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# Design and Development of Garbage Collector Robot

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**ABSTRACT:** The aim of our project is to develop an automatic pick and place robot. This robot helps for object detection with a pick and place robotic arm. This robot is very useful in automatic object detection and separation after the object detection. The robot is controlled using android based smart phones through Bluetooth. Bluetooth is chosen based on the distance that should be covered by the robot. Based on the command given by the user the robot moves. At the receiver end there is a motor interfaced with the microcontroller. The motor is used to control the robot movement and another motor is used to control the robotic arm. Bluetooth control application is used for controlling the direction of the robot. This pick and place robotic arm with wheel can be easily moved from one place to another. A pick and place robot manipulator can be used to pick an object and place them in an orderly manner to get a final destination. A pick and place requires little operator and provides maximum output with efficiency. It is widely used in different industry to pick a different material and place in desire location.

**KEYWORDS:** Bluetooth; Motor; Robotic arm; Detection.

## I. INTRODUCTION

Robotics is part of Today's communication. In today's world ROBOTICS is fast growing and interesting field. It is simplest way for latest technology modification. Now a day's communication is part of advancement of technology, so we decided to work on robotics field, and design something which will make human life simpler in day today aspect. . Robotics is the branch of technology that deals with the design, construction, operation, structural, disposition, manufacture and application of robots and computer systems for their control, sensory feedback, and information processing. Sensors are the components that are very help full in automation and they are the only means to detect information about itself and its environment. There are many types of sensors and all these sensors are used for different specifications. Increasing the number and variety of sensors tends to increase the robot's ability to get a more thorough understanding of the world around it. There are a wide variety of sensors available which are capable of measuring almost anything, from environmental conditions (distance, light, sound, temperature) to angular and linear acceleration, forces and distances. IR sensor is used in our project which is helpful in detecting the object by sending the infrared radiation throughout the full path and automatically gives the information to the motor to pick the object. IR sensor consists of two basic working parts one is emitter and the detector. Photocells in the sensors are good for detecting yellow/green visible light. In this project mainly when ever robot senses any obstacle automatically diverts its position to left or right and follows the path. Robot consists of two motors, which control the side pair wheels of each and help in moving forward and backward direction. Robot senses the object with help of obstacle sensor. We have used D.C motors to give motion to the robot. This robot has sufficient intelligence to cover the maximum area of provided space. The construction of the robot circuit is easy and small .The electronics parts used in the robot circuits are easily available and cheap too.

## II. PROPOSED SYSTEM

In proposed system robot Pick and Place Robotic Arm speeds up the process of picking parts up and placing them in bin. It makes easy to move bulky, large and hazardous product from one place to another in industries. The robot has the capability to detect a black line on a lighter surface. The robot consist an array of IR sensors in order to calculate the reflectance of the surface. The computer controls the robot by rotating individual step motors connected to each joint. . The whole set up is connected with the Arduino Uno board which is the main component in system. Basically, Arduino Uno is capable of producing 5V output so to amplify it we use motor drive. . To control the motion of robotic wheels we use DC motor. For controlling the arm servo motor is used since it has to only hold and place the object precisely with the correct angular position automatically. IR sensor is used to detect the objects in the path of the robot. We use Bluetooth module which is interfaced with Arduino.

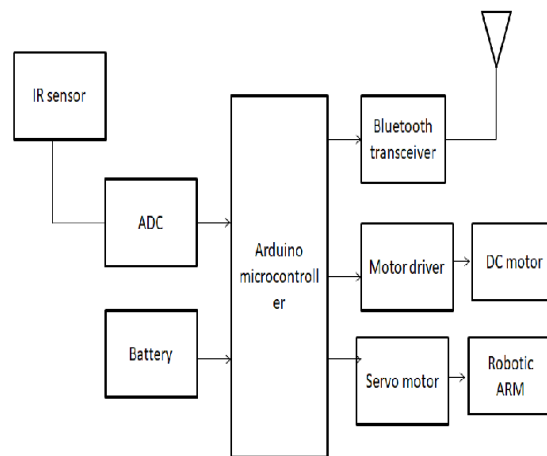


Fig.1. Block Diagram

This system completely depends on few electronic components like Arduino ATmega 328, Bluetooth module, Robotic Arm which is the integral parts of robot. The inputs to the system are Bluetooth module and motor drivers which are connected to Arduino ATmega 328. The output is the movement of wheels attached to the robotic body and the movement of the robotic arm.

### A. Bluetooth

Bluetooth is a device which can be operated at a range of 10 meters approximately. This communication range may vary according to the connections. It is used to communicate with the microcontroller and computer or mobile connected. Bluetooth is a short-range



Fig.2. Bluetooth Module

Wireless communication technology standard. Bluetooth is used to communicate with the microcontroller and it gives the information to move in a correct directions. It helps to move the robot in the desired direction. It gives us to monitor the movement of the robot. This Bluetooth technology eliminates the need of cables or wires. It improves the wireless communication.

### **B. ARDUINO Microcontroller**

Arduino Microcontroller is an open source microcontroller. It can be used in both software and hardware. It is easy to use and for uploading the memory program in the Arduino. It consists of various pins and features for better efficiency. In our project we use Arduino ATmega328 Microcontroller. This microcontroller has 28 pins. It has Electrically Erasable Programmable Read Only Memory (EEPROM). This Arduino ATmega328 feature consists of advanced architecture, good performance, and low power consumption. It operates at a range of 3.3V to 5.5V but we use 5V as a standard. The program is uploaded on AVR micro controller attached on Arduino. This Arduino is used in robotics for automatic process and the repeated process.

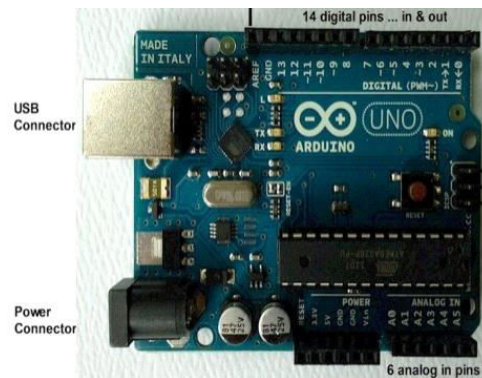


Fig.3. Arduino Microcontroller

### **C. Motor Drive**

Motor drive is a type of amplifier or power modulator that integrates between the DC motor and the controller. It takes low current and then converts it into high current is appropriate for the motor.

### **D. DC Motor**

In this project DC motor is used as a rotational part that rotates the wheels of the robot. DC motor is used for the movement of wheels. It consists of higher starting torque and variable speed with voltage input and the dc motor can be easily controlled.

### **E. Servo Motor**

Servo motor is a type of motor which is used for rotation. This motor is rotated with the greater precision. This motor is used to rotate with an angle for the movement. In this project this motor is used for the rotation of the arm which is helpful in pick and place process.

### **F. IR Sensor**

IR (Infrared) Sensor is an electronic device that measures the infrared radiation reflected from the surface or from its environmental surrounding. When it detects an object in its path the infrared light from the LED reflects off the object and is detected by the receiver.



### III. SOFTWARE DISCRIPTION

An embedded system is an application that contains at least one programmable computer (typically in the form of a microcontroller, a microprocessor or digital signal processor chip) and which is used by individuals who are, in the main, unaware that the system is computer-based. Arduino software is used to control all the components. It is a type of Integrated Development Environment (IDE). This software can be written in C, C++ for the automation process. It can be run on operating systems like Windows, macOS, Linux etc. It is used to write and upload programs to Arduino compatible boards. Here the program for controlling the wheel movement and the movement of arm that are connected to the motors are uploaded in this Arduino software.

The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The current Uno provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs that convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default boot loader of the Arduino UNO is the Opti boot loader. Boards are loaded with program code via a serial connection to another computer.

### IV. SIMULATION RESULTS

The simulation results show that program is uploaded to the Arduino and it is executed. Here the program runs and starts the motor drive and gets the input information from the user for pick and place. Motor drive is connected to the wheels which are represented as circle which is able to rotate when the program runs.

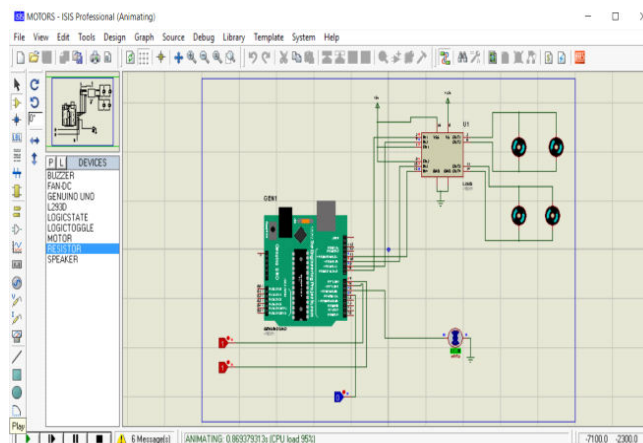


Fig.4. Simulation Results

After the execution of the Arduino program uploaded in the software the wheels starts rotating and then the servo motor connected to the Arduino gets rotating for the pick and place operation. Here the servo motor rotation is controlled with the switches where it is denoted with 0's and 1's. In this the arm is rotated in the reverse where it denotes the placing operation in the bin. The switches are operated from the manual user for the reverse rotation.

### V. HARDWARE IMPLEMENTATION

The communication with the robot is done by the Bluetooth module which can communicate within a distance of 10 meter this helps to pick the garbage in the footpath and to store in a bin. This pick and place movement is done by the servo motor which gives the angle to pick the garbage and a DC motor drive is connected to Arduino which gives

power to the dc motor which is helpful in the movement of wheels of the robot and runs in the range of 30rpm to 100rpm speed. Arduino is used to supply power to the dc motor and the servo motor. In this project the robot works both automatically (pick and place) and manually (direction) and is controlled by Arduino.

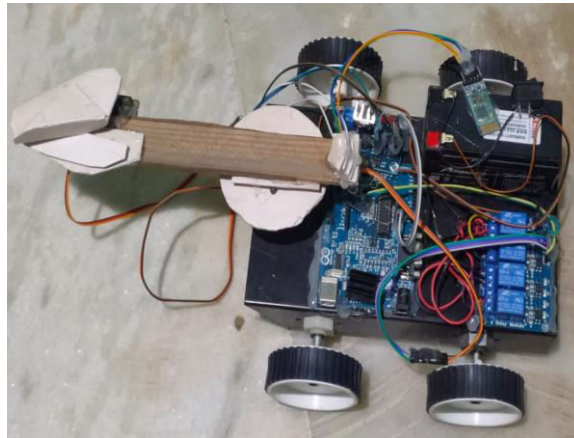


Fig.5.Snapshot of hardware implementation

Here the coded program is fed into the Arduino which is responsible for the automatic operation of servo motor and dc motor. It has internal EEPROM which is useful to add external memory to the Arduino. Servo motor is used to have a precise angle rotation. This gives the most accurate angle to pick the material that is placed in the path.

## VI. CONCLUSIONS

In The aim of this project is the development of automatic pick and place robot arm controlled using Arduino. In the modern era time and man power are major constraints for the completion of a task. The pick and place robots are popular in assembly lines, where the repetitive tasks are present. The robotic arm used here contains a soft catching gripper which safely handles the object. Since the assembly line is mostly about fixing different parts in to the right section of the end product, it is best done by the pick and place robots which can work round the clock without being tired or bored. The use of our product the industrial activities and hazardous operations can be done easily and safely in a short span of time. The proposed system is capable of lifting weights; by introducing high torque providing motor large weights can be picked.

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