

Team 11 : I Choose You 18549 Spring 13

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<http://www.ece.cmu.edu/~ece549/spring13/team11/index.html>

Project Concept and Motivation

A Pokeball that

- opens upon landing
- throws out an AR code
- closes and rolls back to the player
- Reloads parts for another run

Just like the well-known and beloved game

What makes it unique and interesting

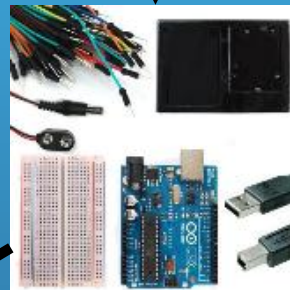
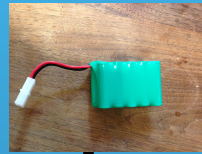
- Self-opening and launching feature
- Classical out layer design
- Physical interaction with Augmented Reality
- Shock-proof
- A toy for kids, not academic purpose

Goals and Requirements

- Mechanism of opening and closing repeatedly
- Mechanism of rolling and spinning by determined path
- Ability to shoot out AR code
- Tracking device of the player's location
- Shock proof, not fragile
- No harm to children

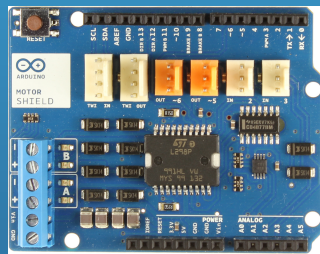
Architecture

Battery

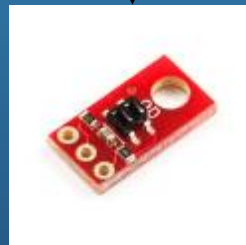


UNO 3

Motor
Shield



RC Car



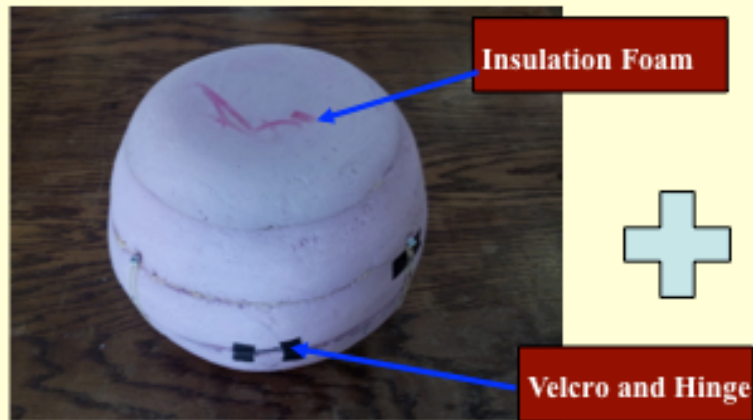
Line Trackers



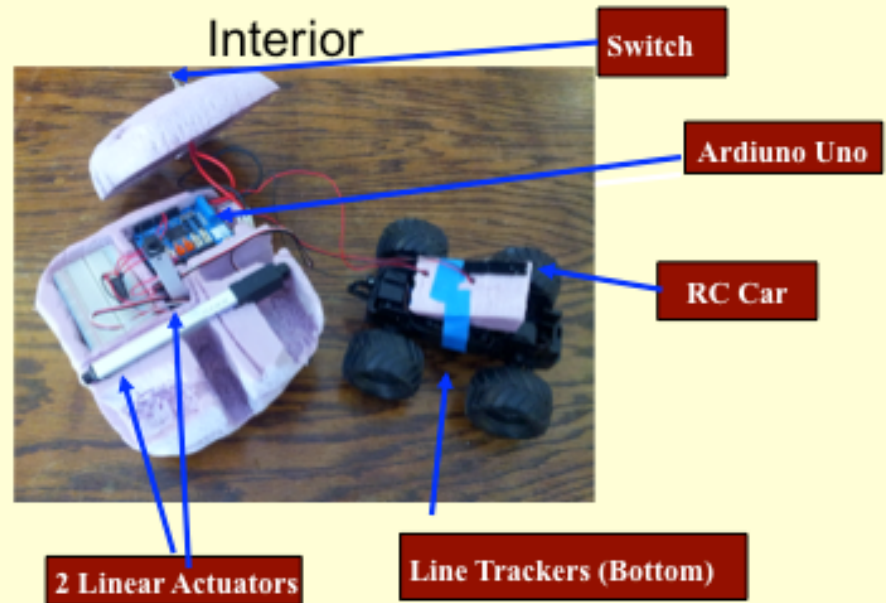
Linear Actuators

Components

Exterior



Interior



Components

- Exterior and Interior housing
 - Insulation foam
 - Velcro
 - Rubber Bands
- Movement
 - RC Car
- Control Units
 - Ardiuno UNO R3 Kit
 - Arduino Motor Shield
 - 100mm Linear Actuator X 2
 - QRE1113 Line Trackers X 3
- Miscellaneous
 - Indoor Frisbee

Coverage Test

Test Item	Test Objective
Open	The layers shall be stable when opening the ball and loading Frisbees.
Movement	Motors and wheels shall work properly when codes are executed
Line Tracking	Line trackers detect color change on the floor and direct the ball (tape and board)
Linear Actuators	The linear actuators shall kick the Frisbees out of the ball once the ball is completely opened
Close	The layers shall be stable when reloading Frisbee and closing the ball
Re-position	The balls moves back to its starting position after it closes.

Testing Open, Close and Movement



Insights from Experiments

- Physical Housing
 - Handmade Interior was too imperfect
 - Center of mass was off
- Internal/External Wheels
 - Interior wheels' friction was not enough
 - External wheels guaranteed success
- Line Tracking /Re-Orient Feature
 - External wheels removed need for re-orienting
 - Line Trackers repurposed to trigger ejection
- Linear Actuators
 - Frisbee ejected with 2nd Linear Actuator not Servo

Bottom Line: Moving to Plan C (Exterior wheels, no IMU)

Performance

- Successfully controls RC car for moving ball around
- Successfully detects color contrast for triggering ejection
- Successfully opens the ball and kick out Frisbee with Linear Actuators
- Exterior remains stable when opening and closing

Open Issues

- Long system reboot time (caused by slow Linear Actuators)
- Momentum causes noise in calculating start and end locations when moving
- Inconsistent launch behavior (Frisbee may get stuck behind rubber band)
- AR code cannot attach on Frisbee (must be painted in factory)
- IMU is inaccurate and largely interfered by the noise in such compact space (causing removal from project)

Conclusions

- Learned new HW parts and SW skills (especially motor drivers and IMU), and also mechanical design
- Finished project as Plan C (no IMU, no interior wheels)
- Physical housing took a long time to create making it impossible to find problems sooner
- Should have started with an RC car driving on the inside of the ball (Easier to make than original plan A and with enough time, is more feasible)
- If possible, should change physical housing's materials for faster building and less imperfections