Project Proposal: BB8

Background

Since the first Star Wars movie came out and the general public was introduced to functional, and social robots, affectionately referred to as “droids”, the world immediately became captivated by them. With this franchise, George Lucas created an ideal of a robot. One with personality, style, and a pleasing chirping means of conversation. Many people have long had the desire for one of these loveable bots as their own. We can make that a reality. By focusing on the latest and arguably most popular version, BB8, we can bring this fantasy off the big screen and put it within reach of the fans.

Construction of this robot will teach the team members about dc motor control, wireless remote control via Bluetooth, Arduino microcontroller programming, servo control, and mechanical construction as well as computer programming using functions and classes.

Once completed, the robot can be useful for community outreach events and recruitment. The Avatar robots we have are very popular. From elementary school to college students, a lot of people have fun driving them around. With the added novelty of the popular character image, BB8 is sure to be at least as popular.

Objectives

- Build a working, life-sized, BB8 droid
    - Accurately recreate the film image
    - Remote control for initial robot
    - Incorporate Turtlebot follower design for autonomous operation
    - Overcome the mechanical challenges of a spherical droid with a magnetically coupled head unit

Scope

This project has many challenges that will need to be overcome.

- Design and construction of a spherical body that must be smooth inside and out to allow the inner drive robot to move completely and allow the head to roll around.
- Development of an internal robot that can motivate the body and magnetically couple to the head unit.
- Incorporation of sensors and cameras for vision and sound detection.
- Onboard computation of sensor input and motor control.
- MP3 sound playback.
- “Personality” algorithms that can portray the characteristics of a social robot.

Personality algorithms:

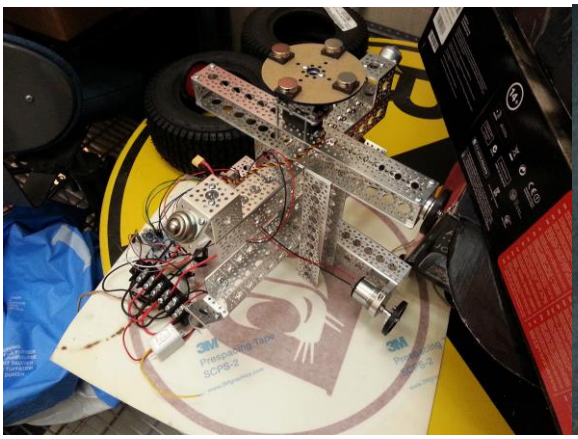
In the film, the BB8 unit elicits emotional responses from the audience by performing specific characteristic sounds and movements. It can portray excitement by tilting its head back and emitting sudden high-pitched squeaks. It can portray empathy by performing a slight twisting body motion and playing a slower, descending, multi-tonal chord. It is capable of suggesting a sarcastic tone with a more bass-tone chord and turning its head with the eye lens facing away from the subject.

These types of distinct patterns of movement and sound can be incorporated into subroutines that would let the robot give an impression of a personality. By incorporating the Turtlebot follower routines, we can link some of these subroutines to the movement to give the impression of intelligence. For example, if the robot is following a person and the person stops suddenly, an annoyed or surprised routine can run. If the person starts walking very fast, the robot can play an excited routine. These would allow a user to feel on a small scale that the robot is capable of understanding the situation and thus elicit an emotional response.

Construction:

Phase I	Construct a prototype - body made of paper mache, head of repurposed plastic bowl, inner robot from rapid prototyping parts to provide sufficient elements to generate interest in the project	October, 2016
Phase II	Develop a method for joining the body. Complete the prototype head unit by adding the MP3 sound playback, servo mounted LED lights, implement Bluetooth remote control	November, 2016
Phase III	Design and construct 2nd generation body out of plastic by either 3d printing or thermal form plastic - incorporate visual and audio sensors - develop a personality program	May 2017






Team:

Name	Major	Role
Marcus Blaisdell	Computer Science	Initial construction / advisor
Nicklaus McHendry	Mechanical Engineering	Team Liaison - Body linkage design / construction
Austin Craigie	Computer Science	Body linkage design - Head control
Jensen Reitz	Computer Engineering	Bluetooth remote control
Luke Erickson	Engineering	Head - mechanical design / assembly
Carter Barnett	Computer Science	Head - mechanical design / assembly
Joseph Crissey	Computer Science	Head control
Nicholas Stein	Computer Science	Body control

Budget

Phase I

Mechanical parts			
Actobotics mechanical assembly parts	$137.55	1	$137.55
machine shop parts	$50.00	1	$50.00
Magnets (3 pack)	$14.95	3	$44.85
Total			**$232.40**
Electrical			
Electronic parts	$163.45	1	$163.45
101 RPM DC Motor	$24.99	2	$49.98
Total			**$213.43**
Body / head			
Materials			18.94
Total			**$18.94**
Grand Total			**$464.77**

Phase II

Kinect	95.99	1	95.99
Kinect adapter	39.99	1	39.99
Raspberry Pi kit	49.99	1	49.99
Thermal Form Plastic Body / Head	81.95	4	327.80
mp3 chip	9.99	1	9.99
Total			**523.76**

Key Stakeholders

Sponsors	Coug Parents Fund
Others	WSU Robotics Club

Monitoring and evaluation

The team meets weekly to work on design and construction. Documentation is recorded on a network Google drive. Contact outside of meetings is handled via email. Team members are assigned tasks to complete outside meeting times.

Approval

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Marcus Blaisdell
Robotics Club President

Dr. Matthew Taylor
Club Advisor