Ahsanullah University
Of
Science and Technology

Project Name: Pick and Place Bluebot

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1. Introduction:

Bluebot means Bluetooth controlled robot. In this project, an Android app "Blue Term" is used to control a remote vehicle and to pick and place small objects.

2. Theory:

a. HC-05 Bluetooth Module:

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.

Features:

Master and slave mode can be switched.

Password: 1234

The core module using the HC-05 , leads interface includes VCC, GND, TXD, RXD, KEY pin , pin-out Bluetooth connection status (STATE), not connected to the output low , after connecting the output high.

Pairing: The master device can not only make pair with the specified Bluetooth address, like cell-phone, computer adapter, slave device, but also can search and make pair with the slave device automatically.

LED1: PIN31, indicator of Bluetooth mode.
Slow flicker (1Hz) represents entering to the AT mode2.
Fast flicker (2Hz) represents entering to the AT mode1.
Double flicker per second represents pairing is finished, the module is communicable.

LED2: PIN32, low level - Before pairing.
High level - After pairing.

Fig: HC-05 Bluetooth Module

During pairing, current is fluctuant in the range of 30-40mA.
After pairing 8mA.
There is no sleep mode.

b. Arduino Uno:

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB

cable or power it with a AC-to-DC adapter or battery to get started.

Features:
Microcontroller: ATmega328
Operating Voltage: 5V
Input Voltage: 7-12 V
Digital I/O Pins: 14
Analog Pins: 6
DC current per I/O pin: 40ma
Flash memory: 32 kb
SRAM: 2 kb
Clock Speed: 16 MHz

Fig: Arduino Uno

c. L293D IC:

L293D is a dual H-bridge motor driver IC. It acts as current amplifier. It can drive 2 dc motors.


Fig: L293D

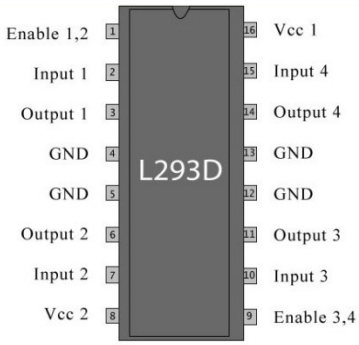


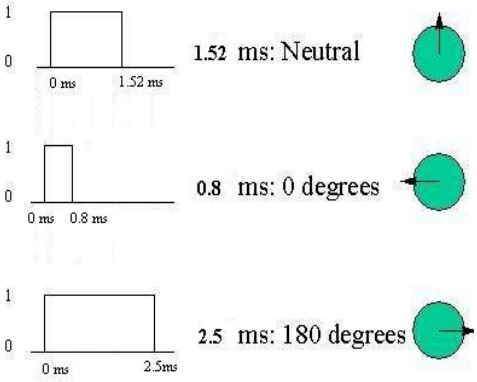
Fig: Pin Diagram of L293D

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

d. Servo Motor:

A servo motor is a dc, ac, or brushless dc motor combined with a position sensing device (e.g. a digital decoder). A three-wire DC servo motor incorporates a DC motor, a gear train; limit stops beyond which the shaft cannot turn a potentiometer for position feedback, and an integrated circuit for position control. Of the three wires protruding from the motor casing, one is for power, one is for ground, and one is a control input where a pulse-width signals to what position the motor should servo. A servo system mainly consists of three basic components - a controlled device, an output sensor, a feedback system.
This is an automatic closed loop control system. Here instead of controlling a device by applying variable input signal, the device is controlled by a feedback signal generated by comparing output signal and reference input signal.


Fig: Servo Motor



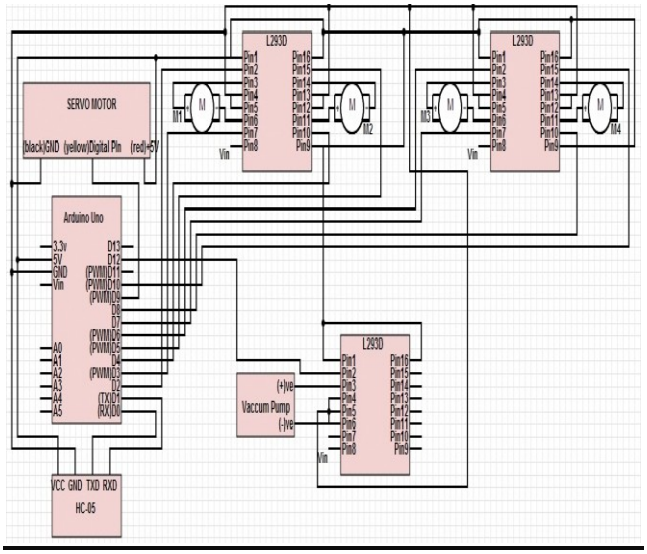
The pulse width of the signal determines how much the servo turns. In the above diagram, 1 represents a logic 1 and 0 represents a logic 0.

The duration of the pulse dictates the angle of the output shaft (shown as the green circle with the arrow).

3. Equipments:

- L293D IC – 3 pieces
- Arduino Uno – 1 piece
- Arduino Cable – 1 piece
- Magician Chassis – 1 piece
- Breadboard – 1 piece
- HC-05 Bluetooth module – 1 piece
- Vacuum Pump – 1 piece
- 14k Servo Motor – 1 piece
- 9V Battery – 2 pieces
- Mobile Battery – 3 pieces
- Jumper wires – as required
- Plywood
- Latex Balloon
- Coffee ground
- Plastic Tube
- Tape
- Funnel

4. Connection Diagram:



5. Working Procedure:

In this project we are using Android phone to control a robot using the Android app called "Blue Term". We have used a HT Bluetooth adapter to our Magician Chassis setup. The code to move the robot is burned on the Arduino Uno. Two L293D IC are used two drive the four dc motor. Another L293D is used to control the operation of vacuum pump. Power supply for the Arduino, motors and the vacuum pump is provided from batteries. The Arduino, Bluetooth and IC are installed on a breadboard which is placed on the chassis.

For the gripping part of the robot, a balloon filled with coffee grounds attached to vacuum pump through a plastic pipe. The gripper works because of the process called "jamming". A vacuum packed of coffee grounds is rock hard as long as the seal remains intact. But as soon as the seal is broken, the coffee become soft and pliable and can be poured like a fluid. This process

happens with many granular materials such as rice, couscous and even sand.

When balloon is slightly pressurized the grounds are loose and easily rearranged. By pressing the balloon against an object, the grounds will move around it and take its shape. But when the air is sucked out of the balloon, the grounds are compressed and grip the object. The rubber surface of the balloon also helps to keep a hold of the object.

One servo motor is used to move the gripper along y-axis. This kind of gripper can hold any kind of small objects.

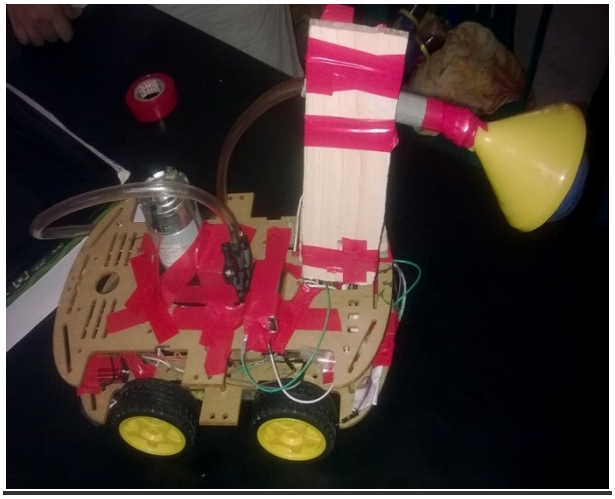
The movement of the gripper is instructed on the code which is burned on the Arduino. So, only by using the Android app “Blue Term”, we are moving the robot and picking and placing any small object with the universal gripper.

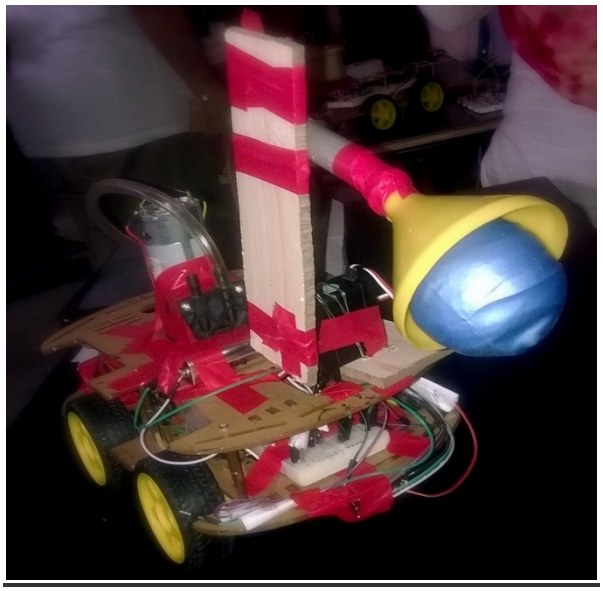
Code:

```
#include<Servo.h>

Servo.arm;

int m1p1=2;

int m1p2=3;

int m2p1=4;

int m2p2=5;

int m3p1=6;

int m3p2=7;

int m4p1=8;

int m4p2=10;

int vp1=12;

int state;


void setup()

{pinMode(m1p1,OUTPUT);

pinMode(m1p2,OUTPUT);

pinMode(m2p1,OUTPUT);

pinMode(m2p2,OUTPUT);

pinMode(m3p1,OUTPUT);

pinMode(m3p2,OUTPUT);

pinMode(m4p1,OUTPUT);

pinMode(m4p2,OUTPUT);

pinMode(vp1,OUTPUT);

arm.attach(9);

Serial.begin(9600);}


Void loop()

{if(Serial.available()>0)

{state=Serial.read();}

if(state==’0’)

{digitalWrite(m1p1,LOW);

digitalWrite(m1p2,LOW);

digitalWrite(m2p1,LOW);

digitalWrite(m2p2,LOW);

digitalWrite(m3p1,LOW);

digitalWrite(m3p2,LOW);

digitalWrite(m4p1,LOW);

digitalWrite(m4p2,LOW);}

else if(state==’1’)

{digitalWrite(m1p1,LOW);

digitalWrite(m1p2,HIGH);

digitalWrite(m2p1,LOW);

digitalWrite(m2p2,HIGH);

digitalWrite(m3p1,LOW);

digitalWrite(m3p2,HIGH);

digitalWrite(m4p1,LOW);

digitalWrite(m4p2,HIGH);}
```

```
else if(state==’2’)
{digitalWrite(m1p1,HIGH);
digitalWrite(m1p2,LOW);
digitalWrite(m2p1,HIGH);
digitalWrite(m2p2,LOW);
digitalWrite(m3p1,HIGH);
digitalWrite(m3p2,LOW);
digitalWrite(m4p1,HIGH);
digitalWrite(m4p2,LOW);}
else if(state==’3’)
{digitalWrite(m1p1,LOW);
digitalWrite(m1p2,HIGH);
digitalWrite(m2p1,LOW);
digitalWrite(m2p2,HIGH);
digitalWrite(m3p1,HIGH);
digitalWrite(m3p2,LOW);
digitalWrite(m4p1,HIGH);
digitalWrite(m4p2,LOW);}
else if(state==’4’)
{digitalWrite(m1p1,HIGH);
digitalWrite(m1p2,LOW);
digitalWrite(m2p1,HIGH);
digitalWrite(m2p2,LOW);
digitalWrite(m3p1,LOW);
digitalWrite(m3p2,HIGH);
digitalWrite(m4p1,LOW);
digitalWrite(m4p2,HIGH);}
else if(state==’u’)
{arm.write(90);
delay(1000);}
else if(state==’d’)
{arm.write(170);
delay(1000);}
else if(state==’p’)
{digitalWrite(vp1,HIGH);}
Else if(state==’o’)
{digitalWrite(vp1,LOW):}
}
```

6. Project Image:





7. Troubleshooting:

1. In this project, we have faced many problems. At first, when we powered the dc motor from Arduino directly, the motor ran very slowly. Then we used three mobile batteries and connected them in series and used them to supply power to the dc motor and servo motor. Per mobile battery has 3.7V-2200mA. So after series connection, they could supply 11.1V~12V, which was sufficient for our project.
2. The connection of the wires was loose so we used tape to connect them firmly.
3. We used 9V battery to supply power to the vacuum pump, but after we used it sometimes, the voltage level of the battery was decreased, and the vacuum was not receiving enough power. So we replaced it with a new one.
4. Operating voltage of an Arduino is 5V. At first we used a dc power supply for the Arduino. The input voltage limit is 6-20V but the Arduino got burned and damaged due to lack of our cautiousness when supplying power. We replaced it with a new one. As the recommended input voltage for Arduino Uno is 7-12V, we used a 9V battery to supply power to the Arduino, and then it was safe.
5. We faced some problems in configuring the correct code to run our project smoothly. After some trying, we burned the perfect code in the Arduino correctly and the command from the mobile via Bluetooth also worked accordingly to the code.
6. The balloon needed to be filled with coffee grounds sufficiently in order to work the jamming process. At first we used small amount of coffee grounds, so it was not able to grip anything. Then we used a large amount of coffee grounds in the balloon. It was able to pick small objects like hair clip as our power supply for the vacuum pump was not enough.

8. Future Works:

1. As all the connection was on breadboard, so it was kind of loose. When the motor started to run, some connections loosen up, as a result it did not receive the Bluetooth signal. We can develop this project if we put all the connection on a PCB board. Then it will run smoothly.
2. We will use correct power supply for the motor to make it work smoothly.
3. We can develop the gripping part by ensuring sufficient power supply for the vacuum pump.