BB 8 ROBOT

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Abstract

Spherical robots have a wide range of self-propulsion mechanisms. Of particular interest in this paper, are propulsion systems where wheels are placed in contact with the inner surface of the spherical shell of the robot. Here, locomotion is achieved by a combination of the actions of the motors along with the rolling constraints at the point of contact of the shell with the ground surface. We find that two points of actuation are all that is needed provided some simple geometric conditions are satisfied. Our analysis is then applied to the BB-8 robot to show how locomotion is achieved in this robot.

I. INTRODUCTION

It is a spherical shaped locomotive robot, it can move much faster than ordinary 2 leg robot. It has a camera fitted in it which can record the data whatever it sees, by using these feature we can send this robot to any suspected area where we want to record data . It has a speaker output also which speak with you and answer you according to your question and gives you a human interaction experience. It is being controlled by smartphone using a Bluetooth application.

II. MOTIVATION

Now a days everything is moving too firstly best example for it is the technology sector even children toys are also modified. So keeping that in the eye we have decided to make this robot it can talk with the children and can run with them make them feel happy. Another reason which motivated us is the investigation purpose it can record the data in video format and transmit it. So we can use it in space missions where the risk of human life is indulged, there it can be the best choice to replace the human interference

III. OBJECTIVE

- To help people to reach dangerous places where human interference is difficult.
  - Transmits data.
  - Fun purpose to play with it.
  - It can used be a for detective purpose.

IV. MAIN COMPONENTS USED

- Plastic ball big size about radius 30cm
- Small ball for head
- Wheels
- Arduino Uno
- HC 05 Bluetooth module
- Motor driver
- Jumper wires
- Battery 12v ,7amp
- Speaker output
- Camera
- Strong magnets

IV. APPLICATION TO A ROLLING SPHERICAL ROBOT AND A SLIDING ROBOT

For BB-8 rolling on a surface, actuation of the robot is achieved by two wheels in contact with the inner surface of the spherical shell . Thus only certain components of the velocity vectors of A, B, and C are prescribed. we label the point of contact of the wheels with the shell by A and C and the instantaneous point of contact as B. Thus vB is completely prescribed (i.e., vB = 0 when the spherical shell is rolling). Without loss of generality, in addition to our earlier selection of e3, we also choose e1 s o that

vA −vC = ve1, xA −xC = D3e3

That is e3 is parallel to the axles of the wheels which contact the spherical shell at A and C. A cursory examination of a BB-8 robot shows that holds. Whence from we can conclude that

ω = ωˆ 2e2 +ωˆ 3e3

Schematic of BB-8 in motion on a horizontal plane. The points of actuation of the motor-driven wheels are labelled A and C, the instantaneous point of contact of the shell with the ground plane is labeled B, and the geometric center of the shell is labeled G. The relative velocity vector

vA −vC = ve1 is prescribed with ωˆ 1 ≡ 0. Given the weight of the structure containing the motors for the wheels and the induction coil, we assume that e2 is approximately parallel to the position vector of the geometric center G of the spherical shell of radiusr0 relative to the point of contact

B: xG −xB ≈ r0e2. Whence, vG= vB +ω×(xG −xB) = −r0ωˆ 3e1 = B3 −C3 D3 (vA −vC)· e1 +vC · e1 e1

where we used to simplify the resulting expression for vG. From the expression for vG we can conclude that the geometric center will move in a direction orthogonal to the axis connecting A and C. By varying the relative speed of rotation of the wheels at A and C we can rotate e3 and so control the direction of the motion of G. In this simple manner, the pair of wheels control the trajectory of G. For the BB-8 robot, an examination of its geometry shows that we do not expect the kinematical condition to hold. Consequently, locomotion of BB-8 on a surface with sliding contact (as opposed to rolling contact) is not anticipated.

A. Equations

The fact that two of the nine conditions arising when the velocity vectors of three points are prescribed are redundant naturally leads us to seek the minimal set of prescriptions. To this end, we now consider the case where the velocity vectors of two points A and C are prescribed but only one component of B is prescribed. This situation arises when a spherical robot is in sliding contact with a surface. In this case, we prescribe vA, vC, and vB ·n, Where n is the unit-normal vector to the surface at the instantaneous point of contact B of the robot with the surface (cf. Without loss in generality, we can assume that the velocities we wish to control are ω and vC. Paralleling the arguments of the previous section, we find that prescribing vA and vC enables us to compute the components of ω orthogonal to (xA −xC) .

We still need to prescribe the component of ω that is parallel to (xA −xC). We have a single equation remaining that can be used to solve for this component:

(vB −vC)·n = (ω×(xB −xC))·n.

We again choose {e1, e2, e3} so that holds and define a vector q q = q1e1 +q2e2 +q3e3 = (xB −xC)×n. Whence we find that the remaining unknown component of

ω is ω3 = ωˆ 3 = 1 q3 ((vB −vC)·n−ωˆ 1q1 −ωˆ 2q2).

For the solution to this equation to be defined we require q3 6= 0. This is equivalent to the condition

((xA −xC)×(xB −xC))·n 6= 0. (28)

In other words, the relative position vectors xA − xC and xB − xC and the normal vector n are linearly independent.When Eqn is satisfied, the prescription of vC, vB ·n, and the two components of vA that are orthogonal to

(xA −xC) is necessary and sufficient to prescribe v¯ and ω = ∑ 3 i=1ωˆ iei of the rigid body.

V. WORKING PRINCIPLE

Basically, what we have is a circle with wheeled instrument inside it. The wheels are constrained down against the mass of BB-8 here and there (either spring or gravity, it doesn't make any difference a gigantic arrangement). Turning the wheels moves the focal point of the framework's mass, the heft of which is in the wheel get together . Inclining creates a second. Do this right, and the ball moves toward the path that the wheels were moved to. There are loads of ways of doing this, yet one that lets BB-8 bob despite everything capacity as it does in the film includes a bunch of appealing and repulsing magnets. Shock most likely holds the head back from reaching the ball, and attractive fascination around the edges of the head holds it back from moving off.All the 4 wheels of motor are connected to the Arduino through motor driver and camera is also connected to it which transmit all the data whatever it sees. And then the mic captures the audio signal whatever user asks and it reply according to it. As there is a program preloaded which helps the robot to reply. By the help of Bluetooth app we can control our robot easily.

VI. CODE

```
char t;

 int leftmotor_terminal1  = 8;

 int leftmotor_terminal2  = 9;

 int rightmotor_terminal1  = 10;

 int rightmotor_terminal2  = 11;

int head_terminal1=12;

int head_terminal2=13;

int voice= 7;

void setup() {
```

```
pinMode(leftmotor_terminal1,OUTPUT);    //left motors t1
pinMode(leftmotor_terminal2,OUTPUT);    //left motors reverse
pinMode(rightmotor_terminal1,OUTPUT);    //right motors forward
pinMode(rightmotor_terminal2,OUTPUT);    //right motors reverse
pinMode(head_terminal1,OUTPUT);
pinMode(head_terminal2,OUTPUT);
pinMode(voice,OUTPUT);//clean motor
Serial.begin(9600);
}
void loop() {
if(Serial.available()){
  t = Serial.read();
  Serial.println(t);
}
 if(t == 'F'){          //move forward(all motors rotate in forward direction)
  digitalWrite(leftmotor_terminal1,HIGH);
  digitalWrite(leftmotor_terminal2,LOW);
  digitalWrite(rightmotor_terminal1,  HIGH);
  digitalWrite(rightmotor_terminal2  , LOW);
}
 else if(t == 'B'){      //move reverse (all motors rotate in reverse direction)
  digitalWrite(leftmotor_terminal1,LOW);
  digitalWrite(leftmotor_terminal2,HIGH);
  digitalWrite(rightmotor_terminal1,  LOW);
  digitalWrite(rightmotor_terminal2  , HIGH);
}

else if(t == 'R'){      //turn right (left side motors rotate in forward direction, right side motors doesn't rotate)
  digitalWrite(leftmotor_terminal1,HIGH);
  digitalWrite(leftmotor_terminal2,LOW);
```

```
  digitalWrite(rightmotor_terminal1,  LOW);
  digitalWrite(rightmotor_terminal2  , HIGH);
}
else if(t == 'S'){      //STOP (all motors stop)
  digitalWrite(leftmotor_terminal1,LOW);
  digitalWrite(leftmotor_terminal2,LOW);
  digitalWrite(rightmotor_terminal1,  LOW);
  digitalWrite(rightmotor_terminal2  , LOW);
}

else if(t == 'L'){      //turn left (right side motors rotate in forward direction, left side motors doesn't rotate)
  digitalWrite(leftmotor_terminal1,LOW);
  digitalWrite(leftmotor_terminal2,HIGH);
  digitalWrite(rightmotor_terminal1,  HIGH);
  digitalWrite(rightmotor_terminal2  , LOW);
}
else if(t == '1'){      // head left
  digitalWrite(head_terminal1,HIGH);
  digitalWrite(head_terminal2,LOW);
}
else if(t == '2'){      // head right
    digitalWrite(head_terminal1,LOW);
  digitalWrite(head_terminal2,HIGH);

}
else if(t == '3'){       // head stop
    digitalWrite(head_terminal1,LOW);
  digitalWrite(head_terminal2,LOW);
  }
else if(t == '4'){
```

```
   digitalWrite(voice,HIGH);

   delay(100);

   digitalWrite(voice,LOW);


}

}
```

VII. ADVANTAGES

- It is made up of smooth plastic which makes it a light weight robot
- Quick movement
- Transmits data
- Sperical shape enables less friction
- Less force is needed to move the robot
- Easy control

VIII .DISADVANTAGE

- As we use Bluetooth application so it has fixed range, say 50 to 100mts.
- As we use battery for the robot it is to be regularly charged.
- Bit complex system
- Any minor injury in the internal system, robot can't work.

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X .FUTURE SCOPE

- Can be used like fire sensor.
- Gesture control can be implement Solar can be used for charging.
- AI can be introduced.
- It can also able to show whatever it has recorded by projection.
- Different kind of sensors

XI. CONCLUSION

By using this robot we can have a joyful experience it's more likely a humanoid robot it can talk , run , record memories and transmit it. We can easily control this robot by using our smartphone we have to just download the Bluetooth application from play store and connect it to the robot and enjoy it. But it is mainly used where we want to investigate like in some new unknown places till not discovered , the camera enables us to see the clear picture of the person standing in front of it. Lastly we can use this robot as a toy for enjoyment and also as a investing robot.

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