Bluetooth Controlled Garbage Collection Robot Arm

Shantanu Deshpande[1], Anurag Nimbalkar[2], Atharv Dhamal[3] , Ami R. Barot[4]

[1,2,3] *Mechanical Department, PVG's College of Engineering and Technology, Pune, India*
[4]*Professor, Dept. of Mechanical Engineering, PVG's College of Engineering and Technology, Pune, India*

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Abstract- The primary end is to introduce a way in which scrap could be collected and disposed off efficiently; To dissect the problem of scrap disposal at public, marketa ble, artificial or any other suitable position; To design and develop a system for working the problem; To test and maintain the enforced system.

We're designing a robot which can collect scrap according to given user commands, for which we're administering Arduino and Bluetooth modules. The machine can be controlled by software which will give command to the robotic jaw to collect the stationary waste.

We've come up with asemi-autonomous scrap collector robot. This device has one robotic arm, having 5 degrees of freedom, which it uses to pick up the scrap and allocate it where the user desires.

Key Words Robotic arm, Control of robot arm, Motor, Robots, Bluetooth, Arduino Uno, Servo Motor.

1. INTRODUCTION

These days, people always need fresh assistance systems which has led them to search for different avenues and people have entered the competition to manufacture quality products cheaply. Robotization systems are required to realize this. Given their unique physical characteristics, people were suitable to use supplementary machines in places where their strength wasn't enough. These machines, which are operated with the need for mortal backing in advance, have been made to operate spontaneously without the need of mortal power with the progress of technology. One of the most habituated factors of robotization systems is robots. Robotic systems are a field where Mechatronics Engineering, Mechanical Engineering, Electrical Engineering and Computer Engineering have all come together to work in tandem.

2. NEED FOR IMPLEMENTATION

Currently, robotic arms have substantially been used for industry automation and operation in dangerous surroundings. This has been brought to light lately given the trying conditions of the COVID- 19 pandemic, which left numerous healthy and safety workers exposed to delicate conditions while performing tasks that can be offset to robotization.

Our aim was to deliver a tool for sanitation workers in high- risk areas, to help them do their job without putting themselves in unwarranted peril. There's a big concern of mortal safety when dangerous gases exist.

The semi-autonomous scrap collection unit may have high manufacturing cost but lower conservation cost. Autonomous bots can be a far better option when it comes to rescinding the humdrum of tasks, over-coming safety issues during homemade labor and in reaching remote areas. In some cases, effectiveness may also be better but the only debit is that the product costs of the robots are high. Our end is to mainly reduce the cost, so as to make the perpetration on a large scale doable..

3. EXECUTION OF CONCEPT

a)   *Components:*

✧   *Servo Motors*

A servomotor is a rotary actuator or linear actuator to provide precise control of angular or linear position, velocity and acceleration. The advantages include being shock proof, accurate, having more constant torque at higher speed and a high ratio of torque to inertia.

The servo motor and micro servo motor of choice are *MG996R* and *SG90 respectively*

✧   *Stepper Motors*

A stepper motor is a DC electric motor that divides a full rotation into a number of equal steps for granular control of the arm. Advantages include smooth rotation, high positional accuracy, excellent response to starting/stopping/reversing, high speed control and high accuracy of around 3 to 5% a step.

For this particular product *NEMA-17* was chosen for it's easy availability and robust feature set.

✧   *Stepper Driver*

A stepper drive controls how the stepper motor operates by sending current through various phases in pulses to the stepper motor. Advantages include, high step rates,

excellent speed control, precise positioning, repeatability of movement and a built-in regulator.

DRV8825 was chosen for this.5V

❖ *Bluetooth Module*

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Advantages include switching mode between master and slave mode, minimal interference and is energy-efficient.

❖ *Arduino Uno Board*

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. Advantages include cost efficiency, programming ease and open source in software.

b) Design Brief:

i.   Select the materials for the 3D Printing process.

ii. Choose micro-controller and software. ⍰

iii. Choose servo motors, servo motor controller, stepper motor, stepper motor controller. ⍰

iv. Check the system whether it is compatible with the micro-controller or not.

v.   Design and analyse arm and robot body. ⍰

vi. If there are any faults correct that part and test again.

vii. Print the parts for assembly.

viii. Assemble the parts and test the model. ⍰

ix. Make necessary changes according to errors that present.

x.   Repeat until desired result is achieved.

4. MANUFACTURING

Given the complex design of the arm, conventional manufacturing processes were deemed too costly and time consuming. Ultimately the design process of decided upon was 3-D printing.

3D printing is a process of manufacturing where three-dimensional objects are printed by adding extremely thin slices of material on top of each other.

3D objects are created digitally by either designing in a CAD software or via scanning the object for it's dimensions. The digital image is processed into a printing software which divide the product into very thin horizontal slices that are to be sequentially printed one after the other, to produce the completed object.

The material of choice to print said design was taken to be poly- lactic acid(PLA), given it's ease of use, wide availability and fairly profitable price point.

5. SOFTWARE

Originally, we need to define the 6 servo, the 4 stepper motors and the Bluetooth communication, as well as define some variables need for the program below. In the setup section we set the maximum speed of the steppers, define the pins to which the servos are connected, begin the Bluetooth communication and set the robot arm to original position. Also in the loop section we start by checking for any incoming data. This data comes from the smartphone or the Android app.

The Android app is made using the MIT App Inventor online application. It consists of simple buttons which have appropriate images as background. However, we can see that all it does is it sends one- byte numbers when the buttons are clicked, If we take a look at the blocks of the app. Depending on clicked button, we tell the Arduino what to do. In this way we simple transmit a single 1- byte number when a particular button is touched down.

The Arduino code enters the while loop of that number, and stays there until we touch up the button, because at that moment we transmit the number 0 which means the robot should do nothing. So, depending on the touched buttons the servos move either in positive or negative direction..

6. CONCLUSION

We've designed a semi-autonomous scrap collector robot which can do multiple functions. The primary reason of completion of this task is to introduce a well- organized way of scrap collection and to shave down the production cost. Intelligently handling scrap waste can help for a cleaner environment and to curb terrain pollution which is seriously felt in the ongoing COVID- 19 pandemic situation.

Also, robotic arms are popular, and although numerous areas of it still need to be developed, it has made work lightly and the resulting error degree has reduced. This design has established the necessary theoretical and practical information for controlling of 5 degree of freedom robot arm via design and integration with a suitable micro-controller and Bluetooth module with an android operation, which may be applicable in colorful other fields in the future.

7. ACKNOWLEDGMENTS

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