STARWARS BB8 MODEL

Abstract

Our project, starwars BB8, is a prototype of the famous conceptual robot shown in the movie “starwars –the force awakens”. What makes it unique is its zero wheel drive and detachable head. We thought of making it because we found that with the help of these features we can solve several real life problems and can be used as an all-terrain vehicle, a versatile and compact space rover, a human companion etc.

Acknowledgment

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Special Thanks to him for his exemplary guidance, monitoring and constant encouragement throughout the Project. I would also like to thank all mentors as they helped us a lot in finishing this project within the limited time although being too busy for the Robocon 2017 project.

THANKS AGAIN TO ALL WHO HELPED US.

Applications

Starwars BB8 model has varied applications, it’s implementation scale can be pitched from a all terrain vehicle to a space rover. The robot can be used for navigation, patrolling, communication and other purposes. The best part of our robot is that it will never topple, this tragedy occurred with Mars rover “Discovery” which toppled and suffered serious complications. Coming on navigation part , since the robot’s movement mechanism is based on shifting of COG of the body inside the outer sphere and the contact area is almost equivalent in all surfaces hence the robot can easily navigate maneuvering different kinds of surfaces.

The head of the BB8 model is detachable , hence it can be used to install various kinds of plug-ins like a communication enhancing network creation antennae can be installed in the head , a camera assemble can be embedded in the head which can help in patrolling remote areas and also for spying purposes since the size of the robot can be varied according to the need.

Team members

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How to run the complete setup from scratch:-

Head

Take a Styrofoam ball cut it into half make a cylindrical groove in it and place three magnets on edges of equilateral triangle

Body

Inflate a gym ball and use paper pieces to stick over it with fevicol and water mixture .(6 such layers). Use same technique to cover canvas sheet (2 layers). Now remove the air from ball and we will get a spherical shell.

Internal mechanism construction

On a circular mdf board mount three steel channels and above it another small board. The bigger board houses the complete electrical and mechanical components, according to the circuit. On smaller board a dc motor is placed. On its shaft is a board on which magnets are placed with opposite polarity as mounted on head (in same equilateral triangle shape)

Working

The robot comprises of 3 parts:-

1- Head Assembly

2- Outer Sphere

3- Internal Mechanism

Head Assembly

Head assembly comprises of a semi spherical thermocol shell. Inside the shell was installed an assembly of magnets and castor wheels. These magnets were paired with the magnets placed on the top of the internal mechanism. When the internal body rotates it’s top using a DC motor,the paired magnets make the top move accordingly.

Outer Sphere

Outer Sphere is the surface contact part of the bot . It contains the internal mechanism which moves inside it to shift center of gravity of the bot and once the COG shifts from the base , the system becomes unbalanced and the Outer sphere moves in the same direction to normalize this change and reduce system’s potential energy.

Internal Mechanism

The internal mechanism comprises of a circular base and differential drive. The internal mechanism has low center of gravity (added weight) .The drive consists of two traction wheels paired on two DC motors . The mechanism moves inside the outer sphere and climbs the wall of the sphere. A net torque is applied on the center of mass of the system and the outer sphere rolls in the same direction to lower the internal mechanism. To change the direction of motion, the wheels are rotated in opposite direction while the bot remains stationary , the internal mechanism aligns itself into different direction.

Mechanical Components:-

DC motors: Two 12 V and one 9 V dc motors

We used two high torque , 200 rpm dc motors with a motor shield.

Mounting: The motors were mounted on a circular chassis of diameter 35 cm made of MDF using L-channels and 3mm nuts and bolts.

Coupling: In-built coupling in the wheels were used to couple the wheels to the motor shaft.

Wheels:

We used two 10 cm plastic wheels with rubber treads.

L-channels & Castors:

To support the magnetic mechanism above the robots body, we used PVC pipe supported by L-channels.

The chassis was supported at four points with the wheels at two diametrically opposite ends and pololu castor wheels at the other two.

Neodymium magnets:

Two powerful high grade magnets were used in the magnetic levitation mechanism.

Aluminium channels:

Aluminium channels with cylindrical cross section were used to make a triangular structure for the head to allow free movement over the surface of the robot. These triangular structures compromised of castors arranged radially.

ELECTRONICS

Arduino UNO:

We used an arduino UNO board. Reason for selecting the board was that our requirements of control was met perfectly by the board.

4A Motor Shield:

We used a 4A motor shield which controlled two motors of the differential drive.

HC-05 bluetooth module:

Navigation was based on bluetooth based control.

OTHERS

1. 12 V Battery

1. Jumper wires(MtoF , FtoF ,MtoM)
2. Copper wires ( 4mm and 2 mm) for electrical connections.

LIMITATIONS

Although the bot has great future scope but it too has some limitations. As bb8 is made up of spherical shell it is prone to fabrication errors which greatly effects its performance. If this bot falls in a pit then due to its spherical shape its difficult to come out, for same reasons only it is difficult to move up the slope.

FUTURE PERSPECTIVES

We worked mainly on BB8’s mechanical motion but and detachable head but a lot of add-ons can be done. Extensible arms can be made which acts as a hinge and helps it to come out of pits. Navigation sensors , camera , communication sensors etc. can be attached to its head which add further to its versatility