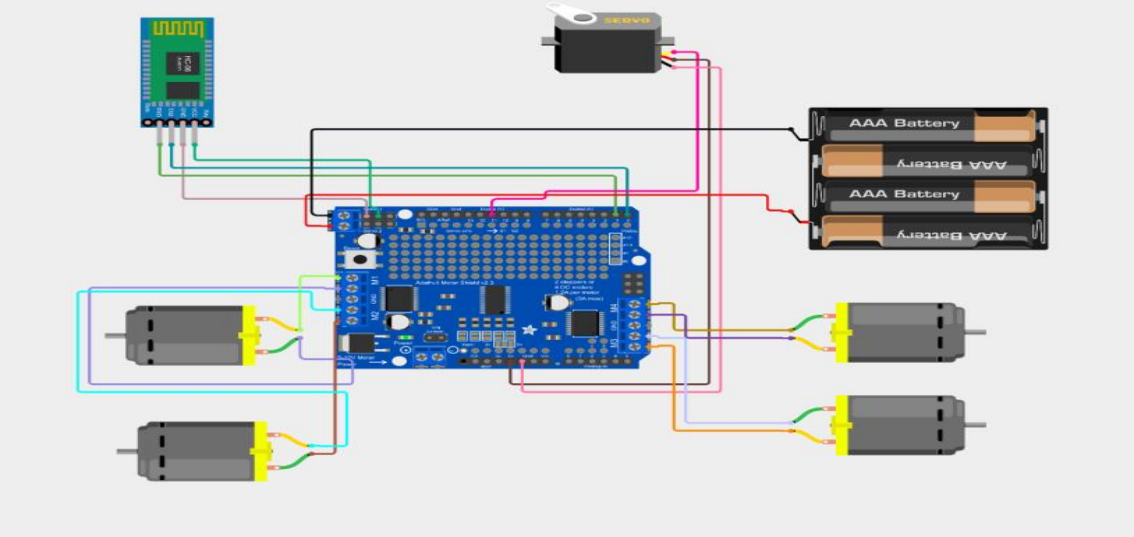



Figure 1.6 Circuit Diagram

**E. Flow Chart**

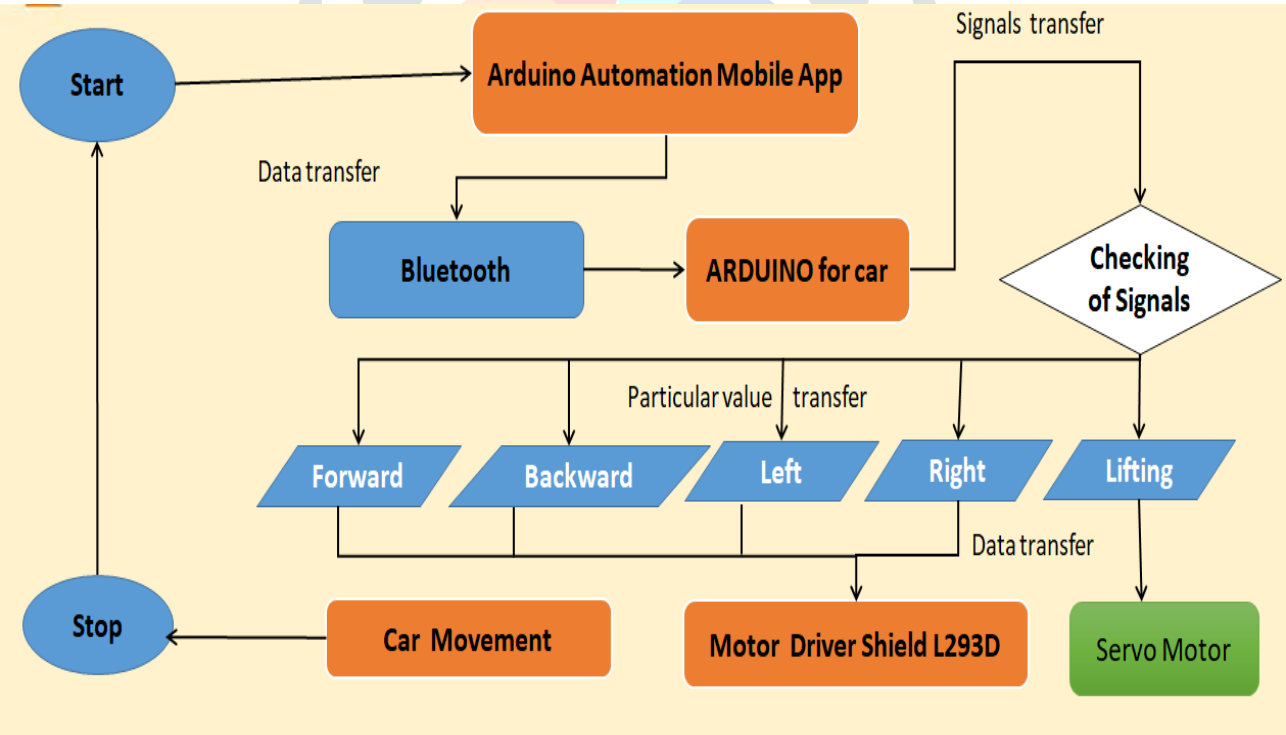



Figure 1.7 of Flow Chart

**F. Working Model**

The Autonomous Garbage Collector Robot collects light weight garbage like plastic, cups bottles etc. It's unable to lift large weight garbage and not detect any obstacle ahead of jaw. This can be the user command basis robot only work when user gives any command through mobile. The Arduino Uno is chargeable for whole working functionality of robot during this robot uses 150 rpm dc motors by which robot speed is maximum.HC05 Bluetooth module play the important role in project that It help to determine the communication between Human and Robot. The HC05 Bluetooth Module work on UART protocol which suggest Universal Asynchronous Receiver Transmitter. It's basically use for serial digital communication from source to destination. HC05 Bluetooth work as transceiver device which implies it's capable to either transmit data or receive data. Motor driver shield is connected to four motors and every motor have 1.5 an influence which is given by 12 v battery. The Arduino UNO operates at minimum 5 volt power supply it's capacity approximately between 7v to 20v. It is the CPU of Robot.

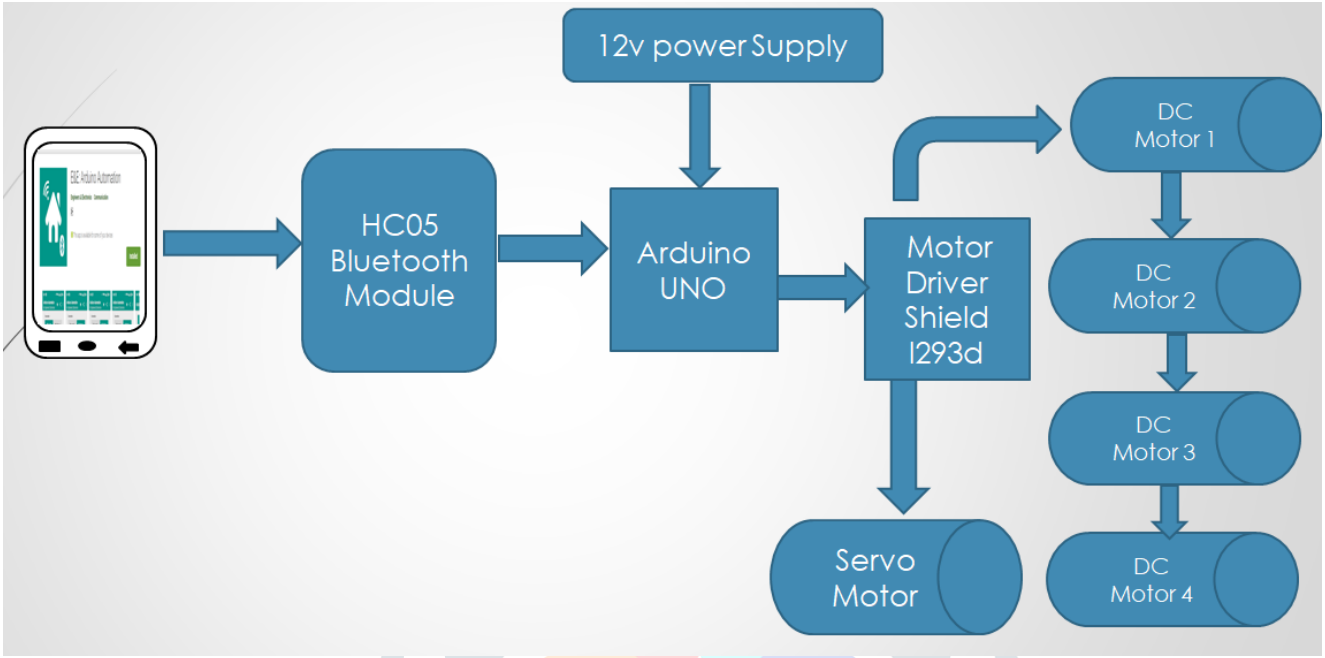



Figure 1.8 of Block diagram of Autonomous Garbage Collector Robot

## III. Result and Discussion

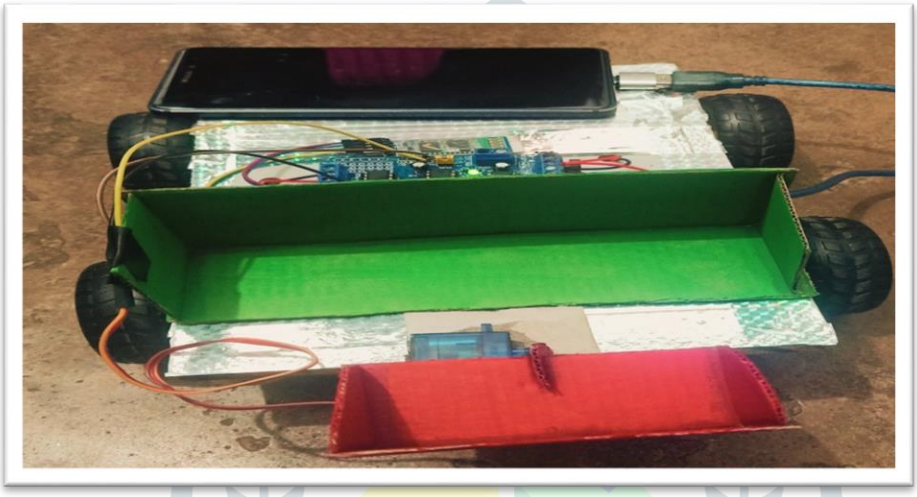
All the coding operation is done on Arduino IDE software which means Arduino Integrated Development Environment that refers open source Arduino software makes to write code and upload it to the board. We tested all the hardware according to particular circuit diagram of project. The motors are working according to user command and Servo motor also. This project is only capable to lift small weight garbage. Movement of Robot follows the logic signal of Arduino UNO when the main programme will executed.

| Direction | M1 | M2 | M3 | M4 |
|---|---|---|---|---|
| Forward | ON | ON | ON | ON |
| Backward | ON | ON | ON | ON |
| Left | ON | ON | OFF | OFF |
| Right | OFF | OFF | ON | ON |
| Stop | OFF | OFF | OFF | OFF |

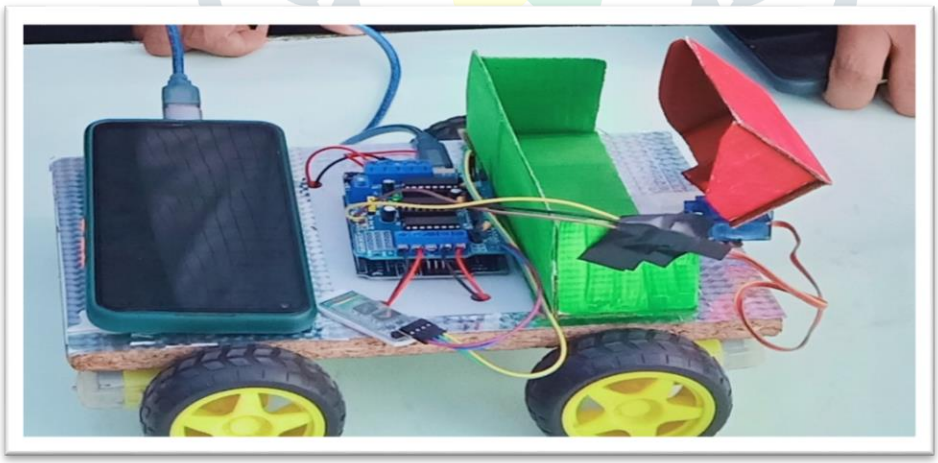
When the user command "c" then servo motor output shaft rotate at angle 0 to 90 degree.

At 0 Degree

At 90 Degree



Front view



Side view

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